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Institutional Control Plan for the Ketchikan Pulp Company Site

Prepared for

Ketchikan Pulp Company
Ketchikan, Alaska

Exponent™

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Prepared for

Ketchikan Pulp Company
7559 North Tongass Highway
Ketchikan, Alaska 99901

Prepared by

Exponent
15375 SE 30th Place, Suite 250
Bellevue, Washington 98007

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Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CoC	chemical of concern
CoPC	chemical of potential concern
Easement and Covenant	*Environmental Protection Easement and Declaration of Restrictive Covenants*
EPA	U.S. Environmental Protection Agency
Gateway	Gateway Forest Products
KPC	Ketchikan Pulp Company
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD/F	polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran
ROD	record of decision
RPM	remedial project manager

1. Introduction

This plan describes the institutional controls for the Uplands Operable Unit of the Ketchikan Pulp Company (KPC) site, which was purchased by Gateway Forest Products (Gateway) in November 1999. Institutional controls are measures undertaken to limit or prohibit activities that may interfere with the integrity of a remedial action or potentially result in exposure to unacceptable levels of hazardous substances at a site. Institutional controls are legal or administrative controls, as opposed to engineering controls, and are not typically the sole remedy. At the Uplands Operable Unit, institutional controls were applied after the early actions to remove principal threats at the site were completed. Examples of institutional controls include legal or administrative controls for managing contaminated soil during development activities and property deed restrictions (e.g., to restrict the land use of a property). The intent of institutional controls is to ensure that remedial efforts are protective of human health and the environment over the long term. The use of institutional controls and the early actions conducted at the Uplands Operable Unit were presented to the public in the proposed plan (ADEC and U.S. EPA 1999) and will be documented in the record of decision (ROD), with consideration of any applicable public comments.

The former KPC site is located approximately 5 miles north of Ketchikan, Alaska (Figure 1), and is divided into two administrative units: the Marine Operable Unit and the Uplands Operable Unit. The Marine Operable Unit is being remediated under a consent decree with the U.S. Environmental Protection Agency (EPA) and includes all of Ward Cove and other marine areas where there has been migration of hazardous substances from Ward Cove or the Uplands Operable Unit in concentrations that potentially pose a threat to public health or the environment. The Uplands Operable Unit is being remediated under a consent order with joint oversight from EPA and the Alaska Department of Environmental Conservation (ADEC) and includes the pulp mill area (including the dredge spoil area), the wood waste and ash disposal landfill, and the former storage areas along the water pipeline road (pipeline road). The Uplands Operable Unit also includes other land-based areas that may have been affected by pulp mill operations (i.e., areas that received aerial deposition from the mill and residences where mill solids may have been used as soil amendments) (Figure 2). The boundary between the two operable units is defined as the mean higher high tide level.

The institutional controls described in this plan for the pulp mill area of the Uplands Operable Unit and institutional controls for the Marine Operable Unit are codified in the *Environmental Protection Easement and Declaration of Restrictive Covenants* (Easement and Covenant) document filed between KPC and the State of Alaska Department of Natural Resources for ADEC, with provisions for designating oversight authority to EPA (ADL 1999). The Easement and Covenant document is attached as Appendix A. Appropriate easement and covenant documents will also be prepared relating to

institutional controls for the wood waste and ash disposal landfill area and for the disposal areas along the pipeline road.

This institutional control plan applies only to the Uplands Operable Unit and addresses only contamination related to KPC's former use of the property. The investigation and remediation of the Marine Operable Unit are being conducted on a separate schedule from the Uplands Operable Unit. The Easement and Covenant document and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) Consent Decree contain provisions for replacing the cap in those areas of the Marine Operable Unit to be capped by clean sediments in the event that any projects or activities cause large portions of the cap to be displaced or eroded. No additional institutional controls or other restrictions for the Marine Operable Unit are anticipated, but if any are identified, they will be addressed separately after the remedy for that unit is selected.

This institutional control plan is to be implemented by the owner(s) of the properties to manage residual contamination as a result of KPC's use of the site. Specifically, the institutional controls are specified in the Easement and Covenant document and the CERCLA Consent Decree, which stipulate management methods for contaminants of concern and areas of concern identified in the KPC remedial investigation and feasibility study or for these contaminants in any areas that might be identified in the future. This plan addresses characterization, management, and disposal of soils in the following areas: soils in the near-shore fill subarea, soils underneath paved areas or structures at the former pulp mill site, and soils at the former pulp mill and at the pipeline road area that were not evaluated[1] or characterized during the remedial investigation but that could be exposed in the future (e.g., as the result of excavation or demolition).

These institutional controls are conferred with the land regardless of the owner. The KPC former mill property was sold to Gateway effective November 1, 1999, for use as a light manufacturing facility. Gateway and any successor will have responsibility for implementing this institutional control plan for the pulp mill property. As part of the sale agreement between KPC and Gateway, a cost and work sharing arrangement has been formalized between the two parties. The agreement contains specific requirements for Gateway and any successors to provide KPC prior notice of any activities that are likely to expose historical contamination and to notify KPC if contamination is discovered; describes how the costs and responsibilities for investigating and managing the contamination will be shared between the two parties; and allocates responsibilities for directing any remedial efforts. In addition, Gateway and any subsequent owners will have responsibility for following all applicable laws including appropriate management of any chemicals used onsite.

[1] The remedial investigation for the upland site evaluated the entire site, but characterization through sampling and analyses was done only in areas where contaminant releases were suspected.

There are no plans for sale of the landfill property at this time. However, if the landfill property is purchased by another entity, then the ADEC solid waste permit for the landfill could be transferred to the new owner through an application to ADEC. Residual concentrations of chemicals of concern (CoCs) at the former storage areas along the water pipeline road are described in Technical Memorandum No. 23 (Exponent 2000a). The mostly likely future use of the pipeline road areas is recreational. Site concentrations were evaluated based on institutional use, however, because this provides a protective means to evaluate less frequent recreational exposure. During investigations of the pipeline road, five areas identified as potentially of concern were investigated: Area 1, Area 2, Drum Area 2, Area 3, and Area 4. In general, soil containing polychlorinated biphenyls (PCBs) greater than the 10 mg/kg cleanup level or lead greater than the 1,000 mg/kg cleanup level identified by EPA Region 10 was removed at all locations along with solid waste. At this time, there are three areas (Area 2, Drum Area 2, and Area 3) that have PCB concentrations greater than the 1 mg/kg cleanup level for residential soils identified by EPA. In addition, although lead concentrations were predominantly less than 100 mg/kg, Area 2 had four surface stations and two subsurface stations with detections of lead greater than 1,000 mg/kg (ranging up to 2,300 mg/kg). The subsurface stations (depths up to 12 ft) were filled to original grade with clean soil, and the entire area was covered with clean soil and seeded with grass. These areas are within a larger area that will be subject to institutional controls.

Area 1 was purchased by Gateway and is considered part of the pulp mill area, but as indicated above, this area does not have any chemicals at concentrations in excess of the residential cleanup levels. KPC is seeking ownership of Drum Area 2 and Areas 2, 3, and 4 (Figure 3). KPC will prepare an easement and covenant document to restrict residential development or digging along this entire corridor. Though there is no plan for sale of the landfill, or the areas along the pipeline road, any easement or covenant documents for these areas would be conferred with the land to any subsequent owners.

The remainder of this section provides background information regarding the KPC site and presents the purpose of this plan. Section 2 presents the objectives of the institutional controls. Section 3 presents the development of the institutional controls for the Uplands Operable Unit. Section 4 presents the record-keeping procedures for tracking activities related to the institutional controls. In addition, there are four documents included as appendices. Appendix A contains the Easement and Covenant document. Appendix B presents a sampling and analysis plan for future demolition/construction activities at the Uplands Operable Unit. Appendix C contains a list of screening levels derived by EPA Region 9 for industrial soils. Appendix D contains a plate depicting the areas that have been sampled at the KPC site.

1.1 Background

This section presents a summary of background information for the Uplands Operable Unit. Additional information regarding the site is included in the remedial investigation report (Exponent 1998e).

KPC operated a pulp mill at the site from its construction in 1954 until shutdown in 1997. The KPC landfill began operation in 1988 and has been used for the disposal of wood waste, flyash, and recovery and wood waste boiler bottom ash. In 1997, a consent order between KPC, Louisiana-Pacific Corporation, ADEC, and EPA was issued to address site contamination. The consent order required KPC to conduct a remedial investigation and clean up CoCs) found at levels determined to be a threat to human health or the environment.

The remedial investigation confirmed the presence of chemicals of potential concern (CoPCs) in soil at the site. The CoPCs were arsenic, lead, manganese, polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDDs/Fs), PCBs, and petroleum hydrocarbons (Table 1). After comparison with screening values and calculation of risk estimates, arsenic, lead, PAHs, PCBs, and petroleum hydrocarbons were identified as CoCs requiring consideration of remedial actions. To identify areas that exceed acceptable risk levels, a decision framework was developed together with EPA and ADEC, which is summarized below:

- **Incremental cancer risks are less than 1 in 100,000 (1×10^{-5}) and/or the hazard indices for noncancer adverse effects are less than 1—** No further action will be considered.

- **Incremental cancer risks are between 1 in 100,000 (1×10^{-5}) and 1 in 10,000 (1×10^{-4}) for cumulative risk and/or cumulative hazard indices for noncancer adverse effects are between 1 and 10—** Development of cleanup options will be considered but may not be required. The remedial project managers (RPMs) will consider additional factors other than only a numerical exceedance of these decision risk levels in deciding on the need for further assessment.

- **Incremental cancer risks are greater than 1 in 10,000 (1×10^{-4}) for pathways or for cumulative risks and/or hazard indices for noncancer adverse effects are greater than 10—**Cleanup options will be developed for this area/pathway (i.e., this area will be carried into a feasibility study unless it is addressed by early action).

During and immediately after the remedial investigation, early actions involving sampling and removal of contaminated soil were completed for the areas identified as having unacceptable risk levels for industrial and commercial uses. Additional areas were remediated as part of plant upgrades during closure, thereby also reducing concentrations of arsenic and PCDDs/Fs in site soils and sediments (i.e., access road ditch). These areas, the CoCs, and their screening levels are listed in Table 2 and shown on Figure 4. Completion of the early actions has resulted in surface soil (i.e., soil that is not covered by paving or buildings) at the mill site and pipeline areas meeting acceptable risk levels for industrial/commercial exposure scenarios. As described above, these exposure levels would also be protective for expected future recreational use of the pipeline road areas.

During the remedial investigation, it was determined that the potential site-related sources of arsenic (limited application of arsenical pesticides at Thorne Bay, possible use of rodenticides) did not fully account for the observed concentrations of arsenic onsite, (i.e., from undetected at 0.5 mg/kg to 670 mg/kg at the paint shop with widespread detections exceeding 50 mg/kg in many pulp mill areas). Moreover, similar concentrations were found in many offsite locations. Specifically, offsite concentrations ranged from undetected at 0.5 mg/kg in forest soil to 207 mg/kg at a gravel driveway near Wards Cove Cannery to more than 4,000 mg/kg at a local quarry. Onsite risk estimates for future workers exposed to arsenic in soil via ingestion and dermal contact ranged from 5×10^{-6} for the former bottom ash storage pile to 2×10^{-4} for paint shop soils with a number of other areas having risk estimates for arsenic between 1×10^{-5} and 5×10^{-5} (Table 1). The risk estimate for offsite residents in aerial deposition areas exposed to arsenic in soil via ingestion, dermal contact, and consumption of homegrown produce was 2×10^{-5}.

Additional investigations identified local rock quarries as a major source of onsite arsenic and determined that the arsenic present in soil is not readily absorbed from soil if ingested (i.e., the arsenic was identified as having low bioavailability), thus reducing possible exposure. These findings, together with procedures for safe use of arsenic-containing rock materials, were documented in an arsenic management plan (Exponent 1998d). EPA and ADEC reviewed this information and determined that soil with arsenic concentrations resulting in mid-range risk decision levels (i.e., incremental cancer risks between $1\times10^{-5}$and 1×10^{-4} and hazard indices between 1 and 10) could be left in place. EPA, ADEC, and KPC also determined that the procedures identified in the arsenic management plan to reduce exposure and risks (Exponent 1998d) should be applied at the site and made available to the community.

Concurrent with the remedial investigation, KPC conducted closure activities for the wood waste and ash disposal landfill in accordance with the solid waste permit administered by ADEC and all applicable regulations. Landfill closure activities conducted in 1997 and 1998 consisted of constructing a low-permeability cover system, including a geomembrane, over the landfill; placing a topsoil cover and vegetation on the landfill; constructing surface water drainage improvements throughout the landfill; and constructing a leachate treatment system adjacent to the landfill. A new cell was constructed in 1997 and is permitted (ADEC Solid Waste Permit No. 9713-BA001) to receive boiler bottom ash, flyash, and smaller volumes of wood waste, rock, and dirt, secondary sludge, and dredge spoils.

Upon completion of the remedial investigation in 1998, ADEC and EPA issued a proposed plan for the Uplands Operable Unit (ADEC and U.S. EPA 1999) that identified a preferred remedial action. Based on public comment on the proposed plan, the final remedies were stipulated in the ROD (ADEC and U.S. EPA 2000). The selected remedial actions for the pulp mill area and pipeline road areas include the following activities:

- Complete all early actions
- Implement institutional controls
- Continue to use the controls specified in the arsenic management plan (Exponent 1998d)
- Conduct sampling and evaluation during future demolition activities that result in exposure of soils not evaluated in the remedial investigation
- Establish a procedure to ensure that if, in the future, soils from the near-shore fill subarea or contaminated soils underneath paved areas or structures are excavated, those soils will be properly characterized and managed.

The preferred remedial action for the wood waste and ash disposal landfill includes the following activities:

- Close the remaining cell of the wood waste and ash disposal landfill in a manner similar to that of the other cells, which KPC has already closed (i.e., in accordance with the ADEC solid waste permit and all applicable regulations)
- Conduct long-term monitoring at the landfill in accordance with all applicable permits
- Implement institutional controls.

As previously mentioned, the early actions at the pulp mill and pipeline road have been completed. This institutional control plan addresses the other components of the preferred remedial action for the pulp mill and pipeline road areas. For the wood waste and ash disposal landfill, the remaining cell will be closed in the same manner as the other cells. In addition, long-term monitoring and institutional controls will be implemented in accordance with the ADEC solid waste permit, applicable ADEC solid waste regulations, and any National Pollutant Discharge Elimination System (NPDES) permit that may be in place at the time. Some landfill monitoring requirements are now being fulfilled through the existing NPDES permit for the Ward Cove facility. If the property owners request a permit modification or reissuance in the future, EPA and ADEC will be provided 30 days notice of any proposed changes to the landfill monitoring requirements. These institutional controls will also be a part of the CERCLA ROD for the site. This institutional control plan summarizes the institutional controls for the wood waste and ash disposal landfill.

1.2 Purpose of the Institutional Control Plan

The intent of the institutional controls is to ensure that remedial efforts are protective of human health and the environment over the long term at the KPC site. Institutional controls are part of the preferred remedial action for the Uplands Operable Unit to prevent residential use. These requirements are specified in the Easement and Covenant document for the pulp mill area and are conveyed with the property (regardless of the owner) until soil concentrations reach acceptable site-specific, risk-based concentrations for residential use or appropriate regulatory levels, or until 2099, whichever occurs first. Prior to 2099, the parties will evaluate the need to continue institutional controls beyond 2099. Covenants to stipulate appropriate controls for the wood waste and ash disposal landfill and the former disposal area along the pipeline road are in development. Although soil concentrations of CoCs are lower or within the acceptable range for industrial use as determined in the risk assessment (Table 1), concentrations in some areas of the KPC site are higher than risk-based concentrations identified for residential land use.[2] The institutional controls for the KPC site have several purposes:

- To address specific areas of the Uplands Operable Unit (i.e., the wood waste and ash disposal landfill) that are known to have CoCs in soil at concentrations greater than risk-based concentrations considered to be protective for residential use and that require ongoing maintenance or other controls to limit exposure and risk
- To address specific areas of the Uplands Operable Unit (e.g., the near-shore fill subarea and areas under buildings or structures) that may require characterization and or remediation if they are exposed during demolition or excavation activities
- To address area-wide concerns (i.e., the paint shop and much of the mill area and some areas along the pipeline road) regarding appropriate use of the site (e.g., maintaining industrial/commercial zoning for the site because of the CoCs present in soil at concentrations higher than those considered to be protective of residential use).

This institutional control plan will ensure coordinated and reliable implementation and maintenance of the institutional controls for the Uplands Operable Unit. It will also ensure that the objectives of land use restrictions or controls are being achieved and that

[2] Risk-based concentrations for soils were taken from EPA Region 3 and Region 9 and were derived using a target risk level of 1×10^{-6} and conservative assumptions based on contact with contaminants in soil in a residential or industrial setting. As indicated above, although arsenic concentrations in soil are within the mid-range of risk decision levels (i.e., higher than EPA risk-based concentrations for industrial soils), EPA and ADEC have agreed that it is appropriate to leave the soil in place because of demonstrated low bioavailability and because the arsenic is associated with native rock.

the tools and procedures that the facility uses to implement restrictions/controls are in place. In addition, this plan describes controls for areas where future excavations may modify site risks (e.g., the near-shore fill subarea and areas under roads and buildings).

To fulfill these goals, the institutional control plan:

- Develops appropriate institutional controls for the pulp mill site and areas along the pipeline road to maintain adequate short- and long-term protection of human health and the environment
- Summarizes the institutional controls for the landfill that are being conducted in accordance with the ADEC solid waste permit, applicable ADEC regulations, and any NPDES permit in place at the time.
- Identifies procedures for implementing the institutional controls, including procedures for tracking activities related to the institutional controls
- Serves as a one-source reference for other related activities, documents, and permits (however, this institutional control plan does not supersede any regulatory or permit requirements).

2. Institutional Control Objectives

Soils at the pulp mill area and pipeline road that contained chemicals at unacceptable risk levels for industrial/commercial use have been removed through early actions at the site. However, residual concentrations of chemicals remain in soils at the pulp mill area and at areas along the pipeline road above EPA risk-based concentrations for residential land use. EPA guidance regarding land use in the CERCLA remedy selection process states the following:

> The volume and concentration of contaminants left on-site, and thus the degree of residual risk at a site, will affect future land use. For example, a remedial alternative may include leaving in place contaminants in soil at concentrations protective for industrial exposures, but not protective for residential exposures. In this case, institutional controls should be used to ensure that industrial use of the land is maintained and to prevent risks from residential exposures. (U.S. EPA 1995)

The near-shore fill subarea was characterized during the site investigation, and no contaminants were found at levels exceeding applicable risk-based concentrations. In addition, migration of contaminants to Ward Cove was ruled out through evaluation of the potential volume of dissolved contaminants that could reach Ward Cove[3] and sampling results from Ward Cove. Due to the past use of the area as a fill area, however, there is uncertainty as to whether chemicals are present in soils in areas that were not directly characterized. Similarly, there is uncertainty about soils beneath the paved areas and structures at the mill because these areas were not sampled during the remedial investigation. Soils at the pipeline road were sampled where contamination was suspected, but some uncertainty remains regarding areas that were not sampled. Therefore, uncharacterized soils at the pipeline road and in the nearshore fill subarea and soils beneath paved areas and structures remaining at the pulp mill area will need to be further evaluated to determine the need for sampling if soils are exposed during

[3] PCB (Aroclor® 1254) was measured at concentrations (0.49 µg/L) near the analytical detection limit in unfiltered water in one of three test pits in the near-shore fill subarea. Only the dissolved portion would be able to migrate into Ward Cove. The dissolved portion in the groundwater was estimated to be approximately 0.013 µg/L, which is less than the ecological screening criterion of 0.030 µg/L in marine waters. PCB was therefore not considered a CoPC for ecological receptors. The EPA proposed PCB criterion for protecting human health (from fish consumption) is extremely low (i.e., 0.00017 µg/L) and is actually below analytical detection limits for PCBs (i.e., Aroclors®). Nevertheless, the potential for transport of PCBs from the groundwater into Ward Cove was evaluated. PCBs would be carried out into Ward Cove during ebbing tides and mixed with seawater along the shoreline of the near-shore fill subarea. Using conservative assumptions, PCB concentrations are predicted to be less than the proposed criterion of 0.00017 µg/L within 0.1 m of the shoreline. Because of the very low (probably less than background) concentrations and limited area of potential impact, PCBs are not considered CoPCs for human health for this pathway.

demolition or excavation activities. The institutional controls described in a subsequent section of this document address sampling and evaluation of soil for demolition activities at the pulp mill area and the pipeline road. In addition, the institutional controls address procedures for properly characterizing and managing excavated soils.

Closure and monitoring of the wood waste and ash disposal landfill in accordance with the ADEC solid waste permit and ADEC regulations, including institutional controls, is consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the EPA NPDES permit. The NCP states that EPA expects to use engineering controls, such as containment, for waste that poses a relatively low long-term threat and to use institutional controls such as water use and deed restrictions to supplement the engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants (40 CFR 300.430(a)(1)(iii)).

ADEC regulations also include requirements for institutional controls. In general, ADEC may require institutional controls on a site-specific basis where they are necessary to protect human health, safety, or welfare or the environment. The institutional controls may include deed restrictions or other measures that would be examined during a routine title search and that limit site use or site conditions over time or provide notice of any residual contamination. ADEC regulations that address institutional controls include 18 AAC 75.350(2)(C), 18 AAC 75.375, and 18 AAC 75.990 (54).

Based on the regulations and requirements presented above, the conditions at the Uplands Operable Unit, and the preferred remedial action presented in the proposed plan, the objectives for the institutional controls for the pulp mill site and the pipeline road are as follows:

- Maintain acceptable risk levels for soils for industrial/commercial exposure scenarios (which will also be protective of recreational use of the pipeline road)
- Comply with requirements identified in the *Management Plan for Arsenic in Rock and Soil* (Exponent 1998d) to reduce exposure to arsenic in soil and rock
- Restrict residential land use (or similar non-industrial/commercial land use resulting in around-the-clock residence by people or daily use by children)
- Prohibit drilling of water wells and use of groundwater
- Identify and address source areas (if any) during demolition and excavation activities using applicable or relevant and appropriate requirements (ARARs) such as current risk-based concentrations or standards and criteria

- Properly characterize and manage soils from the near-shore fill subarea or underneath paved areas or structures and from other locations not evaluated or characterized in the remedial investigation if those soils are excavated.

The objectives for the institutional controls for the wood waste and ash disposal landfill are to fulfill the requirements of any permits (e.g., the ADEC solid waste permit and the EPA NPDES permit) that may be active and in force at the time. Additional objectives are to restrict future use of the landfill property to preclude any of the following:

- Use of groundwater
- Activities that could result in exposure to landfill materials
- Activities that could compromise the integrity of the landfill cap, the leachate treatment system, or any ancillary equipment.

3. Development of Institutional Controls

Institutional controls are developed in this section for the pulp mill area, the pipeline road areas, and wood waste landfill to ensure that the objectives in the previous section are met. Consistent with the Easement and Covenant document (ADL 1999), the institutional controls will remain in place until 2099, or until site CoCs no longer exceed site-specific, risk-based residential cleanup levels, whichever comes first. The Easement and Covenant document allows for oversight by EPA and ADEC, in decisions regarding any future revisions to the controls to be determined by these agencies and the current owner. Project managers with EPA and ADEC may also identify and initiate appropriate changes to this institutional control plan to be consistent with future regulatory changes or changes in land use.

3.1 Institutional Control Program Administration

Respective roles of organizations responsible for administering the institutional control program are listed in Table 3 with their phone numbers and addresses. These organizations include KPC, Gateway, or subsequent owners (and other parties under the direction of site owners including contractors), the Ketchikan Gateway Borough, and appropriate regulatory agencies. KPC will be responsible for the institutional controls for the landfill property as long as KPC owns that property. There are no plans for sale of the landfill property at this time. Gateway and any successors will be responsible for institutional controls for the pulp mill property. A plan for institutional controls for the pipeline road is in development to restrict residential use of the areas with CoCs exceeding residential cleanup levels. KPC is seeking ownership of Drum Area 2 and Areas 2, 3, and 4 and will be responsible for administering institutional controls in these areas.

3.2 Pulp Mill Site and Pipeline Road

Institutional controls for the pulp mill site and for the pipeline road include zoning and deed restrictions, procedures for characterizing and managing soil during routine excavations, procedures for characterizing and managing soil during demolition activities, and notification procedures.

3.2.1 Zoning and Deed Restrictions

The Ketchikan Gateway Borough has zoned the pulp mill area for industrial use (i.e., industrial-heavy). There are no plans for the zoning designation to be revised, and it is unlikely that revision of the zoning designation would ever occur. The wood waste landfill area and the dredge spoil subarea are also zoned as industrial-heavy. No

construction is planned on the wood waste landfill area. Any construction would require substantiation that the proposed activity would not compromise the integrity of the landfill cap or leachate collection system in any manner.

As described previously, KPC and the Alaska Department of Law (ADL) prepared and filed the Easement and Covenant document for the pulp mill area. This document has been filed with the Ketchikan Gateway Borough and would be examined during a routine title search. It limits site use over time and provides notice of residual contamination on the property. KPC, along with ADL, is in the process of developing a similar document for the wood waste and ash landfill and will provide a draft of the deed restriction or other measure to ADEC and EPA for review prior to filing it. The former disposal areas along the water pipeline road are too small for residential development. Nevertheless, an easement and covenant agreement will be put into place for the pipeline road with stipulations similar to the agreement for the former pulp mill area (i.e., to prevent future residential use of this area).

3.2.2 Routine Excavations

Routine excavations are relatively minor excavations that may occur during normal maintenance or operational activities. A routine excavation is defined as an area of approximately 25 ft^2 or smaller or a volume of soil of approximately 3 yd^3 or less, and where excavated soils will remain onsite and not be transported offsite for disposal. A routine excavation may not include removal of a paved area or structure (limited to the area formerly mentioned). It is anticipated that soil sampling will not be required as part of routine excavations unless there is visible evidence of debris or contamination, or knowledge of past or present use of the area suggests that contamination may be present. If sampling is required, it will be carried out as described in the section below and in Appendix B (and in consultation with EPA and ADEC).

If sampling is required, analytical results for soil samples will be compared with screening levels. Specifically, risk-based concentrations derived by EPA and ADEC to identify possible CoCs and background concentrations will be applied where available. For constituents other than petroleum products, the results for the soil samples will be compared to screening levels derived by EPA Region 9 for industrial soils, which were identified by EPA as the appropriate screening levels for soil (included in Appendix C). (The EPA Region 9 risk-based concentrations will be used unless EPA Region 10 no longer recommends them for use in Region 10.) For petroleum products, soil sampling results will be compared with ADEC's soil cleanup levels for the protection of nonpotable groundwater, which will be calculated consistent with ADEC guidance (18 AAC 75, ADEC [1998]) or comparable applicable requirements in effect at the time of the demolition. Any possible CoCs identified will then be evaluated in comparison with ARARs presented in the ROD for the KPC Uplands Operable Unit to determine the need for remedial actions, if any.

The landowner will notify ADEC and EPA if any soil sample results exceed screening levels or if suspect debris is found. In addition, if soil sample results exceed screening

levels, then the landowner will coordinate with ADEC and EPA, and a decision will be made on a case-by-case basis as to whether additional excavation will be conducted. If soil sample results exceed screening levels (discussed above), then EPA and/or ADEC will determine the appropriate action (i.e., offsite disposal or a screening-level risk evaluation to determine the appropriate remedy). If the soil sample results do not exceed screening levels, then the excavated soil may be placed back into the excavated area or otherwise properly disposed. Any suspect debris will be removed for appropriate disposal in accordance with applicable regulations and landfill requirements. Any imported material for backfill or other purposes must meet the requirements of the arsenic management plan (Exponent 1998d). Records will be kept of the routine excavations as described in the record-keeping section of this plan.

3.2.3 Major Excavations and Demolitions

Demolition activities such as excavations larger than those defined in *Routine Excavations*, excavations that require removal of paved areas or structures, or excavation of portions of the near-shore fill subarea or the water pipeline storage area are addressed in this section. For major excavations, an excavation-specific sampling and analysis strategy will be developed in consultation with EPA and ADEC using the following guidance and the procedures described in Appendix B. Similar to the procedure used in the remedial investigation to determine the appropriate analytes for a given area, it is recommended that the need for confirmation sample collection and analysis be determined by the history of the area's use.

Soil underneath paved areas (i.e., railroad track areas), soil underneath structures, or soil in areas where petroleum products were stored or used would be analyzed for diesel- and residual-range organics and PAHs (and gasoline-range organics and benzene, toluene, ethylbenzene, and xylenes, if appropriate). PCB analyses may also be needed depending on site characterization. Soil from the flyash silo would be analyzed for PCDDs/Fs. Soil in the near-shore fill subarea and the water pipeline storage area would be analyzed for diesel- and residual-range organics, target analyte list metals, volatile organic compounds, semivolatile organic compounds, organochlorine pesticides and PCBs, and chlorinated herbicides. The analyte list for soils in other areas will be determined in consultation with EPA and ADEC. Excavated soil will be sampled and characterized as needed for appropriate disposal in accordance with all applicable regulations and/or landfill requirements. Soil sample results will be compared with the screening levels described above to identify CoCs. Any remediation of areas with CoCs would be discussed with RPMs and would include consideration of ARARs.

The landowner will notify ADEC and EPA if any soil sample results exceed screening levels or if suspect debris is found. The landowner will coordinate with ADEC and EPA, and a decision will be made on a case-by-case basis as to whether additional excavation will be conducted. Any soil that is excavated will be sampled and characterized as needed for appropriate disposal in accordance with applicable regulations and landfill requirements. If soil sample results are below state and federal EPA soil screening and cleanup levels, then the excavated soil may be used onsite as fill material. Any suspect

debris will be removed for appropriate disposal in accordance with applicable regulations and landfill requirements. Any imported material for backfill or other purposes must meet the requirements of the arsenic management plan (Exponent 1998d). Records will be kept of the excavation/demolition activities and onsite and offsite treatment or disposal as described in the record-keeping section of this plan.

3.2.4 Notification Procedures

The landowner will notify both ADEC (Contaminated Sites and Remediation Program) and EPA (Alaska Operations Office) by calling them at the telephone numbers listed in Table 3 or contacting appropriate agency personnel via e-mail if any of the following occur:

- Major demolition activities are planned
- Any sampling is to be conducted during major demolition
- Any soil samples collected during routine excavations or demolition activities exceed soil screening levels
- Suspect debris (e.g., buried drum or paint can) is found during routine excavations or demolition activities.

3.3 Wood Waste Landfill

The wood waste landfill is currently regulated by ADEC Solid Waste Permit No. 9713-BA001 (Figure 5). This section summarizes post-closure requirements for the landfill, including long-term restrictions and monitoring, that are included in the permit. This institutional control plan does not supersede any current or future permit requirements; it only summarizes the relevant requirements of the current permit. EPA has reviewed existing monitoring requirements and found them to be sufficient. KPC will allow at least 30 days notice of any proposed change in monitoring resulting from any future changes in permit requirements. Any permitting changes may result in the need for modifications in this plan to meet EPA requirements for institutional controls.

The ADEC solid waste permit requires long-term inspection and monitoring of the landfill. The current *Comprehensive Landfill Monitoring Plan* (KPC 1999) presents the inspections and monitoring that will be conducted throughout the post-closure care period of the landfill. Future inspections and monitoring of the landfill will be conducted in accordance with the current plan or subsequent plans that may be required for the landfill. Under the current plan, visual and surface water monitoring are conducted. Visual monitoring includes, but is not limited to, inspecting physical damage to the cover system, drainage structures, escape of waste or leachate, unauthorized waste disposal, erosion, and evidence of death or stress to fish, wildlife, or vegetation that might be caused by the facility. Surface water monitoring includes collecting water samples to

assess whether surface water leaving the site could potentially endanger public health or cause a violation of water quality standards.

Post-closure care will also include gas monitoring, leachate monitoring, maintenance of the final cover system (including prevention of tree growth on that system), maintenance of the appurtenances, operation of the passive gas venting system, and operation of the leachate collection system. Annual inspections for slippage of the cover system and for landfill subsidence will be conducted. An inventory of the volumes of landfill leachate collected and treated will be maintained.

The current NPDES permit also requires monitoring storm water at the landfill. This monitoring includes sampling and analysis of surface water in the major conveyances at the landfill. Groundwater monitoring wells have not been constructed. In general, groundwater at the landfill discharges to the small surface water drainages, all of which flow toward Refuge, "Dawson," or Ward coves. These drainages are being routinely monitored. In addition, routine monitoring of leachate provides a "worst-case" representation of potential groundwater contamination from the landfill that is not being detected by surface water monitoring (i.e., groundwater discharging directly to marine waters by underwater seeps, if occurring). Because local groundwater flow is determined by topography, contaminant transport toward the mainland (i.e., "uphill") is unlikely.

Permit requirements for deed restrictions or other measures for the landfill property include the following:

- KPC will prepare and submit to ADEC, upon closure of the facility, a survey as-built or record drawings that show the location, types, and volume of waste deposited at the facility. A copy will be provided to any purchaser or transferee at the time of property sale or lease.
- KPC will file the survey as-built or record drawings of the area as a landfill with the appropriate land records office within 60 days after the entire facility has been permanently closed to landfilling and will submit proof of such recording to ADEC.
- KPC will record a notation on the deed to the property notifying subsequent landowners of the type of waste that has been buried on the property and warning them that a water supply for drinking water purposes should not be developed. An additional notation will be made that warns subsequent owners or operators that a geosynthetic liner has been placed over the waste and that operations should be carried out in a way that does not rupture the liner. Rupture of the liner could be caused by the operation of heavy machinery or the construction of buildings or placement of any structure on the surface. In addition, an easement and covenant document similar to that developed for the pulp mill property will be prepared for the landfill.

- The locations where waste was deposited will not be subdivided from run-on diversion systems, leachate collection systems, or the margins of geosynthetic liners; when conveyed, they will be conveyed as one parcel.
- KPC will notify ADEC in accordance with the notification and reporting procedures identified in the ADEC solid waste permit.

4. Record-Keeping

Record-keeping will include documentation of field and sampling activities, analytical results including laboratory data sheets, disposal records, notification records, a written summary of each excavation or demolition event, and notation on a site map of activities involving sampling. Records related to KPC's former activities at the site will be kept by KPC in Ketchikan or by the parent corporation, Louisiana-Pacific in Portland, Oregon. Records related to Gateway will be kept by Gateway in Ketchikan. EPA and ADEC will be notified of any change in record locations.

Documentation of soil sampling activities is described in Appendix B. For routine excavations that do not involve sampling, only the documentation listed in Appendix B that is applicable to such excavations will be recorded. All analytical results, including laboratory data sheets, will be retained for excavation and demolition activities. Available laboratory quality assurance and quality control results will also be retained. The analytical results will be retained pertaining to site characterization as well as the profiling of excavated soil for disposal. Disposal records will be retained for any soil or debris disposed offsite. The records will include the amount and type of material disposed, the date shipped, the name and address of the disposal facility, and receipts from the disposal facilities. Notification records, such as telephone contact summary sheets, of contact between the landowner and the agencies will be retained.

A brief written summary of each excavation or demolition event will be prepared to document the activities and to provide appropriate information that is not in the project documentation records. This written summary will include a summary of onsite and offsite treatment or disposal locations. The written summary will likely range from a few sentences for some routine excavation events to a page or two for more extensive demolition activities. Each excavation or demolition area will also be documented on a site map (Appendix D) in a manner that cross references the location on the site map to the written documentation in the project files.

For the wood waste and ash disposal landfill, KPC will keep records regarding landfill post-closure activities in accordance with the requirements of the ADEC solid waste permit. These records will include inspection logs, surveying results, analytical results including laboratory sheets, and notification records between KPC and the agencies.

5. References

ADEC. 1998. Guidance on cleanup standards—equations and input parameters. Alaska Department of Environmental Conservation, Division of Spill Prevention and Response, Contaminated Sites Remediation Program.

ADEC and U.S. EPA. 1999. Proposed plan for the Uplands Operable Unit, Ketchikan Pulp Company, Ketchikan, AK. Alaska Department of Environmental Conservation, Anchorage, AK, and U.S. Environmental Protection Agency, Anchorage, AK.

ADEC and U.S. EPA. 2000. Ketchikan Pulp Company (KPC), Ketchikan, AK, Uplands Operable Unit, Record of Decision. Alaska Department of Environmental Conservation, Anchorage, AK, and U.S. Environmental Protection Agency, Anchorage, AK.

ADL. 1999. Environmental protection easement and declaration of restrictive covenants. Between Ketchikan Pulp Company and the State of Alaska Department of Natural Resources for use by Alaska Department of Environmental Conservation as represented by Alaska Department of Law. Effective October 28, 1999.

E&E. 1991. Draft site inspection report for Ketchikan Pulp Company. Prepared for Alaska Department of Environmental Quality. Ecology and Environment, Inc., Anchorage, AK.

Exponent. 1998a. Addendum no. 1 to the RI/FS work plan, supplemental sampling at the grit chamber, local rock quarries, and water pipeline storage area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1998b. Addendum no. 4 to the RI/FS work plan, supplemental soil sampling at the paint shop area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1998c. Addendum no. 5 to the RI/FS work plan, supplemental soil and sediment sampling at the pipeline road and railroad tracks area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1998d. Management plan for arsenic in rock and soil. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1998e. Remedial investigation, Ketchikan Pulp Company site. Volumes I–IV. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1998f. Technical memorandum no. 8, remediation plan for early action at the access road ditch, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999a. Addendum no. 6 to the RI/FS work plan, supplemental soil sampling at the railroad tracks and retaining wall areas. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999b. Letter to D. Soderlund, U.S. Environmental Protection Agency, Anchorage, AK, and R. Klein, Alaska Department of Environmental Conservation, Anchorage, AK, dated July 28, 1999, regarding Ketchikan Pulp Company site, Uplands Operable Unit, early action for the pipeline road. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999c. Letter to D. Soderlund, U.S. Environmental Protection Agency, Anchorage, AK, and R. Klein, Alaska Department of Environmental Conservation, Anchorage, AK, dated August 9, 1999, regarding Ketchikan Pulp Company site, Uplands Operable Unit, early action for the paint shop area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999d. Technical memorandum no. 11, early action plan for the pipeline storage area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999e. Technical memorandum no. 12, early action plan for the paint shop/former maintenance shop area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999f. Technical memorandum no. 13, early action plan for railroad tracks and compressor areas, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999g. Technical memorandum no. 15, early action report for the access road ditch, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999h. Technical memorandum no. 17, supplemental soil sampling at the paint shop area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999i. Technical memorandum no. 18, early action plan for the bulk fuel tank area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999j. Technical memorandum no. 19, summary of supplemental sampling at the pipeline storage area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999k. Technical memorandum no. 20, early action report for the railroad tracks and compressors areas, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999l. Technical memorandum no. 21, early action for the bulk fuel tank area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999m. Technical memorandum no. 22, early action report for the paint shop/former maintenance shop area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 2000a. Technical memorandum no. 23, early action report for the pipeline storage area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 2000b. Technical memorandum no. 24, early action report for the railroad tracks area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

KPC. 1999. Comprehensive landfill monitoring plan. Ketchikan Pulp Company, Ketchikan, AK.

U.S. EPA. 1989. Memorandum from H.L. Longest II, Director, Office of Emergency and Remedial Response, and B. Diamond, Director, Office of Waste Programs Enforcement, to Directors, Waste Management Division, Regions I, II, IV, V, VII, and VIII; Director, Emergency and Remedial Response Division, Region II; Directors, Hazardous Waste Management Division, Regions III and VI; Director, Toxic Waste Management Division, Region IX; and Director, Hazardous Waste Division, Region X, dated September 7, 1989, regarding interim guidance on establishing soil lead cleanup levels at Superfund sites. OSWER Directive #9355.4-02. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1995. Memorandum from E.P. Laws, Assistant Administrator, to Director, Waste Management Division, Regions I, IV, V, and VII; Director, Emergency and Remedial Response Division, Region II; Director, Hazardous Waste Management Division, Regions III, VI, VIII, and IX; Director, Hazardous Waste Division, Region X; and Director, Environmental Services Division, Regions I, VI, and VII, regarding land use in the CERCLA remedy selection process, dated May 25, 1995. OSWER Directive No. 9355.7-04. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1998. Memorandum from J. Hubbard to RBC Table mailing list, regarding updated risk-based concentration table, dated April 1, 1998. U.S. Environmental Protection Agency, Region 3, Philadelphia, PA.

U.S. EPA. 1999. National recommended water quality criteria—correction. EPA 822-Z-99-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Appendix A

Easement and Covenant Document

ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS

(1) This Environmental Protection Easement and Declaration of Restrictive Covenants ("Easement and Covenant") is made this 28 day of Oct., 1997, by and between Ketchikan Pulp Company ("Grantor"), having an address of P.O. Box 6600, Ketchikan, Alaska, 99901, and the State of Alaska Department of Natural Resources ("Grantee"), having an address of 3601 "C" Street, Suite 960, Anchorage, Alaska 99503, for use by the State of Alaska Department of Environmental Conservation (DEC), as represented by its State of Alaska Department of Law.

WITNESSETH:

(2) WHEREAS, Grantor is the owner of a parcel of land and tide and submerged lands located in the Ketchikan Gateway Borough, State of Alaska, more particularly described on **Exhibit A** attached hereto and made a part hereof ("the Property"); and

(3) WHEREAS, the U.S. Environmental Protection Agency (EPA) and the State of Alaska Department of Environmental Conservation (DEC) intend to select response actions for the Property in Records of Decision pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 *et seq.*, AS 46.03.822, and/or pursuant to a consent decree dated September 19, 1995, filed under U.S. v. Ketchikan Pulp Company, No. A92-587-CV (D. Alaska);

(4) WHEREAS, the parties hereto agree (a) to grant a permanent right of access over the Property to the Grantee for purposes of implementing, facilitating and monitoring the response actions; and (b) to impose on the Property use restrictions as covenants that will run with the land for the purpose of protecting human health and the environment; and

(5) WHEREAS, Grantor wishes to cooperate fully with the Grantee and EPA in the implementation of all response actions at the Property;

NOW, THEREFORE:

(6) Grant: Grantor, for good and sufficient consideration received, does hereby covenant and declare that the Property shall be subject to the restrictions on use set forth below, and does give, grant and convey to the Grantee, and its assigns, (a) a right to enforce said use restrictions for the duration of this Easement and Covenant as established in Paragraph (9) below, and (b) an environmental protection easement of the nature and character, and for the purposes hereinafter set forth, with respect to the Property.

(7) Purpose: It is the purpose of this instrument to convey to the Grantee real property rights, which will run with the land, to facilitate the remediation of past environmental contamination and to protect human health and the environment by reducing the risk of exposure to contaminants.

(8) Restrictions on use: The following covenants, conditions, and restrictions apply to the use of the Property, run with the land, and are binding on the Grantor:

(a) Uses of the Property are limited to commercial or industrial use.

(b) The Property shall not, at any time, be used, in whole or in part, for human habitation, schooling of children, hospital care, child care or any purpose necessitating around-the-clock residence by humans.

(c) Drilling of drinking water wells is prohibited.

(d) Use of ground water for drinking water is prohibited.

(e) Controls specified in the "Management Plan for Arsenic and Rock and Soil," prepared by Exponent for KPC, dated July 1998, to limit concentrations of arsenic from crushed rock shall be complied with.

(f) Soils in the nearshore fill area or soils underneath paved areas or structures at the pulp mill site that are exposed in the future, e.g., as the result of excavation or demolition activities, shall be properly characterized and managed in accordance with applicable disposal requirements.

(g) Projects or activities that materially damage the cap applied to tide and submerged lands shall be required, at the direction of EPA, to redress such impacts, e.g., a dredging project that may erode or displace large portions of the cap will be required to repair or replace the cap.

(9) Modification of restrictions: The restrictions for the Property set forth in Paragraphs (8)(a) through (f) above shall exist until 2099, or until concentrations of the contaminants set forth in **Exhibit B** attached hereto no longer exceed site-specific, risk-based, residential cleanup levels, whichever comes first. The restriction set forth in

Paragraph (8)(g) above for tide and submerged lands shall exist until 2020 or until EPA determines that healthy benthic communities exist in the capped tide and submerged lands, whichever comes earlier. The above restrictions may be terminated in whole or in part, in writing, by the Grantee. If requested by the Grantor, such writing will be executed by Grantee in recordable form.

(10) Environmental Protection Easement: Grantor hereby grants to the Grantee an irrevocable and continuing right of access under the terms and conditions of this instrument at all reasonable times to the Property for purposes of implementing the following activities pursuant to CERCLA, AS 46.03.822, or the above-referenced consent decree. Grantee, in its sole discretion, may relinquish this easement for right of access. Grantee may designate EPA as its authorized representative for the following activities:

(a) Implementing response actions for the Property selected by EPA and/or DEC in Records of Decision.

(b) Verifying any data or information submitted to EPA or the Grantee by the Grantor.

(c) Verifying that no action is being taken on the Property in violation of the terms of this instrument, CERCLA, AS 46.03.822, or the above-referenced consent decree.

(d) Monitoring response actions on the Property including, without limitation, sampling of air, water, sediments, soils, and specifically, without limitation,

obtaining split or duplicate samples.

(e) Conducting periodic reviews of any response action(s) selected by EPA and/or DEC, including but not limited to, reviews required by applicable statutes and/or regulations.

(f) Assessing the need for and implementing additional or new response actions authorized under CERCLA, AS 46.03.822, or the above-referenced consent decree.

(11) Reserve rights of Grantor: Grantor hereby reserves unto itself, its successors, and assigns, all rights and privileges in and to the use of the Property which are not contrary to the restrictions, rights and easements granted herein.

(12) Other Authorities. Nothing in this document shall limit or otherwise affect the State of Alaska's or EPA's rights of entry and access or their authority to take response actions under CERCLA, the National Contingency Plan (NCP), or other federal or state law.

(13) No Public Access and Use: No right of access or use by the general public to any portion of the Property is conveyed or authorized by this instrument nor are any such existing rights affected by this instrument.

(14) Notice requirement: Grantor agrees to include in any instrument conveying any interest in any portion of the Property, including but not limited to deeds, leases and mortgages, a notice which is in substantially the following form:

NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL PROTECTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS, DATED _____ _____, 19 ___, RECORDED IN THE KETCHIKAN RECORDING DISTRICT, FIRST JUDICIAL DISTRICT, STATE OF ALASKA, ON _____, 19 ___, IN BOOK ___, PAGE ___ THAT IS IN FAVOR OF, AND ENFORCEABLE BY, THE STATE OF ALASKA.

Within thirty (30) days of the date any such instrument of conveyance is executed, Grantor must provide Grantee with a certified true copy of said instrument and, if it has been recorded in the public land records, its recording reference.

(15) Administrative jurisdiction: The interests conveyed to the State of Alaska by this instrument are to its Department of Natural Resources, for administration by its Department of Environmental Conservation.

(16) Enforcement: The Grantee shall be entitled to enforce the terms of this instrument by resort to specific performance or legal process without regard to the existence or nonexistence of any dominant estate. Grantee or its authorized representative shall be entitled to enforce the rights of access set forth in Paragraph (10) above. All remedies available hereunder shall be in addition to any and all other remedies at law or in equity, including CERCLA and AS 46.03.822. Enforcement of the terms of this instrument shall be at the discretion of the Grantee; any forbearance, delay or omission to exercise its rights under this instrument in the event of a breach of any term of this instrument shall not be deemed to be a waiver by the Grantee of such term or of any subsequent breach of the same or any other term, or of any of the rights of the Grantee under this instrument.

(17) Damages: Grantee shall be entitled to recover damages for violations of the terms of this instrument.

(18) Waiver of certain defenses: Grantor hereby waives any defense of laches, estoppel, or prescription.

(19) Notices: Unless and until changed by Grantor or Grantee, any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and shall either be served personally or sent by first class mail, postage prepaid, addressed as follows:

To Grantor:

Ketchikan Pulp Company
Attn: President and General Manager
c/o Louisiana-Pacific Corp.
111 SW 5th Avenue
Portland, Oregon 97204

To Grantee:

State of Alaska
Department of Natural Resources
Division of Mining, Land and Water
Realty Services Section
3601 "C" Street, Suite 960
Anchorage, Alaska 99503

AND

State of Alaska
Department of Environmental Conservation
Spill Prevention & Response
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-1795

(20) General provisions:

(a) Controlling law: The interpretation and performance of this instrument shall be governed by the laws of the United States and the State of Alaska.

(b) Liberal construction: Any general rule of construction to the contrary

notwithstanding, this instrument shall be liberally construed in favor of the Grant of this instrument to effect the purpose of this instrument and policy and purpose of CERCLA, the above-referenced consent decree, and applicable state law. If any provision of this instrument is found to be ambiguous, an interpretation consistent with the purpose of this instrument that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability: If any provision of this instrument, or the application of it to any person or circumstance, is found to be invalid, the remainder of the provisions of this instrument, or the application of such provisions to persons or circumstances other than those to which it is found to be invalid, as the case may be, shall not be affected thereby.

(d) Entire Agreement: This instrument sets forth the entire agreement of the parties with respect to rights and restrictions created hereby, and supersedes all prior discussions, negotiations, understandings, or agreements relating thereto, all of which are merged herein.

(e) No Forfeiture: Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors: The covenants, terms, conditions, and restrictions of this instrument shall be binding upon, and inure to the benefit of, the parties

hereto and their respective personal representatives, heirs, successors, and assigns and shall continue as a servitude held by Grantee in gross without regard to the existence or absence of privity of estate with Grantor or its successors or assigns, and shall run with the Property for the duration of this Easement and Covenant as established in Paragraph (9) above. The term "Grantor", wherever used herein, and any pronouns used in place thereof, shall include the persons and/or entities named at the beginning of this document, identified as "Grantor" and their personal representatives, heirs, successors, and assigns. The term "Grantee", wherever used herein, and any pronouns used in place thereof, shall include the persons and/or entities named at the beginning of this document, identified as "Grantee" and their personal representatives, heirs, successors, and assigns. The rights of the Grantor under this instrument are freely assignable. The rights of the Grantee under this instrument are freely assignable to governmental bodies, subject to the notice provisions hereof. The term "EPA" shall include any successor agencies of EPA.

(g) Termination of Rights and Obligations: Grantor's rights and obligations under this instrument terminate upon transfer of the party's interest in the Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(h) Captions: The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon construction or interpretation.

(i) Counterparts: The parties may execute this instrument in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

TO HAVE AND TO HOLD unto the State of Alaska and its assigns forever.

IN WITNESS WHEREOF, Grantor has caused this Agreement to be signed in its name.

Executed this 28 Day of Oct., 1999.

By: _____
Chris Paulson
Its: President & General Manager
Ketchikan Pulp Company

STATE OF ALASKA)
: ss
FIRST JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 28th day of Oct., 1999, at ~~Juneau~~ Ketchikan, Alaska, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn, personally appeared Chris Paulson, known to me and known to me to be the person he represents himself to be, and the same identical person who executed the above and foregoing document regarding an Environmental Protection Easement and Declaration of Restrictive Covenants, and who acknowledged to me that he executed the same freely and voluntarily for the purposes and uses herein mentioned.

WITNESS my hand and official seal the day, month and year in this certificate first written above.

NOTARY PUBLIC STATE OF ALASKA

_____
Notary Public, State of Alaska
My Commission Expires: 9-19-2002

This easement and declaration is accepted this 27 day of October, 19 99.

STATE OF ALASKA DEPARTMENT
OF NATURAL RESOURCES

By: _____

_____

STATE OF ALASKA)
:SS
FIRST JUDICIAL DISTRICT)

THIS IS TO CERTIFY that on this 27 day of Oct, 1999, before me, the undersigned, a Notary Public in and for the State of Alaska, duly commissioned and sworn as such, personally appeared _____, known to me and to me known to be the _____, and he/she acknowledged to me that he/she signed as accepting the foregoing Environmental Protection Easement and Declaration of Restrictive Covenants, granting to the State of Alaska, those lands described therein, and he/she executed the foregoing instrument freely and voluntarily.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year first written above.

(SEAL)

_____
Notary Public in and for the State of Alaska
My commission expires _____

AFTER RECORDING PLEASE RETURN ORIGINALS TO:

Carol Shobe, Chief
Realty Services Section
State of Alaska, Department of Natural Resources
Division of Mining, Land and Water
3601 "C" Street, Suite 960
Anchorage Alaska 99503

Location Index:
Sections 33 and 34, T. 74 S., R 90 E., CRM
Sections 3 and 4, T. 75 S., 90 E., CRM

STATE BUSINESS, NO CHARGE

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EXHIBIT A
To The Environmental Protection Easement
And Declaration of Restrictive Covenants

Description of "the Property"

PARCEL NO. 1:

ALASKA TIDELANDS SURVEY NO. 1 (CR 74S 90E), according to the recorded plat thereof, (mistakenly recorded in the Juneau Recording District as Plat No. 292), Ketchikan Recording District, First Judicial District, State of Alaska;

Excepting therefrom: That portion thereof taken by the State of Alaska, Department of Transportation and Public Facilities by that certain Declaration of Taking (filed under Ketchikan Superior Court Case No. 1KE-87-444 CI) recorded May 28, 1987 in Book 149 at Page 625.

PARCEL NO. 2:

U.S. Survey 1056, accepted by the General Land Office, in Juneau, Alaska on January 24, 1919, and located within the Ketchikan Recording District, First Judicial District, State of Alaska;

Excepting therefrom: Those portions of U.S.Survey 1056 situated upland (North) of the north Right-of-way line of the North Tongass Highway;

Excepting therefrom: That certain portion thereof conveyed to Eugene Wacker and Lillian Wacker, his wife by Warranty Deed recorded January 27, 1950 in Volume "W" of Deeds at Page 614;

Also excepting therefrom: That certain portion conveyed to The United States of America by Right-of-Way Deed recorded April 28, 1949 in Volume "W" of Deeds at Page 397.

PARCEL NO. 13:

Lots 1-7, inclusive, Block 1, Lots 1-6, inclusive, Block 2, Lots 1-4, inclusive, Block 3 and Lots 1-16, inclusive Block

4, and the Unsubdivided Remainder, according to the subdivision plat of U.S. Survey 1754 recorded March 8, 1956 in Volume 1 of Plats at Packet 20, Ketchikan Recording District, First Judicial District, State of Alaska;

Excepting therefrom: Those portions of U.S.Survey 1754 situated upland (North) of the North Tongass Highway.

PARCEL NO. 15:

That portion of U.S. Survey 1862, according to the plat of survey approved by the Department of the Interior, General Land Office in Washington, D.C., on January 20, 1931 and located within the Ketchikan Recording District, First Judicial District, State of Alaska, more particularly described as follows: Beginning at U.S. Location Monument No. 2; thence North 32 degrees 27 minutes West a distance of 155.5 feet to Corner No. 1 of U.S. Survey 1862 and the true point of beginning of the portion herein described; thence North 0 degrees 25 minutes West a distance of 515 feet, more or less, to a point on the South Right of Way line of North Tongass Highway, which point is 50 feet from the center line of said highway and at right angles to Engineers Station 299+50; thence along that portion of a spiral curve to the left whose chord bears South 24 degrees 30 minutes East a distance of 114.65 feet; thence along the arc of a 527.46 foot radius curve the long chord of which bears South 36 degrees 35 minutes East a distance of 126.14 feet; thence along a spiral curve whose chord bears South 51 degrees 21 minutes East a distance of 210.05 feet; thence South 55 degrees 27 minutes East a distance of 316.97 feet; thence South 34 degrees 33 minutes West a distance of 50 feet; thence South 55 degrees 27 minutes East a distance of 137.00 feet; thence South 88 degrees 00 minutes West a distance of 535 feet more or less along Meander Line No. 11 of U.S. survey 1862; thence North 29 degrees 30 minutes West a distance of 155.50 feet along Meander Line No. 12 of U.S. Survey 1862 to Corner No. 1, which is the point of beginning;

ALSO: That portion of U.S. Survey 1862 lying with the North Tongass Highway Right of Way as created by a deed dated April 1, 1949 and recorded in Volume "W" of Deeds at Page 362, Ketchikan Recording District, First Judicial District,

State of Alaska, and as conveyed to Ketchikan Pulp Company by Quitclaim Deed recorded July 27, 1988 in Book 158 at Page 588.

Excepting therefrom: Those portions of U.S.Survey 1862 situated upland (north) of the north Right-of-way line of the North Tongass Highway.

Exhibit B to Environmental Protection Easement
and Declaration of Restrictive Covenants

Contaminants of Concern

Arsenic
Dioxin
Lead
Petroleum
Polycyclic aromatic hydrocarbons (benz(a)anthracene, benzo(b)fluroanthene, benzo(a)pyrene, and dibenz(a,h)anthracene)
Polychlorinated biphenyls

Appendix B

Sampling and Analysis Plan

1. Introduction

This sampling and analysis plan (SAP) describes the procedures for collecting data to characterize soils exposed during future demolition/construction activities at the Uplands Operable Unit of the Ketchikan Pulp Company site in Ketchikan, Alaska (Figure B-1). The sampling methods presented in this SAP are designed to meet the needs of the institutional control plan (see main text). The institutional control plan states that if future demolition activities, such as removal of paved areas or structures or excavation of portions of the near-shore fill subarea for construction, result in the exposure of soils not evaluated as part of the Uplands Operable Unit remedial investigation or early actions, then those soils will be properly characterized and managed. Specific areas previously characterized are presented in Figure B-2 and are described in detail in the remedial investigation report (Exponent 1998) and subsequent technical memoranda (Exponent 1999a–c). The SAP will be used as a reference for conducting all soil characterization activities; however, the specific sampling approach for each excavation will be developed in consultation with the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC). Field sampling and analysis procedures for soil are included in this SAP. If groundwater or tidally intruding seawater (but not transitory accumulated rainwater) is encountered during demolition activities, specific water characterization procedures will be developed with EPA and ADEC. The soil sampling and analysis procedures presented in this SAP were developed in accordance with 18 AAC 75 and 18 AAC 78.

2. Field Sampling Methods

Soil sampling and analysis will be conducted whenever demolition or excavation activities result in the exposure of soils that were not characterized during the remedial investigation or early actions. The specific sampling approach for each excavation will be developed in consultation with EPA and ADEC, but the following general guidelines, as specified in 18 AAC 75 and 18 AAC 78, should be followed. For each discrete area exposed, if the surface area of the exposed soil is 250 ft^2 or less, three grab samples of soil will be collected from the bottom of the excavation. For each additional 250 ft^2 of exposed surface area, one additional grab sample will be collected from the bottom of the excavation. The actual location of the grab samples will be determined in the field, but will be spaced in such a way as to provide an accurate representation of site-specific conditions. In addition, if visually stained or texturally different areas within the exposed area are encountered, they will be sampled separately. Samples will be collected from a depth of 0–6 in. or to bedrock if it is encountered at less than 6 in. If the excavation is greater than 4 ft in depth, one soil sample will be collected from each sidewall of the excavation. Sidewall samples will be collected, to the extent possible, over the entire depth of excavation (e.g., a grab sample will be collected from the excavation equipment bucket after the bucket has swept a sample from the entire vertical extent of the sidewall).

The following steps will be taken to minimize sample collection errors:

- All samples will be collected with disposable or clean tools that have been decontaminated as outlined in Section 2.3, *Equipment Decontamination.*
- Disposable gloves will be worn and changed between sample collections.
- Precleaned sample containers supplied by the analytical laboratory will be used.
- Sample containers will be filled quickly.
- Samples will be placed in containers in the order of volatility of the analyte; for example, volatile organic compound (VOC) samples will be taken first, followed by the semivolatile organic compound (SVOC) samples and then metal samples.
- Containers will be quickly and adequately sealed, and rims will be cleaned before lids are tightened. Tape may be used only if known not to affect sample analysis.
- Sample containers will be labeled as outlined in Section 2.2, *Sample Labeling.*

- Samples will be immediately preserved according to procedures described in Section 3, *Laboratory Analysis*. Unless specified otherwise, immediately after sample containers are filled, they will be placed on ice in a cooler at 4°C. This temperature must be maintained throughout delivery to the laboratory and until samples are analyzed.

2.1 Documentation of Soil Sampling Activities

A field logbook or other type of field record will be used to document the collection of samples and site data. This record must include the following:

- The name of each person onsite supervising or conducting the sampling
- The date and time of sampling
- Weather conditions, including temperature, wind speed, humidity, and precipitation
- The name of each person who physically collected the samples
- Clear photographs of the site, bottom of excavation, and sampling locations
- A site sketch that, at a minimum, shows the following:
  - Distances from the excavation to nearby structures
  - Sampling locations and depth and corresponding sample ID numbers
  - Any visually stained soils or texturally different materials
  - Scale
  - North arrow.

When appropriate, the field record should also include the following:

- A description of the size of the excavation
- Location of stockpiled soils
- Amount and type of backfill material
- Soil types
- Utility trenches.

2.2 Sample Labeling

Indelible, waterproof ink will be used to label sample containers. Labels must be securely fastened to the container. All information entered onto the label must be duplicated in the field logbook. Information on the label must include the following:

- Unique identifying number (sample ID number) assigned to the sample for laboratory analysis
- Date and time of sample collection
- Name of person collecting the sample
- Each intended laboratory analysis for the sample
- Preservative (if applicable).

A chain-of-custody form(s) will accompany each shipment of samples to the analytical laboratory. The chain-of-custody form will contain sample ID number, date and time of collection, and requested analysis for each sample. The field team leader will also be identified. The chain-of-custody form will be completed in triplicate, with the original form sent to the laboratory along with the samples and one copy retained by the field team leader.

2.3 Equipment Decontamination

All sampling equipment must be decontaminated prior to sampling and between sampling locations. Clean, solvent-resistant gloves and appropriate protective equipment must be worn by persons decontaminating tools and equipment. At a minimum, soil sampling tools must be cleaned and decontaminated by scrubbing in an Alconox® (or equivalent laboratory-grade detergent) solution with a stiff brush, rinsing twice with clean site water, and finally rinsing with distilled or deionized water. If free product or highly contaminated soils are encountered during sampling, an appropriate solvent should be used to remove heavy residues from the sampling equipment, followed by the cleaning steps described above.

Wastewater and rinsate solutions must be collected in appropriate containers and disposed of properly in accordance with federal, state, and local regulations.

2.4 Health and Safety

All sampling activities will be conducted in accordance with both the current owner's and the sampling contractor's health and safety plans.

3. Laboratory Analysis

An excavation-specific set of analytes will be developed in consultation with EPA and ADEC; however, the following analytes are suggested for specific areas of the site. Soil underneath paved areas (i.e., railroad track areas) or other areas where petroleum products were stored or used will be analyzed for diesel- and residual-range organics and polycyclic aromatic hydrocarbons (PAHs) (and gasoline-range organics and benzene, toluene, ethylbenzene, and xylenes, if appropriate). Soil underneath structures will be analyzed for diesel- and residual-range organics, PAHs, and polychlorinated biphenyls (PCBs). Soil from the flyash silo will be analyzed for polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans. Soil in the near-shore fill subarea and the water pipeline storage area will be analyzed for diesel- and residual-range organics, target analyte list metals, VOCs, SVOCs, organochlorine pesticides and PCBs, and chlorinated herbicides. The analyte list for soils in other areas will be determined in consultation with EPA and ADEC. All analyses will be conducted in accordance with EPA, ADEC, American Society for Testing and Materials, or equivalent methods. The analytical methods presented in Table B-1, or updated versions of these methods, should be used if applicable. Sample preservation and handling requirements for these methods are also presented in Table B-1.

4. Data Reporting

For each characterization effort, a brief memorandum will be prepared after receipt of analytical results from the laboratory. The memorandum will contain a description of the sampling, including site photographs, a figure showing all sampling locations, and tabulated analytical results. The memorandum will be sent to EPA and ADEC within 60 days of the receipt of final results from the analytical laboratory.

5. References

ADEC. 1998. Alaska Department of Environmental Conservation, Storage Tank Program, underground storage tanks procedures manual. Guidance for remediation of petroleum-contaminated soil and water and standard sampling procedures. December 10, 1998. Alaska Department of Environmental Conservation, Juneau, AK.

ASTM. 1989. Annual book of ASTM standards. Volume 04.08, soil and rock; building stones; geotextiles. American Society for Testing and Materials, Philadelphia, PA.

Exponent. 1998. Remedial investigation, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999a. Technical memorandum no. 19, summary of supplemental sampling at the pipeline storage area. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999b. Technical memorandum no. 20, early action report for the railroad tracks and compressors areas, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

Exponent. 1999c. Technical memorandum no. 21, early action for the bulk fuel tank area, Ketchikan Pulp Company site. Prepared for Ketchikan Pulp Company, Ketchikan, AK. Exponent, Bellevue, WA.

U.S. EPA. 1994. Method 1613: Tetra- through octa-chlorinated dioxins and furans by isotope dilution HRGC/HRMS. EPA 831-B-94-005. U.S. Environmental Protection Agency, Office of Water, Engineering and Analysis Division, Washington, DC.

U.S. EPA. 1997. Test methods for evaluating solid waste–physical chemical methods, SW-846. Version 2. U.S. Environmental Protection Agency, Washington, DC.

Appendix C

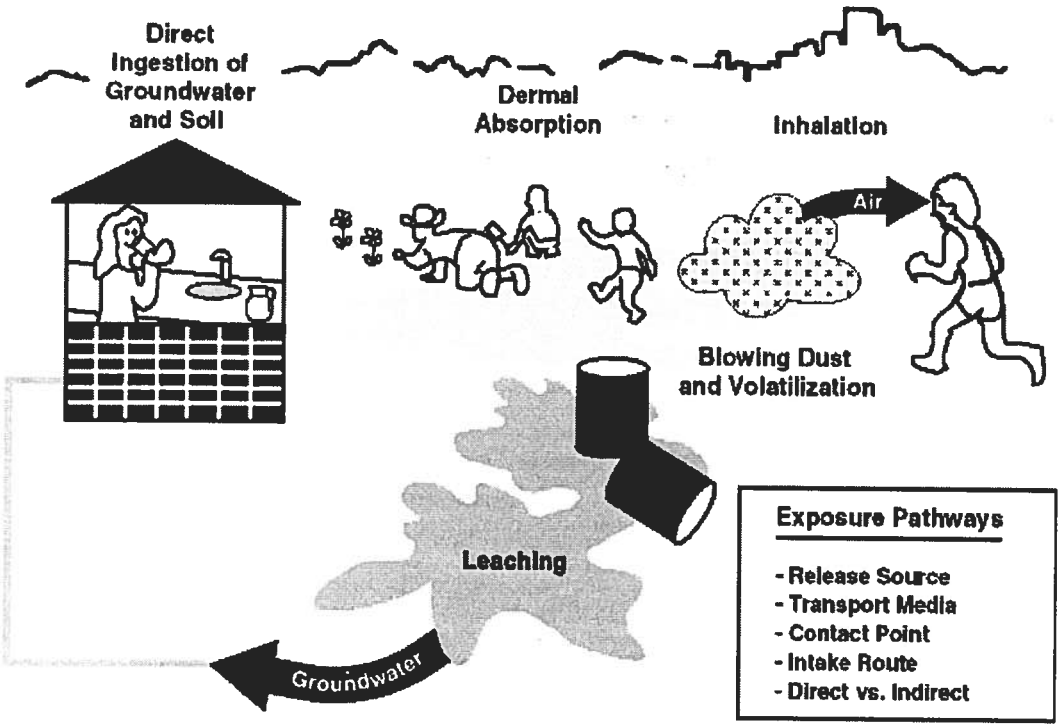
Screening Levels Derived by EPA Region 9 for Industrial Soils

EPA United States Environmental Protection Agency

Waste Programs

Region 9

Preliminary Remediation Goals (PRGs)



Introduction [This can also be downloaded in MS Word (225K) or WordPerfect (174K)]

R9 PRGs Table [A-Bu] [Ca-De] [Di-Fe]* [Fl-Mo]** [Na-Pu] [Py-Zi]

Soil PRGs [A-Bu] [Ca-De] [Di-Fe] [Fl-Mo] [Na-Pu] [Py-Zi]

Air-Water PRGs [A-Bu] [Ca-De] [Di-Fe] [Fl-Mo] [Na-Pu] [Py-Zi]

Toxicity Values [A-Bu] [Ca-De] [Di-Fe] Fl-Mo] [Na-Pu] [Py-Zi]

Phys-Chem Data [A-Di]* [Ep-Tr]*

All the tables above can be downloaded as a complete set in Excel* (751K) or Lotus 123* † (594K).

*** Indicates that the table was updated with missing values on November 29, 1999.**

**** Indicates that the table was updated with missing values on December 3, 1999.**

† **If your browser is having trouble downloading this file, click on it with your right mouse button and select "Save Link As ...".**

Go to: [Region 9 Waste Home] [Region 9 Home] [Superfund Home] [EPA Home]

Send questions and comments to: smucker.stan@epa.gov
Region 9 Office: 75 Hawthorne Street, San Francisco, California, 94105-3901

Updated: December 3, 1999

URL: http://www.epa.gov/region09/waste/sfund/prg/index.htm

EPA United States Environmental Protection Agency

Waste Programs

Region 9 PRGs: Introduction

Region 9 Preliminary Remediation Goals (PRGs) are tools for evaluating and cleaning up contaminated sites. This page includes an explanation of the use of PRGs, key equations for computing PRGs and a table of PRG values.

Table of Contents:

Download the Preliminary Remediation Goals Table in Excel or Lotus 123 and Text in MS Word or WordPerfect. Another available resource is EPA's Soil Screening Guidance.

[R9 PRG Home] [Introduction] [R9 PRGs Table] [Soil PRGs]
[Air-Water PRGs] [Toxicity Values] [Phys-Chem Data]

Letter to PRG Table Mailing List

October 1, 1999
Subject: Region 9 Preliminary Remediation Goals (PRGs) 1999

From: Stanford J. Smucker, Ph.D.
Regional Toxicologist (SFD-8-B)
Technical Support Team

To: PRG Table Mailing List

Please find the annual update to the Region 9 PRG (Preliminary Remediation Goals) table. Risk-based PRGs presented in the "lookup" table are useful tools for evaluating and cleaning up contaminated sites. They are being used to streamline and standardize all stages of the risk decision-making process. If you are not currently on the PRG table mailing list but would like to be, please call

Lynn Trujillo (415.744.2419) or email her (Trujillo.Dianna@epa.gov) and leave your name, address, and phone number.

EPA Region 9 has established a homepage for the PRGs on the World Wide Web which you can find at http://www.epa.gov/region09/waste/sfund/prg/ . The PRG homepage presents additional information not available in the printed tables that are sent out to folks; including pathway-specific screening concentrations, non-cancer PRGs for carcinogenic substances, and physical-chemical information for volatile organic compounds (VOCs). This information may be viewed or downloaded at our website.

Region 9 risk-based PRGs are "evergreen" and have evolved as new methodologies and parameters have been developed. Changes to individual PRGs that have occurred from the 1998 table reflect either updates in toxicity information or a reclassification of a chemical's status as a VOC. These chemical-specific changes are identified by boldface type in the table. In addition, a more global change in the PRG numeric values reflects new exposure guidelines presented in "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance" (USEPA 1999a, see Section 4.3).

Chemicals for which toxicity values have been revised or added include: **acetonitrile, aluminum, antimony trioxide, chlordane, chlorobenzene, chloroethane, chloroform, chloromethane, chromium VI, dichlorobenzene isomers, ethyl chloride, manganese, nitroglycerin, 4-nitrophenol, PCBs, 1,1,2,2-tetrachloroethane, and tetrahydrofuran**. Updates to EPA toxicity values were obtained from IRIS and the National Center for Environmental Assessment (NCEA) through August 1999.

Chemicals for which the VOC status has changed in an effort to reconcile differences among the regions include: **chloronitrobenzene isomers, cyanogen and its salts, methylcyclohexane, methylene bromide, and the nitrotoluene isomers**. The criteria for VOC status are taken from RAGS Part B. However, three "borderline chemicals" (**dibromochloromethane, 1,2-dibromochloropropane, and pyrene**) that do not strictly meet the RAGS criteria of volatility have also been included based upon discussions with other state and federal agencies and after a consideration of vapor pressure characteristics etc.

Before relying on any number in the table, it is recommended that the user verify the numbers with an agency toxicologist or risk assessor because the toxicity / exposure information in the table may contain errors or default assumptions that need to be refined based on further evaluation. If you find an error please send me a note via email at smucker.stan@epa.gov or fax at 415.744.1916.

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DISCLAIMER

Preliminary remediation goals (PRGs) focus on common exposure pathways and may not consider all exposure pathways encountered at CERCLA / RCRA sites (Exhibit 1-1). PRGs do not consider impact to groundwater or address ecological concerns. PRGs are specifically not intended as a (1) stand-alone decision-making tool, (2) as a substitute for EPA guidance for preparing baseline risk assessments, or (3) a rule to determine if a waste is hazardous under RCRA.

The guidance set out in this document is not final Agency action. It is not intended, nor can it be relied upon to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided herein, or act at variance with the guidance, based on an analysis of specific circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

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1.0 INTRODUCTION

Region 9 Preliminary Remediation Goals (PRGs) are risk-based tools for evaluating and cleaning up contaminated sites. They are being used to streamline and standardize all stages of the risk decision-making process.

The Region 9 PRG table combines current EPA toxicity values with "standard" exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above these levels would not automatically designate a site as "dirty" or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates (e.g. appropriateness of route-to-route extrapolations, appropriateness of using chronic toxicity values to evaluate childhood exposures, appropriateness of generic exposure factors for a specific site etc.).

The PRG concentrations presented in the table can be used to screen pollutants in environmental media, trigger further investigation, and provide an initial cleanup goal if applicable. When considering PRGs as preliminary goals, residential concentrations should be used for maximum beneficial uses of a property. Industrial concentrations are included in the table as an alternative cleanup goal for soils. In general, it is not recommended that industrial PRGs be used for screening sites unless they are used in conjunction with residential values.

Before applying PRGs as screening tools or initial goals, the user of the table should consider whether the exposure pathways and exposure scenarios at the site are fully accounted for in the PRG calculation. Region 9 PRG concentrations are based on exposure pathways for which generally accepted methods, models, and

assumptions have been developed (i.e. ingestion, dermal contact, and inhalation) for specific land-use conditions and do not consider impact to groundwater or ecological receptors (see Developing a Conceptual Site Model below).

EXHIBIT 1-1
TYPICAL EXPOSURE PATHWAYS BY MEDIUM
FOR RESIDENTIAL AND INDUSTRIAL LAND USES[a]

	EXPOSURE PATHWAYS, ASSUMING:	
MEDIUM	RESIDENTIAL LAND USE	INDUSTRIAL LAND USE
Ground Water	***Ingestion from drinking***	Ingestion from drinking
	Inhalation of volatiles	Inhalation of volatiles
	Dermal absorption from bathing	Dermal absorption
Surface Water	***Ingestion from drinking***	Ingestion from drinking
	Inhalation of volatiles	Inhalation of volatiles
	Dermal absorption from bathing	Dermal absorption
	Ingestion during swimming	
	Ingestion of contaminated fish	
Soil	***Ingestion***	***Ingestion***
	Inhalation of particulates	***Inhalation of particulates***
	Inhalation of volatiles	***Inhalation of volatiles***
	Exposure to indoor air from soil gas	Exposure to indoor air from soil gas
	Exposure to ground water contaminated by soil leachate	Exposure to ground water contaminated by soil leachate
	Ingestion via plant, meat, or dairy products	Inhalation of particulates from trucks and heavy equipment
	Dermal absorption	***Dermal absorption***

Footnote:

[a]Exposure pathways considered in the PRG calculations are indicated in boldface italics.

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2.0 READING THE PRG TABLE

2.1 General Considerations

With the exceptions described below, PRGs are chemical concentrations that correspond to fixed levels of risk (i.e. either a one-in-one million [10^{-6}] cancer risk or a noncarcinogenic hazard quotient of 1) in soil, air, and water. In most cases, where a substance causes both cancer and noncancer (systemic) effects, the 10^{-6} cancer risk will result in a more stringent criteria and consequently this value is presented in the hard copy of the table. PRG concentrations that equate to a 10^{-6} cancer risk are indicated by "ca". PRG concentrations that equate to a hazard quotient of 1 for noncarcinogenic concerns are indicated by "nc".

If the risk-based concentrations are to be used for site screening, it is recommended that both cancer and noncancer-based PRGs be used. Both carcinogenic and noncarcinogenic values may be obtained at the Region 9 PRG homepage at:

http://www.epa.gov/region09/waste/sfund/prg/

It has come to my attention that some users have been multiplying the cancer PRG concentrations by 10 or 100 to set "action levels" for triggering remediation or to set less stringent cleanup levels for a specific site after considering non-risk-based factors such as ambient levels, detection limits, or technological feasibility. This risk management practice recognizes that there may be a range of values that may be "acceptable" for carcinogenic risk (EPA's risk management range is one-in-a-million [10^{-6}] to one-in-ten thousand [10^{-4}]). However, this practice could lead one to overlook serious noncancer health threats and it is strongly recommended that the user consult with a toxicologist or regional risk assessor before doing this. For carcinogens, I have indicated by asterisk ("ca*") in the PRG table where the noncancer PRGs would be exceeded if the cancer value that is displayed is multiplied by 100. Two stars ("ca**") indicate that the noncancer values would be exceeded if the cancer PRG were multiplied by 10. There is no range of "acceptable" noncarcinogenic "risk" so that under no circumstances should noncancer PRGs be multiplied by 10 or 100, when setting final cleanup criteria.

In general, PRG concentrations in the table are risk-based but for soil there are two important exceptions: (1) for several volatile chemicals, PRGs are based on the soil saturation equation ("sat") and (2) for relatively less toxic inorganic and semivolatile contaminants, a non-risk based "ceiling limit" concentration is given as 10^{+5} mg/kg ("max").

Also included in the PRG table are California EPA PRGs ("CAL-Modified PRGs")

for specific chemicals where CAL-EPA screening values may be "significantly" more restrictive than the federal values; and, soil screening levels (SSLs) for protection of groundwater (see Section 2.3 below).

2.2 Toxicity Values

Heirarchy of Toxicity Values

EPA toxicity values, known as noncarcinogenic reference doses (RfD) and carcinogenic slope factors (SF) were obtained from IRIS, NCEA (formerly ECAO) through August 1999, and HEAST. The priority among sources of toxicological constants has changed since the last iteration of the table because the HEAST tables are no longer being updated. Therefore, the revised order of preference is as follows: (1) IRIS (indicated by "i"), (2) NCEA ("n"), (3) HEAST ("h"), (4) withdrawn from IRIS or HEAST and under review ("x") or obtained from other EPA documents ("o").

Inhalation Conversion Factors

As of January 1991, IRIS and NCEA databases no longer present RfDs or SFs for the inhalation route. These criteria have been replaced with reference concentrations (RfC) for noncarcinogenic effects and unit risk factors (URF) for carcinogenic effects. However, for purposes of estimating risk and calculating risk-based concentrations, inhalation reference doses (RfDi) and inhalation slope factors (SFi) are preferred. This is not a problem for most chemicals because the inhalation toxicity criteria are easily converted. To calculate an RfDi from an RfC, the following equation and assumptions may be used for most chemicals:

$$\text{RfDi}\ \frac{\text{mg}}{\text{(kg - day)}} = \text{RfC}\,(\text{mg}/\text{m}^3) \times \frac{20\text{m}^3}{\text{day}} \times \frac{1}{70\text{kg}}$$

Likewise, to calculate an SFi from an inhalation URF, the following equation and assumptions may be used:

$$\text{SFi}\ \frac{\text{(kg - day)}}{\text{(mg)}} = \text{URF}\,(\text{m}^3/\text{ug}) \times \frac{\text{day}}{20\text{m}^3} \times 70\text{kg} \times \frac{10^3\ \text{ug}}{\text{mg}}$$

Substances with New Toxicity Values

To help users rapidly identify substances with new toxicity values, these chemicals are printed in boldface type. This issue of the PRG table contains new or revised toxicity values for **acetonitrile, aluminum, antimony trioxide, chlordane, chlorobenzene, chloroethane, chloroform, chloromethane, chromium VI, dichlorobenzene isomers, ethyl chloride, manganese, nitroglycerin, 4-nitrophenol, PCBs, 1,1,2,2-tetrachloroethane, and tetrahydrofuran**.

Route-to-Route Methods

Route-to-route extrapolations ("r") were frequently used when there were no toxicity values available for a given route of exposure. Oral cancer slope factors ("SFo") and reference doses ("RfDo") were used for both oral and inhaled exposures for organic compounds lacking inhalation values. Inhalation slope factors ("SFi") and inhalation reference doses ("RfDi") were used for both inhaled and oral exposures for organic compounds lacking oral values. Route extrapolations were not performed for inorganics due to portal of entry effects and known differences in absorption efficiency for the two routes of exposure.

An additional route extrapolation is the use of oral toxicity values for evaluating dermal exposures. For many chemicals, a scientifically defensible data base does not exist for making an adjustment of an oral slope factor/RfD to estimate a dermal toxicity value. Based on the current guidance (USEPA 1999a), the only chemical for which an adjustment is recommended is cadmium. An oral absorption efficiency of 5% is assumed for cadmium which leads to an estimated dermal reference dose (RfDd) of 2.5E-05. Please note that the 1999 PRG calculations for cadmium are based on this adjustment.

Although route-to-route methods are a useful screening procedure, the appropriateness of these default assumptions for specific contaminants should be verified by a toxicologist or regional risk assessor. Please note that whenever route-extrapolated values are used to calculate risk-based PRGs, additional uncertainties are introduced in the calculation.

2.3 Soil Screening Levels

Generic, soil screening levels (SSLs) for the protection of groundwater have been included in the PRG table for 100 of the most common contaminants at Superfund sites. Generic SSLs are derived using default values in standardized equations presented in *Soil Screening Guidance* (available from NTIS as document numbers PB96-963502 and PB96-963505 or EPA/540/R-95/128 and EPA/540/R-96/018).

The SSLs were developed using a default dilution-attenuation factor (DAF) of 20 to account for natural processes that reduce contaminant concentrations in the subsurface. Also included are generic SSLs that assume no dilution or attenuation between the source and the receptor well (i.e., a DAF of 1). These values can be used at sites where little or no dilution or attenuation of soil leachate concentrations is expected at a site (e.g., sites with shallow water tables, fractured media, karst topography, or source size greater than 30 acres).

In general, if an SSL is not exceeded for the migration to groundwater pathway, the user may eliminate this pathway from further investigation.

2.4 Miscellaneous

Volatile organic compounds (VOCs) are indicated by "1" in the VOC column of the table and in general, are defined as those chemicals having a Henry's Law constant greater than 10^{-5} (atm-m^3/mol) and a molecular weight less than 200 g/mole). Three borderline chemicals (dibromochloromethane, 1,2-dibromochloropropane, and pyrene) which do not strictly meet these criteria of volatility have also been included based upon discussions with other state and federal agencies and after a consideration of vapor pressure characteristics etc. Volatile organic chemicals are evaluated for potential volatilization from soil/water to air using volatilization factors (see Section 4.1).

Chemical-specific dermal absorption values for contaminants in soil and dust are presented for arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, TCDD, PAHs, PCBs, and pentachlorophenols as recommended in the "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance" (USEPA 1999a). Otherwise, default skin absorption fractions are assumed to be 0.10 for nonvolatile organics. Please note that previous defaults of 0.01 and 0.10 for inorganics and VOCs respectively, have been withdrawn per new guidance.

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3.0 USING THE PRG TABLE

The decision to use PRGs at a site will be driven by the potential benefits of having generic risk-based concentrations in the absence of site-specific risk assessments. The original intended use of PRGs was to provide initial cleanup goals for individual chemicals given specific medium and land-use combinations (see RAGS Part B, 1991), however risk-based concentrations have several applications. They can also be used for:

- Setting health-based detection limits for chemicals of potential concern
- Screening sites to determine whether further evaluation is appropriate
- Calculating cumulative risks associated with multiple contaminants

A few basic procedures are recommended for using PRGs properly. These are briefly described below. Potential problems with the use of PRGs are also identified.

3.1 Developing a Conceptual Site Model

The primary condition for use of PRGs is that exposure pathways of concern and conditions at the site match those taken into account by the PRG framework. Thus, it is always necessary to develop a conceptual site model (CSM) to identify likely contaminant source areas, exposure pathways, and potential receptors. This information can be used to determine the applicability of PRGs at the site and the need for additional information. For those pathways not covered by PRGs, a risk

assessment specific to these additional pathways may be necessary. Nonetheless, the PRG lookup values will still be useful in such situations for focusing further investigative efforts on the exposure pathways not addressed.

To develop a site-specific CSM, perform an extensive records search and compile existing data (e.g. available site sampling data, historical records, aerial photographs, and hydrogeologic information). Once this information is obtained, CSM worksheets such as those provided in ASTM's *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (1995) can be used to tailor the generic worksheet model to a site-specific CSM. The final CSM diagram represents linkages among contaminant sources, release mechanisms, exposure pathways and routes and receptors. It summarizes our understanding of the contamination problem.

As a final check, the CSM should answer the following questions:

- Are there potential ecological concerns?
- Is there potential for land use other than those covered by the PRGs (that is, residential and industrial)?
- Are there other likely human exposure pathways that were not considered in development of the PRGs (e.g. impact to groundwater, local fish consumption, raising beef, dairy, or other livestock)?
- Are there unusual site conditions (e.g. large areas of contamination, high fugitive dust levels, potential for indoor air contamination)?

If any of these four conditions exist, the PRG may need to be adjusted to reflect this new information. Suggested references for evaluating pathways not currently evaluated by Region 9 PRG's are presented in Exhibit 3-1.

EXHIBIT 3-1
SUGGESTED READINGS FOR EVALUATING EXPOSURE PATHWAYS NOT CURRENTLY ADDRESSED BY REGION 9 PRGs

EXPOSURE PATHWAY	REFERENCE
Migration of contaminants to an underlying potable aquifer	*Soil Screening Guidance* (USEPA 1996a, b), *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM 1995)
Ingestion via plant uptake	*Soil Screening Guidance* (USEPA 1996a, b),
Ingestion via meat, dairy products, human milk	*Estimating Exposure to Dioxin-Like Compounds* (USEPA 1994a)
Inhalation of volatiles that have migrated into basements	*User's Guide for Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings* (USEPA 1997a)
Ecological pathways	*Ecological Risk Assessment: Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments,* (USEPA 1997b), *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities* (CAL-EPA 1996)

3.2 Background Levels Evaluation

A necessary step in determining the usefulness of Region 9 PRGs is the consideration of background contaminant concentrations. EPA may be concerned with two types of background at sites: naturally occurring and anthropogenic. Natural background is usually limited to metals whereas anthropogenic (i.e. human-made) "background" includes both organic and inorganic contaminants. Before embarking on an extensive sampling and analysis program to determine local background concentrations in the area, one should first compile existing data on the subject. Far too often there is pertinent information in the literature that gets ignored, resulting in needless expenditures of time and money.

Generally EPA does not clean up below natural background. In some cases, the predictive risk-based models generate PRG levels that lie within or even below typical background. If natural background concentrations are higher than the risk-based PRGs, an adjustment of the PRG is probably needed. Exhibit 3-2 presents summary statistics for selected elements in soils that have background levels that may exceed risk-based PRGs. An illustrative example of this is naturally occurring arsenic in soils which frequently is higher than the risk-based concentration set at a one-in-one-million cancer risk (the PRG for residential soils is 0.39 mg/kg). After considering background concentrations in a local area, EPA Region 9 has at times used the non-cancer PRG (22 mg/kg) to evaluate sites recognizing that this value tends to be above background levels yet still falls within the range of soil concentrations (0.39-39 mg/kg) that equates to EPA's "acceptable" cancer risk range of 10E-6 to 10E-4.

Where anthropogenic "background" levels exceed PRGs and EPA has determined that a response action is necessary and feasible, EPA's goal will be to develop a comprehensive response to the widespread contamination. This will often require coordination with different authorities that have jurisdiction over the sources of contamination in the area.

EXHIBIT 3-2
BACKGROUND CONCENTRATIONS OF SELECTED ELEMENTS IN SOILS

TRACE	U.S. STUDY DATA[1]			CALIFORNIA DATA[2]		
ELEMENT	Range	GeoMean	ArMean	Range	GeoMean	ArMean
Arsenic	<.1-97	5.2 mg/kg	7.2 mg/kg	0.59-11	2.75 mg/kg	3.54 mg/kg
Beryllium	<1-15	0.63 "	0.92 "	0.10-2.7	1.14 "	1.28 "
Cadmium	<1-10	--	<1	0.05-1.7	0.26	0.36
Chromium	1-2000	37	54	23-1579	76.25	122.08
Nickel	<5-700	13	19	9.0-509	35.75	56.60

[1]Shacklette and Hansford, "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", USGS Professional Paper 1270, 1984.
[2]Bradford et. al, "Background Concentrations of Trace and Major Elements in California Soils", Kearney Foundation Special Report, UC-Riverside and CAL-EPA DTSC, March 1996.

3.3 Screening Sites with Multiple Pollutants

A suggested stepwise approach for PRG-screening of sites with multiple pollutants is as follows:

- Perform an extensive records search and compile existing data.
- Identify site contaminants in the PRG table. Record the PRG concentrations for various media and note whether PRG is based on cancer risk (indicated by "ca") or noncancer hazard (indicated by "nc"). Segregate cancer PRGs from non-cancer PRGs and exclude (but don't eliminate) non-risk based PRGs ("sat" or "max").
- For cancer risk estimates, take the site-specific concentration (maximum or 95 UCL) and divide by the PRG concentrations that are designated for cancer evaluation ("ca"). Multiply this ratio by 10^{-6} to estimate chemical-specific risk for a reasonable maximum exposure (RME). For multiple pollutants, simply add the risk for each chemical:

$$Risk = [(\frac{conc_x}{PRG_x}) + (\frac{conc_y}{PRG_y}) + (\frac{conc_z}{PRG_z})] \times 10^{6}$$

- For non-cancer hazard estimates. Divide the concentration term by its respective non-cancer PRG designated as "nc" and sum the ratios for multiple contaminants. The cumulative ratio represents a non-carcinogenic hazard index (HI). A hazard index of 1 or less is generally considered "safe". A ratio greater than 1 suggests further evaluation. **[Note that carcinogens may also have an associated non-cancer PRG that is not listed in the printed copy of the table sent to folks on the mailing list. To obtain these values, the user should view or download the PRG table at our website and display the appropriate sections.]**

$$Hazard\ Index = [(\frac{conc_x}{PRG_x}) + (\frac{conc_y}{PRG_y}) + (\frac{conc_z}{PRG_z})]$$

For more information on screening site risks, the reader should contact EPA Region 9's Technical Support Team.

3. 4 Potential Problems

As with any risk-based tool, the potential exists for misapplication. In most cases the root cause will be a lack of understanding of the intended use of Region 9 PRGs. In order to prevent misuse of PRGs, the following should be avoided:

- Applying PRGs to a site without adequately developing a conceptual site model that identifies relevant exposure pathways and exposure scenarios,
- Not considering background concentrations when choosing PRGs as cleanup goals,
- Use of PRGs as cleanup levels without the nine-criteria analysis specified in the National Contingency Plan (or, comparable analysis for programs outside of Superfund),
- Use of PRGs as cleanup levels without verifying numbers with a toxicologist or regional risk assessor,

- Use of antiquated PRG tables that have been superseded by more recent publications,
- Not considering the effects of additivity when screening multiple chemicals, and
- Adjusting PRGs upward by factors of 10 or 100 without consulting a toxicologist or regional risk assessor.

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4.0 TECHNICAL SUPPORT DOCUMENTATION

Region 9 PRGs consider human exposure hazards to chemicals from contact with contaminated soils, air, and water. The emphasis of the PRG equations and technical discussion are aimed at developing screening criteria for soils, since this is an area where few standards exist. For air and water, additional reference concentrations or standards are available for many chemicals (e.g. MCLs, non-zero MCLGs, AWQC, and NAAQS) and consequently the discussion of these media are brief.

4.1 Soils - Direct Ingestion

Calculation of risk-based PRGs for direct ingestion of soil is based on methods presented in RAGS HHEM, Part B (USEPA 1991a) and *Soil Screening Guidance* (USEPA 1996a,b). Briefly, these methods backcalculate a soil concentration level from a target risk (for carcinogens) or hazard quotient (for noncarcinogens).

A number of studies have shown that inadvertent ingestion of soil is common among children 6 years old and younger (Calabrese et al. 1989, Davis et al. 1990, Van Wijnen et al. 1990). To take into account the higher soil intake rate for children, two different approaches are used to estimate PRGs, depending on whether the adverse health effect is cancer or some effect other than cancer.

For carcinogens, the method for calculating PRGs uses an age-adjusted soil ingestion factor that takes into account the difference in daily soil ingestion rates, body weights, and exposure duration for children from 1 to 6 years old and others from 7 to 31 years old. This health-protective approach is chosen to take into account the higher daily rates of soil ingestion in children as well as the longer duration of exposure that is anticipated for a long-term resident. For more on this method, see USEPA RAGs Part B (1991a).

For noncarcinogenic concerns, the more protective method of calculating a soil PRG is to evaluate childhood exposures separately from adult exposures. In other words, an age-adjustment factor is not applied as was done for carcinogens. This approach is considered conservative because it combines the higher 6-year exposure for children with chronic toxicity criteria. In their analysis of the method, the Science Advisory Board (SAB) indicated that, for most chemicals, the approach may be overly protective. However, they noted that there are specific instances when the chronic RfD may be based on endpoints of toxicity that are specific to children (e.g. fluoride and nitrates) or when the dose-response is steep (i.e., the dosage difference between the no-observed-adverse-effects level [NOAEL] and an adverse effects level is

small). Thus, for the purposes of screening, EPA Region 9 has adopted this approach for calculating soil PRGs for noncarcinogenic health concerns.

4.2 Soils - Vapor and Particulate Inhalation

Agency toxicity criteria indicate that risks from exposure to some chemicals via inhalation far outweigh the risk via ingestion; therefore soil PRGs have been designed to address this pathway as well. The models used to calculate PRGs for inhalation of volatiles/particulates are updates of risk assessment methods presented in RAGS Part B (USEPA 1991a) and are identical to the *Soil Screening Guidance: User's Guide and Technical Background Document* (USEPA 1996a,b).

To address the soil-to-air pathways the PRG calculations incorporate volatilization factors (VF_s) for volatile contaminants and particulate emission factors (PEF) for nonvolatile contaminants. These factors relate soil contaminant concentrations to air contaminant concentrations that may be inhaled on-site. The VF_s and PEF equations can be broken into two separate models: an emission model to estimate emissions of the contaminant from the soil and a dispersion model to simulate the dispersion of the contaminant in the atmosphere.

It should be noted that the box model in RAGS Part B has been replaced with a dispersion term (Q/C) derived from a modeling exercise using meteorological data from 29 locations across the United States because the box model may not be applicable to a broad range of site types and meteorology and does not utilize state-of-the-art techniques developed for regulatory dispersion modeling. The dispersion model for both volatiles and particulates is the AREA-ST, an updated version of the Office of Air Quality Planning and Standards, Industrial Source Complex Model, ISC2. However, different Q/C terms are used in the VF and PEF equations. Los Angeles was selected as the 90th percentile data set for volatiles and Minneapolis was selected as the 90th percentile data set for fugitive dusts (USEPA 1996 a,b). A default source size of 0.5 acres was chosen for the PRG calculations. This is consistent with the default exposure area over which Region 9 typically averages contaminant concentrations in soils. If unusual site conditions exist such that the area source is substantially larger than the default source size assumed here, an alternative Q/C could be applied (see USEPA 1996a,b).

Volatilization Factor for Soils

Volatile chemicals, defined as those chemicals having a Henry's Law constant greater than
10^{-5} (atm-m^3/mol) and a molecular weight less than 200 g/mole, were screened for inhalation exposures using a volatilization factor for soils (VF_s). Please note that VF_s's are available at our website.

The emission terms used in the VF_s are chemical-specific and were calculated from

physical-chemical information obtained from several sources. The priority of these sources were as follows: *Soil Screening Guidance* (USEPA 1996a,b), *Superfund Chemical Data Matrix* (USEPA 1996c), *Fate and Exposure Data* (Howard 1991), *Subsurface Contamination Reference Guide* (EPA 1990a), and *Superfund Exposure Assessment Manual* (SEAM, EPA 1988). In those cases where Diffusivity Coefficients (Di) were not provided in existing literature, Di's were calculated using Fuller's Method described in SEAM. A surrogate term was required for some chemicals that lacked physico-chemical information. In these cases, a proxy chemical of similar structure was used that may over- or under-estimate the PRG for soils.

Equation 4-9 forms the basis for deriving generic soil PRGs for the inhalation pathway. The following parameters in the standardized equation can be replaced with specific site data to develop a simple site-specific PRG

- Source area
- Average soil moisture content
- Average fraction organic carbon content
- Dry soil bulk density

The basic principle of the VF_s model (Henry's law) is applicable only if the soil contaminant concentration is at or below soil saturation "sat". Above the soil saturation limit, the model cannot predict an accurate VF-based PRG. How these particular cases are handled, depends on whether the contaminant is liquid or solid at ambient soil temperatures (see Section 4.5).

Particulate Emission Factor for Soils

Inhalation of chemicals adsorbed to respirable particles (PM_{10}) were assessed using a default PEF equal to 1.316×10^9 m^3/kg that relates the contaminant concentration in soil with the concentration of respirable particles in the air due to fugitive dust emissions from contaminated soils. The generic PEF was derived using default values in Equation 4-11, which corresponds to a receptor point concentration of approximately 0.76 ug/m^3. The relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time (e.g. years). This represents an annual average emission rate based on wind erosion that should be compared with chronic health criteria; it is not appropriate for evaluating the potential for more acute exposures.

The impact of the PEF on the resultant PRG concentration (that combines soil exposure pathways for ingestion, skin contact, and inhalation) can be assessed by accessing the Region 9 PRG website and viewing the pathway-specific soil concentrations. Equation 4-11 forms the basis for deriving a generic PEF for the inhalation pathway. For more details regarding specific parameters used in the PEF model, the reader is referred to *Soil Screening Guidance: Technical Background Document* (USEPA 1996a).

Note: the generic PEF evaluates windborne emissions and does not consider dust emissions from traffic or other forms of mechanical disturbance that could lead to greater emissions than assumed here.

4.3 Soils - Dermal Exposure

Dermal Contact Assumptions

Since the 1998 PRG table was issued, exposure factors for dermal contact with soil have changed in a few cases (USEPA 1999a). Recommended RME (reasonable maximum exposure) defaults for adult workers' skin surface areas (3300 cm^2/day) and soil adherence factors (0.2 mg/cm^2) now differ from the defaults recommended for adult residents (5700 cm^2/day, 0.07 mg/cm^2) as noted in Exhibit 4-1. This is due to differences in the range of activities experienced by workers versus residents.

Dermal Absorption

Chemical-specific skin absorption values recommended by the Superfund Dermal Workgroup were applied when available. Chemical-specific values are included for the following chemicals: arsenic, cadmium, chlordane, 2,4-D, DDT, lindane, TCDD, PAHs, PCBs, and pentachlorophenols.

The recently issued ARisk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim Guidance" (USEPA 1999a) recommends a default dermal absorption factor for semivolatile organic compounds of 10% as a screening method for the majority of SVOCs without dermal absorption factors. Default dermal absorption values for other chemicals (VOCs and inorganics) are not recommended in the new guidance. Therefore, the assumption of 1% for inorganics and 10% for volatiles is no longer included in the Region 9 PRG table. This change has minimal impact on the final risk-based calculations because human exposure to VOCs and inorganics in soils is generally driven by other pathways of exposure.

4.4 Soils - Migration to Groundwater

The methodology for calculating SSLs for the migration to groundwater was developed to identify chemical concentrations in soil that have the potential to contaminate groundwater. Migration of contaminants from soil to groundwater can be envisioned as a two-stage process: (1) release of contaminant in soil leachate and (2) transport of the contaminant through the underlying soil and aquifer to a receptor well. The SSL methodology considers both of these fate and transport mechanisms.

SSLs are backcalculated from acceptable ground water concentrations (i.e. nonzero MCLGs, MCLs, or risk-based PRGs). First, the acceptable groundwater concentration is multiplied by a dilution factor to obtain a target leachate concentration. For example, if the dilution factor is 10 and the acceptable ground

water concentration is 0.05 mg/L, the target soil leachate concentration would be 0.5 mg/L. The partition equation (presented in the *Soil Screening Guidance* document) is then used to calculate the total soil concentration (i.e. SSL) corresponding to this soil leachate concentration.

The SSL methodology was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Because of this constraint, the methodology is based on conservative, simplifying assumptions about the release and transport of contaminants in the subsurface. For more on SSLs, and how to calculate site-specific SSLs versus generic SSLs presented in the PRG table, the reader is referred to the *Soil Screening Guidance* document (USEPA 1996a,b).

4.5 Soil Saturation Limit

The soil saturation concentration "sat" corresponds to the contaminant concentration in soil at which the absorptive limits of the soil particles, the solubility limits of the soil pore water, and saturation of soil pore air have been reached. Above this concentration, the soil contaminant may be present in free phase, i.e., nonaqueous phase liquids (NAPLs) for contaminants that are liquid at ambient soil temperatures and pure solid phases for compounds that are solid at ambient soil temperatures.

Equation 4-10 is used to calculate "sat" for each volatile contaminant. As an update to RAGS HHEM, Part B (USEPA 1991a), this equation takes into account the amount of contaminant that is in the vapor phase in soil in addition to the amount dissolved in the soil's pore water and sorbed to soil particles.

Chemical-specific "sat" concentrations must be compared with each VF-based PRG because a basic principle of the PRG volatilization model is not applicable when free-phase contaminants are present. How these cases are handled depends on whether the contaminant is liquid or solid at ambient temperatures. Liquid contaminant that have a VF-based PRG that exceeds the "sat" concentration are set equal to "sat" whereas for solids (e.g., PAHs), soil screening decisions are based on the appropriate PRGs for other pathways of concern at the site (e.g., ingestion and dermal contact).

4.6 Ground Water/Surface Water - Ingestion and Inhalation

Calculation of PRGs for ingestion and inhalation of contaminants in domestic water is based on the methodology presented in RAGS HHEM, Part B (USEPA 1991a). Ingestion of drinking water is an appropriate pathway for all chemicals. For the purposes of this guidance, however, inhalation of volatile chemicals from water is considered routinely only for chemicals with a Henry's Law constant of 1×10^{-5} atm-m^3/mole or greater and with a molecular weight of less than 200 g/mole.

For volatile chemicals, an upperbound volatilization constant (VF_w) is used that is based on all uses of household water (e.g showering, laundering, and dish washing). Certain assumptions were made. For example, it is assumed that the volume of water used in a residence for a family of four is 720 L/day, the volume of the dwelling is

150,000 L and the air exchange rate is 0.25 air changes/hour (Andelman in RAGS Part B). Furthermore, it is assumed that the average transfer efficiency weighted by water use is 50 percent (i.e. half of the concentration of each chemical in water will be transferred into air by all water uses). Note: the range of transfer efficiencies extends from 30% for toilets to 90% for dishwashers.

4.7 Default Exposure Factors

Default exposure factors were obtained primarily from RAGS Supplemental Guidance Standard Default *Exposure Factors* (OSWER Directive, 9285.6-03) dated March 25, 1991 and more recent information from U.S. EPA's Office of Solid Waste and Emergency Response, U.S. EPA's Office of Research and Development, and California EPA's Department of Toxic Substances Control (see Exhibit 4-1).

Because contact rates may be different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors ("adj"). Use of age-adjusted factors are especially important for soil ingestion exposures, which are higher during childhood and decrease with age. However, for purposes of combining exposures across pathways, additional age-adjusted factors are used for inhalation and dermal exposures. These factors approximate the integrated exposure from birth until age 30 combining contact rates, body weights, and exposure durations for two age groups - small children and adults. Age-adjusted factors were obtained from RAGS PART B or developed by analogy (see derivations next page).

For soils only, noncarcinogenic contaminants are evaluated in children separately from adults. No age-adjustment factor is used in this case. The focus on children is considered protective of the higher daily intake rates of soil by children and their lower body weight. For maintaining consistency when evaluating soils, dermal and inhalation exposures are also based on childhood contact rates.

(1) ingestion([mg-yr]/[kg-d]:

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{(ED_r - ED_c) \times IRS_a}{BW_a}$$

(2) skin contact([mg-yr]/[kg-d]:

$$SFS_{adj} = \frac{ED_c \times AF \times SA_c}{BW_c} + \frac{(ED_r - ED_c) \times AF \times SA_a}{BW_a}$$

(3) inhalation ([m^3-yr]/[kg-d]):

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a}{BW_a}$$

EXHIBIT 4-1
STANDARD DEFAULT FACTORS

Symbol	Definition (units)	Default	Reference
CSFo	Cancer slope factor oral (mg/kg-d)-1	--	IRIS, HEAST, or NCEA
CSFi	Cancer slope factor inhaled (mg/kg-d)-1	--	IRIS, HEAST, or NCEA
RfDo	Reference dose oral (mg/kg-d)	--	IRIS, HEAST, or NCEA
RfDi	Reference dose inhaled (mg/kg-d)	--	IRIS, HEAST, or NCEA
TR	Target cancer risk	10^{-6}	--
THQ	Target hazard quotient	1	--
BWa	Body weight, adult (kg)	70	RAGS (Part A), EPA 1989 (EPA/540/1-89/002)
BWc	Body weight, child (kg)	15	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
ATc	Averaging time - carcinogens (days)	25550	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
ATn	Averaging time - noncarcinogens (days)	ED*365	
SAa	Exposed surface area, adult (cm^2/day)		Dermal Assessment, EPA 1998 (EPA/540/R-99/005)
	- adult resident	5700	
	- adult worker	**3300**	
SAc	Exposed surface area, child (cm^2/day)	2800	Dermal Assessment, EPA 1999 (EPA/540/R-99/005)
AFa	Adherence factor, adult (mg/cm^2)		Dermal Assessment, EPA 1999 (EPA/540/R-99/005)
	- adult resident	**0.07**	
	- adult worker	**0.2**	
AFc	Adherence factor, child (mg/cm^2)	0.2	Dermal Assessment, EPA 1999 (EPA/540/R-99/005)
ABS	Skin absorption (unitless):		
	-- semi-volatile organics	0.1	Dermal Assessment, EPA 1999 (EPA/540/R-99/005)
	-- volatile organics	--	Dermal Assessment, EPA 1999 (EPA/540/R-99/005)
	-- inorganics	--	Dermal Assessment, EPA 1999 (EPA/540/R-99/005)
IRAa	Inhalation rate - adult (m^3/day)	20	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRAc	Inhalation rate - child (m3/day)	10	Exposure Factors, EPA 1997 (EPA/600/P-95/002Fa)
IRWa	Drinking water ingestion - adult (L/day)	2	RAGS(Part A), EPA 1989 (EPA/540/1-89/002)
IRWc	Drinking water ingestion - child (L/day)	1	PEA, Cal-EPA (DTSC, 1994)
IRSa	Soil ingestion - adult (mg/day)	100	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRSc	Soil ingestion - child (mg/day),	200	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
IRSo	Soil ingestion - occupational (mg/day)	50	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EFr	Exposure frequency - residential (d/y)	350	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EFo	Exposure frequency - occupational (d/y)	250	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)

EDr	Exposure duration - residential (years)	30[a]	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDc	Exposure duration - child (years)	6	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
EDo	Exposure duration - occupational (years)	25	Exposure Factors, EPA 1991 (OSWER No. 9285.6-03)
	Age-adjusted factors for carcinogens:		
IFSadj	Ingestion factor, soils ([mg-yr]/[kg-d])	114	RAGS(Part B), EPA 1991 (OSWER No. 9285.7-01B)
SFSadj	Dermal factor, soils ([mg-yr]/[kg-d])	**361**	By analogy to RAGS (Part B)
InhFadj	Inhalation factor, air ([m3-yr]/[kg-d])	11	By analogy to RAGS (Part B)
IFWadj	Ingestion factor, water ([l-yr]/[kg-d])	1.1	By analogy to RAGS (Part B)
VFw	Volatilization factor for water (L/m3)	0.5	RAGS(Part B), EPA 1991 (OSWER No. 9285.7-01B)
PEF	Particulate emission factor (m3/kg)	See below	Soil Screening Guidance (EPA 1996a,b)
VFs	Volatilization factor for soil (m3/kg)	See below	Soil Screening Guidance (EPA 1996a,b)
sat	Soil saturation concentration (mg/kg)	See below	Soil Screening Guidance (EPA 1996a,b)

Footnote:

[a]Exposure duration for lifetime residents is assumed to be 30 years total. For carcinogens, exposures are combined for children (6 years) and adults (24 years).

4.8 Standardized Equations

The equations used to calculate the PRGs for carcinogenic and noncarcinogenic contaminants are presented in Equations 4-1 through 4-8. The PRG equations update RAGS Part B equations. The methodology backcalculates a soil, air, or water concentration level from a target risk (for carcinogens) or hazard quotient (for noncarcinogens). For completeness, the soil equations combine risks from ingestion, skin contact, and inhalation simultaneously. Note: the electronic version of the table also includes pathway-specific PRGs, should the user decide against combining specific exposure pathways; or, the user wants to identify the relative contribution of each pathway to exposure.

To calculate PRGs for volatile chemicals in soil, a chemical-specific volatilization factor is calculated per Equation 4-9. Because of its reliance on Henry's law, the VF_s model is applicable only when the contaminant concentration in soil is at or below saturation (i.e. there is no free-phase contaminant present). Soil saturation ("sat") corresponds to the contaminant concentration in soil at which the adsorptive limits of the soil particles and the solubility limits of the available soil moisture have been reached. Above this point, pure liquid-phase contaminant is expected in the soil. If the PRG calculated using VFs was greater than the calculated sat, the PRG was set equal to sat, in accordance with *Soil Screening Guidance* (USEPA 1996 a,b). The equation for deriving sat is presented in Equation 4-10.

PRG EQUATIONS

Soil Equations: For soils, equations were based on three exposure routes (ingestion, skin contact, and inhalation).

Equation 4-1: Combined Exposures to Carcinogenic Contaminants in Residential Soil

$$C(mg/kg) = \frac{TR \times AT_c}{EF_r \left[\left(\frac{IFS_{adj} \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{SFS_{adj} \times ABS \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{InhF_{adj} \times CSF_i}{VF_s^a}\right)\right]}$$

Equation 4-2: Combined Exposures to Noncarcinogenic Contaminants in Residential Soil

$$C(mg/kg) = \frac{THQ \times BW_c \times AT_n}{EF_r \times ED_c \left[\left(\frac{1}{RfD_o} \times \frac{IRS_c}{10^6 mg/kg}\right) + \left(\frac{1}{RfD_o} \times \frac{SA_c \times AF \times ABS}{10^6 mg/kg}\right) + \left(\frac{1}{RfD_i} \times \frac{IRA_c}{VF_s^a}\right)\right]}$$

Equation 4-3: Combined Exposures to Carcinogenic Contaminants in Industrial Soil

$$C(mg/kg) = \frac{TR \times BW_a \times AT_c}{EF_o \times ED_o \left[\left(\frac{IRS_o \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{SA_a \times AF \times ABS \times CSF_o}{10^6 mg/kg}\right) + \left(\frac{IRA_a \times CSF_i}{VF_s^a}\right)\right]}$$

Equation 4-4: Combined Exposures to Noncarcinogenic Contaminants in Industrial Soil

$$C(mg/kg) = \frac{THQ \times BW_a \times AT_n}{EF_o \times ED_o \left[\left(\frac{1}{RfD_o} \times \frac{IRS_o}{10^6 mg/kg}\right) + \left(\frac{1}{RfD_o} \times \frac{SA_a \times AF \times ABS}{10^6 mg/kg}\right) + \left(\frac{1}{RfD_i} \times \frac{IRA_a}{VF_s^a}\right)\right]}$$

Footnote:

[a]Use VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol) or PEF for non-volatile chemicals.

Tap Water Equations:

Equation 4-5: Ingestion and Inhalation Exposures to Carcinogenic Contaminants in Water

$$C(ug/L) = \frac{TR \times AT_c \times 1000ug/mg}{EF_r \left[\left(IFW_{adj} \times CSF_o\right) + \left(VF_w \times InhF_{adj} \times CSF_i\right)\right]}$$

Equation 4-6: Ingestion and Inhalation Exposures to Noncarcinogenic Contaminants in Water

$$C(ug/L) = \frac{THQ \times BW_a \times AT_n \times 1000ug/mg}{EF_r \times ED_r \times [(\frac{IRW_a}{RfD_o}) + (\frac{VF_w \times IRA_a}{RfD_i})]}$$

Air Equations:

Equation 4-7: Inhalation Exposures to Carcinogenic Contaminants in Air

$$C(ug/m^3) = \frac{TR \times AT_c \times 1000ug/mg}{EF_r \times InhF_{adj} \times CSF_i}$$

Equation 4-8: Inhalation Exposures to Noncarcinogenic Contaminants in Air

$$C(ug/m^3) = \frac{THQ \times RfD_i \times BW_a \times AT_n \times 1000ug/mg}{EF_r \times ED_r \times IRA_a}$$

SOIL-TO-AIR VOLATILIZATION FACTOR (VF_s)

Equation 4-9: Derivation of the Volatilization Factor

$$VF_s(m^3/kg) = (Q/C) \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4}(m^2/cm^2)$$

where:

$$D_A = \frac{[(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w)/n^2]}{\rho_B K_d + \Theta_w + \Theta_a H'}$$

Parameter	Definition (units)	Default
VF_s	Volatilization factor (m^3/kg)	--
D_A	Apparent diffusivity (cm^2/s)	--
Q/C	Inverse of the mean conc. at the center of a 0.5-acre square source (g/m^2-s per kg/m^3)	68.81
T	Exposure interval (s)	9.5×10^8
rho_b	Dry soil bulk density (g/cm^3)	1.5
$theta_a$	Air filled soil porosity (L_{air}/L_{soil})	0.28 or n- w
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 - (b/ s)
$theta_w$	Water-filled soil porosity (L_{water}/L_{soil})	0.15
rho_s	Soil particle density (g/cm^3)	2.65
Di	Diffusivity in air (cm^2/s)	Chemical-specific
H	Henry's Law constant ($atm-m^3/mol$)	Chemical-specific
H'	Dimensionless Henry's Law constant	Calculated from H by multiplying by 41 (USEPA 1991a)
D_w	Diffusivity in water (cm^2/s)	Chemical-specific
K_d	Soil-water partition coefficient (cm^3/g) = $K_{oc}f_{oc}$	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient (cm^3/g)	Chemical-specific

	(cm³/g)	
f_{oc}	Fraction organic carbon in soil (g/g)	0.006 (0.6%)

SOIL SATURATION CONCENTRATION (sat)

Equation 4-10: Derivation of the Soil Saturation Limit

$$sat = \frac{S}{\rho_b}\left(K_d \rho_b + \Theta_w + H'\Theta_a\right)$$

Parameter	Definition (units)	Default
sat	Soil saturation concentration (mg/kg)	--
S	Solubility in water (mg/L-water)	Chemical-specific
rho_b	Dry soil bulk density (kg/L)	1.5
n	Total soil porosity (L_{pore}/L_{soil})	0.43 or 1 - (b/ s)
rho_s	Soil particle density (kg/L)	2.65
Kd	Soil-water partition coefficient (L/kg)	K_{oc} x f_{oc} (chemical-specific)
k_{oc}	Soil organic carbon/water partition coefficient (L/kg)	Chemical-specific
f_{oc}	Fraction organic carbon content of soil (g/g)	0.006 or site-specific
$theta_w$	Water-filled soil porosity (L_{water}/L_{soil})	0.15
$theta_a$	Air filled soil porosity (L_{air}/L_{soil})	0.28 or n- w
w	Average soil moisture content (kg_{water}/kg_{soil} or L_{water}/kg_{soil})	0.1
H	Henry's Law constant (atm-m3/mol)	Chemical-specific
H'	Dimensionless Henry's Law constant	H x 41, where 41 is a units conversion factor

SOIL-TO-AIR PARTICULATE EMISSION FACTOR (PEF)

Equation 4-11: Derivation of the Particulate Emission Factor

$$PEF(m^3/kg) = Q/C \times \frac{3600 s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

Parameter	Definition (units)	Default
PEF	Particulate emission factor (m3/kg)	1. 316 x 10^9
Q/C	Inverse of the mean concentration at the center of a 0.5-acre-square source (g/m2-s per kg/m3)	90.80
V	Fraction of vegetative cover (unitless)	0.5
Um	Mean annual windspeed (m/s)	4.69
Ut	Equivalent threshold value of windspeed at 7 m (m/s)	11.32
F(x)	Function dependent on Um/Ut derived using Cowherd (1985) (unitless)	0.194

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Send questions and comments to: smucker.stan@epa.gov
Region 9 Office: 75 Hawthorne Street, San Francisco, California, 94105-3901

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Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.7E-03	i	4.0E-03	i	8.7E-03	r	4.0E-03	r	0	0.10	30560-19-1	Acephate	5.6E+01	ca**	2.8E+02	ca*	7.7E-01	ca*	7.7E+00	ca*		
				7.7E-03	i	2.6E-03	i	1		75-07-0	Acetaldehyde	1.1E+01	ca**	2.3E+01	ca**	8.7E-01	ca*	1.7E+00	ca		
		2.0E-02	i			2.0E-02	r	0	0.10	34256-82-1	Acetochlor	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			1.0E-01	r	1		67-64-1	Acetone	1.6E+03	nc	6.2E+03	nc	3.7E+02	nc	6.1E+02	nc	2E+01	8E-01
		8.0E-04	h			8.0E-04	r	0	0.10	75-86-5	Acetone cyanohydrin	4.9E+01	nc	7.0E+02	nc	2.9E+00	nc	2.9E+01	nc		
		6.0E-03	x			1.7E-02	i	1		75-05-8	**Acetonitrile**	2.7E+02	nc	1.7E+03	nc	6.2E+01	nc	7.9E+01	nc		
		1.0E-01	i			5.7E-06	x	1		98-86-2	Acetophenone	4.9E-01	nc	1.6E+00	nc	2.1E-02	nc	4.2E-02	nc		
1.1E-01	o	1.3E-02	i	1.1E-01	r	1.3E-02	r	0	0.10	50594-66-6	Acifluorfen	4.4E+00	ca	2.2E+01	ca	6.1E-02	ca	6.1E-01	ca		
		2.0E-02	h			5.7E-06	i	1		107-02-8	Acrolein	1.0E-01	nc	3.4E-01	nc	2.1E-02	nc	4.2E-02	nc		
4.6E+00	i	2.0E-04	i	4.6E+00	i	2.0E-04	r	0	0.10	79-06-1	Acrylamide	1.1E-01	ca	5.4E-01	ca	1.5E-03	ca	1.5E-02	ca		
		5.0E-01	i			2.9E-04	i	0	0.10	79-10-7	Acrylic acid	2.9E+04	nc	1.0E+05	max	1.0E+00	nc	1.8E+04	nc		
5.4E-01	i	1.0E-03	h	2.4E-01	i	5.7E-04	i	1		107-13-1	Acrylonitrile	2.1E-01	ca*	5.1E-01	ca*	2.8E-02	ca*	3.9E-02	ca*		
8.1E-02	h	1.0E-02	i	8.0E-02	r	1.0E-02	r	0	0.10	15972-60-8	Alachlor	6.0E+00	ca	3.1E+01	ca	8.4E-02	ca	8.4E-01	ca		
		1.5E-01	i			1.5E-01	r	0	0.10	1596-84-5	Alar	9.2E+03	nc	1.0E+05	max	5.5E+02	nc	5.5E+03	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	116-06-3	Aldicarb	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	1646-88-4	Aldicarb sulfone	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
1.7E+01	i	3.0E-05	i	1.7E+01	i	3.0E-05	r	0	0.10	309-00-2	Aldrin	2.9E-02	ca*	1.5E-01	ca	3.9E-04	ca	4.0E-03	ca	1.2E+04	6E+02
		2.5E-01	i			2.5E-01	r	0	0.10	5585-64-8	Ally	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	107-18-6	Allyl alcohol	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		5.0E-02	h			2.9E-04	i	0	0.10	107-05-1	Allyl chloride	3.0E+03	nc	4.3E+04	nc	1.0E+00	nc	1.8E+03	nc		
		1.0E+00	n			1.4E-03	n	0		7429-90-5	**Aluminum**	7.6E+04	nc	1.0E+05	max	5.1E+00	nc	3.6E+04	nc		
		4.0E-04	i					0		20859-73-8	Aluminum phosphide	3.1E+01	nc	8.2E+02	nc			1.5E+01	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	67485-29-4	Amdro	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		9.0E-03	i			9.0E-03	r	0	0.10	834-12-8	Ametryn	5.5E+02	nc	7.9E+03	nc	3.3E+01	nc	3.3E+02	nc		
		7.0E-02	h			7.0E-02	r	0	0.10	591-27-5	m-Aminophenol	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-05	h			2.0E-05	r	0	0.10	504-24-5	4-Aminopyridine	1.2E+00	nc	1.8E+01	nc	7.3E-02	nc	7.3E-01	nc		
		2.5E-03	i			2.5E-03	r	0	0.10	33089-61-1	Amitraz	1.5E+02	nc	2.2E+03	nc	9.1E+00	nc	9.1E+01	nc		
						2.9E-02	i			7664-41-7	Ammonia					1.0E+02	nc				
		2.0E-01	i					0	0.10	7773-06-0	Ammonium sulfamate	1.2E+04	nc	1.0E+05	max			7.3E+03	nc		
5.7E-03	i	7.0E-03	n	5.7E-03	r	2.9E-04	i	0	0.10	62-53-3	Aniline	8.5E+01	ca**	4.3E+02	ca*	1.0E+00	nc	1.2E+01	ca*		
		4.0E-04	i					0		7440-36-0	Antimony and compounds	3.1E+01	nc	8.2E+02	nc			1.5E+01	nc	5.0E+00	3E-01
		5.0E-04	h					0		1314-60-9	Antimony pentoxide	3.9E+01	nc	1.0E+03	nc			1.8E+01	nc		
		9.0E-04	h					0		28300-74-5	Antimony potassium tartrate	7.0E+01	nc	1.8E+03	nc			3.3E+01	nc		
		4.0E-04	h					0		1332-81-6	Antimony tetroxide	3.1E+01	nc	8.2E+02	nc			1.5E+01	nc		
		4.0E-04	h			5.7E-05	i	0		1309-64-4	**Antimony trioxide**	3.1E+01	nc	8.2E+02	nc	2.1E-01	nc	1.5E+01	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	74115-24-5	Apollo	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
2.5E-02	i	5.0E-02	h	2.5E-02	i	5.0E-02	r	0	0.10	140-57-8	Aramite	1.9E+01	ca	9.9E+01	ca	2.7E-01	ca	2.7E+00	ca		
		3.0E-04	i					0	0.03	7440-38-2	Arsenic (noncancer endpoint)	2.2E+01	nc	4.4E+02	nc						
1.5E+00	i	3.0E-04	i	1.5E+01	i			0	0.03	7440-38-2	Arsenic (cancer endpoint)	3.9E-01	ca*	2.7E+00	ca	4.5E-04	ca	4.5E-02	ca	2.9E+01	1E+00
						1.4E-05	i			7784-42-1	Arsine (see arsenic for cancer endpoint)					5.2E-02	nc				
		9.0E-03	i			9.0E-03	r	0	0.10	76578-12-6	Assure	5.5E+02	nc	7.9E+03	nc	3.3E+01	nc	3.3E+02	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	3337-71-1	Asulam	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
2.2E-01	h	3.5E-02	h	2.2E-01	r	3.5E-02	r	0	0.10	1912-24-9	Atrazine	2.2E+00	ca	1.1E+01	ca	3.1E-02	ca	3.0E-01	ca		
		4.0E-04	i			4.0E-04	r	0	0.10	71751-41-2	Avermectin B1	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
1.1E-01	i			1.1E-01	i			0	0.10	103-33-3	Azobenzene	4.4E+00	ca	2.2E+01	ca	6.2E-02	ca	6.1E-01	ca		
		7.0E-02	i			1.4E-04	h	0		7440-39-3	Barium and compounds	5.4E+03	nc	1.0E+05	max	5.2E-01	nc	2.6E+03	nc	1.6E+03	8E+01
		4.0E-03	i			4.0E-03	r	0	0.10	114-26-1	Baygon	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	43121-43-3	Bayleton	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	68359-37-5	Baythroid	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-01	i			3.0E-01	r	0	0.10	1861-40-1	Benefin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	17804-35-2	Benomyl	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	25057-89-0	Bentazon	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	100-52-7	Benzaldehyde	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
2.9E-02	i	3.0E-03	n	2.7E-02	i	1.7E-03	n	1		71-43-2	Benzene	6.7E-01	ca*	1.5E+00	ca*	2.5E-01	ca*	4.1E-01	ca*	3.0E-02	2E-03
2.3E+02	i	3.0E-03	i	2.3E+02	i	3.0E-03	r	0	0.10	92-87-5	Benzidine	2.1E-03	ca	1.1E-02	ca	2.9E-05	ca	2.9E-04	ca		
		4.0E+00	i			4.0E+00	r	0	0.10	65-85-0	Benzoic acid	1.0E+05	max	1.0E+05	max	1.5E+04	nc	1.5E+05	nc	4.0E+02	2E+01

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
1.3E+01	i			1.3E+01	r			0	0.10	98-07-7	Benzotrichloride	3.7E-02	ca	1.9E-01	ca	5.2E-04	ca	5.2E-03	ca		
		3.0E-01	h			3.0E-01	r	0	0.10	100-51-6	Benzyl alcohol	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
1.7E-01	i			1.7E-01	r			1		100-44-7	Benzyl chloride	8.9E-01	ca	2.3E+00	ca	4.0E-02	ca	6.6E-02	ca		
		2.0E-03	i	8.4E+00	i	5.7E-06	i	0		7440-41-7	Beryllium and compounds	1.5E+02	nc	2.2E+03	ca**	8.0E-04	ca*	7.3E+01	nc	6.3E+01	3E+00
		1.0E-04	i			1.0E-04	r	0	0.10	141-66-2	Bidrin	6.1E+00	nc	8.8E+01	nc	3.7E-01	nc	3.6E+00	nc		
		1.5E-02	i			1.5E-02	r	0	0.10	82657-04-3	Biphenthrin (Talstar)	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r	1		92-52-4	1,1-Biphenyl	3.5E+02	sat	3.5E+02	sat	1.8E+02	nc	3.0E+02	nc		
1.1E+00	i			1.2E+00	i			1		111-44-4	Bis(2-chloroethyl)ether	2.1E-01	ca	6.2E-01	ca	5.8E-03	ca	9.8E-03	ca	4.0E-04	2E-05
7.0E-02	h	4.0E-02	i	3.5E-02	h	4.0E-02	r	1		108-60-1	Bis(2-chloroisopropyl)ether	2.9E+00	ca	8.1E+00	ca	1.9E-01	ca	2.7E-01	ca		
2.2E+02	i			2.2E+02	i			1		542-88-1	Bis(chloromethyl)ether	1.9E-04	ca	4.4E-04	ca	3.1E-05	ca	5.2E-05	ca		
7.0E-02	h			3.5E-02	h			0	0.10	108-60-1	Bis(2-chloro-1-methylethyl)ether	6.9E+00	ca	3.5E+01	ca	1.9E-01	ca	9.6E-01	ca		
1.4E-02	i	2.0E-02	i	1.4E-02	r	2.2E-02	r	0	0.10	117-81-7	Bis(2-ethylhexyl)phthalate (DEHP)	3.5E+01	ca*	1.8E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.0E-02	i			5.0E-02	r	0	0.10	80-05-7	Bisphenol A	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		9.0E-02	i			5.7E-03	h	0	0.10	7440-42-8	Boron	5.5E+03	nc	7.9E+04	nc	2.1E+01	nc	3.3E+03	nc		
						2.0E-04	h	0	0.10	7637-07-2	Boron trifluoride					7.3E-01	nc				
		2.0E-02	n			2.9E-03	n	1		108-86-1	Bromobenzene	2.8E+01	nc	9.2E+01	nc	1.0E+01	nc	2.0E+01	nc		
6.2E-02	i	2.0E-02	i	6.2E-02	r	2.0E-02	r	1		75-27-4	Bromodichloromethane	1.0E+00	ca	2.4E+00	ca	1.1E-01	ca	1.8E-01	ca	6E-01	3E-02
7.9E-03	i	2.0E-02	i	3.9E-03	i	2.0E-02	r	0	0.10	75-25-2	Bromoform (tribromomethane)	6.2E+01	ca*	3.1E+02	ca*	1.7E+00	ca*	8.5E+00	ca*	8E-01	4E-02
		1.4E-03	i			1.4E-03	i	1		74-83-9	Bromomethane (Methyl bromide)	3.9E+00	nc	1.3E+01	nc	5.2E+00	nc	8.7E+00	nc	2E-01	1E-02
								0	0.10	101-55-3	4-Bromophenyl phenyl ether										
		5.0E-03	h			5.0E-03	r	0	0.10	2104-96-3	Bromophos	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	1689-84-5	Bromoxynil	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	1689-99-2	Bromoxynil octanoate	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
1.8E+00	r			1.8E+00	i			1		106-99-0	1,3-Butadiene	3.5E-03	ca	7.6E-03	ca	3.7E-03	ca	6.2E-03	ca		
		1.0E-01	i			1.0E-01	r	0	0.10	71-36-3	1-Butanol	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	2E+01	9E-01
		5.0E-02	i			5.0E-02	r	0	0.10	2008-41-5	Butylate	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		1.0E-02	n			1.0E-02	r	1		104-51-8	n-Butylbenzene	1.4E+02	nc	2.4E+02	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	n			1.0E-02	r	1		135-9-88	sec-Butylbenzene	1.1E+02	nc	2.2E+02	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	n			1.0E-02	r	1		98-06-6	tert-Butylbenzene	1.3E+02	nc	3.9E+02	sat	3.7E+01	nc	6.1E+01	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	85-68-7	Butyl benzyl phthalate	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc	9E+02	8E+02
		1.0E+00	i			1.0E+00	r	0	0.10	85-70-1	Butylphthalyl butylglycolate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
		3.0E-03	h			3.0E-03	r	0	0.10	75-60-5	Cacodylic acid	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		5.0E-04	i	6.3E+00	i			0	0.001	7440-43-9	Cadmium and compounds	3.7E+01	nc	8.1E+02	nc	1.1E-03	ca	1.8E+01	nc	8E+00	4E-01
											"CAL-Modified PRG" (PEA, 1994)	9.0E+00									
		5.0E-01	i			5.0E-01	r	0	0.10	105-60-2	Caprolactam	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
8.6E-03	h	2.0E-03	i	8.6E-03	r	2.0E-03	r	0	0.10	2425-06-1	Captafol	5.7E+01	ca**	2.9E+02	ca**	7.8E-01	ca**	7.8E+00	ca**		
3.5E-03	h	1.3E-01	i	3.5E-03	r	1.3E-01	r	0	0.10	133-06-2	Captan	1.4E+02	ca*	7.0E+02	ca	1.9E+00	ca	1.9E+01	ca		
		1.0E-01	i			1.1E-01	r	0	0.10	63-25-2	Carbaryl	6.1E+03	nc	8.8E+04	nc	4.0E+02	nc	3.6E+03	nc		
2.0E-02	h			2.0E-02	r			0	0.10	86-74-8	Carbazole	2.4E+01	ca	1.2E+02	ca	3.4E-01	ca	3.4E+00	ca	6E-01	3E-02
		5.0E-03	i			5.0E-03	r	0	0.10	1563-66-2	Carbofuran	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-01	i			2.0E-01	i	1		75-15-0	Carbon disulfide	3.6E+02	nc	7.2E+02	sat	7.3E+02	nc	1.0E+03	nc	3E+01	2E+00
1.3E-01	i	7.0E-04	i	5.3E-02	i	7.0E-04	r	1		56-23-5	Carbon tetrachloride	2.4E-01	ca**	5.3E-01	ca*	1.3E-01	ca*	1.7E-01	ca*	7E-02	3E-03
		1.0E-02	i			1.0E-02	r	0	0.10	55285-14-8	Carbosulfan	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	5234-68-4	Carboxin	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	302-17-0	Chloral	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.5E-02	i			1.5E-02	r	0	0.10	133-90-4	Chloramben	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
4.0E-01	h			4.0E-01	r			0	0.10	118-75-2	Chloranil	1.2E+00	ca	6.1E+00	ca	1.7E-02	ca	1.7E-01	ca		
3.5E-01	i	5.0E-04	i	3.5E-01	i	2.0E-04	i	0	0.04	12789-03-6	**Chlordane**	1.6E+00	ca*	1.1E+01	ca*	1.9E-02	ca*	1.9E-01	ca*	1E+01	5E-01
		2.0E-02	i			2.0E-02	r	0	0.10	90982-32-4	Chlorimuron-ethyl	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i							7782-50-5	Chlorine							3.6E+03	nc		
						5.7E-05	i			10049-04-4	Chlorine dioxide					2.1E-01	nc				
								1		107-20-0	Chloroacetaldehyde										
		2.0E-03	h			2.0E-03	r	0	0.10	79-11-8	Chloroacetic acid	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		8.6E-06	r			8.6E-06	i	1		532-27-4	2-Chloroacetophenone	3.3E-02	nc	1.1E-01	nc	3.1E-02	nc	5.2E-02	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	106-47-8	4-Chloroaniline	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc	7E-01	3E-02
		2.0E-02	i			1.7E-02	n	1		108-90-7	**Chlorobenzene**	1.5E+02	nc	5.4E+02	nc	6.2E+01	nc	1.1E+02	nc	1E+00	7E-02

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	Migration to Ground Water DAF 1 (mg/kg)
2.7E-01	h	2.0E-02	i	2.7E-01	h	2.0E-02	r	0	0.10	510-15-6	Chlorobenzilate	1.8E+00	ca	9.1E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-01	h			2.0E-01	r	0	0.10	74-11-3	p-Chlorobenzoic acid	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	h			2.0E-02	r	0	0.10	98-56-6	4-Chlorobenzotrifluoride	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	h			2.0E-03	h	1		126-99-8	2-Chloro-1,3-butadiene	3.6E+00	nc	1.2E+01	nc	7.3E+00	nc	1.4E+01	nc		
		4.0E-01	h			4.0E-01	r	1		109-69-3	1-Chlorobutane	4.8E+02	sat	4.8E+02	sat	1.5E+03	nc	2.4E+03	nc		
		1.4E+01	r			1.4E+01	i	1		75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	3.4E+02	sat	3.4E+02	sat	5.2E+04	nc	8.7E+04	nc		
		1.4E+01	r			1.4E+01	i	1		75-45-6	Chlorodifluoromethane	3.4E+02	sat	3.4E+02	sat	5.1E+04	nc	8.5E+04	nc		
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	1		75-00-3	**Chloroethane**	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
								1		110-75-8	2-Chloroethyl vinyl ether										
6.1E-03	i	1.0E-02	i	8.1E-02	i	8.6E-05	n	1		67-66-3	**Chloroform**	2.4E-01	ca**	5.2E-01	ca**	8.4E-02	ca**	1.6E-01	ca**	6E-01	3E-02
1.3E-02	h			6.3E-03	h	8.6E-02	n	1		74-87-3	**Chloromethane**	1.2E+00	ca	2.7E+00	ca	1.1E+00	ca	1.5E+00	ca		
5.8E-01	h			5.8E-01	r			0	0.10	95-69-2	4-Chloro-2-methylaniline	8.4E-01	ca	4.3E+00	ca	1.2E-02	ca	1.2E-01	ca		
4.6E-01	h			4.6E-01	r			0	0.10	3165-93-3	4-Chloro-2-methylaniline hydrochloride	1.1E+00	ca	5.4E+00	ca	1.5E-02	ca	1.5E-01	ca		
		8.0E-02	i			8.0E-02	r	1		91-58-7	beta-Chloronaphthalene	4.9E+03	nc	2.7E+04	nc	2.9E+02	nc	4.9E+02	nc		
2.5E-02	h			2.5E-02	r			r	1	88-73-3	**o-Chloronitrobenzene**	8.1E+00	ca	2.3E+01	ca	2.7E-01	ca	4.5E-01	ca		
1.8E-02	h			1.8E-02	r			r	1	100-00-5	**p-Chloronitrobenzene**	1.1E+01	ca	3.2E+01	ca	3.7E-01	ca	6.2E-01	ca		
		5.0E-03	i			5.0E-03	r	1		95-57-8	2-Chlorophenol	6.3E+01	nc	2.4E+02	nc	1.8E+01	nc	3.0E+01	nc	4E+00	2E-01
		2.9E-02	r			2.9E-02	h	1		75-29-6	2-Chloropropane	1.7E+02	nc	5.9E+02	nc	1.0E+02	nc	1.7E+02	nc		
1.1E-02	h	1.5E-02	i	1.1E-02	r	1.5E-02	r	0	0.10	1897-45-6	Chlorothalonil	4.4E+01	ca*	2.2E+02	ca*	6.1E-01	ca*	6.1E+00	ca*		
		2.0E-02	i			2.0E-02	r	1		95-49-8	o-Chlorotoluene	1.6E+02	nc	5.7E+02	nc	7.3E+01	nc	1.2E+02	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	101-21-3	Chlorpropham	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	2921-88-2	Chlorpyrifos	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		1.0E-02	h			1.0E-02	r	0	0.10	5598-13-0	Chlorpyrifos-methyl	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	64902-72-3	Chlorsulfuron	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		8.0E-04	h			8.0E-04	r	0	0.10	60238-56-4	Chlorthiophos	4.9E+01	nc	7.0E+02	nc	2.9E+00	nc	2.9E+01	nc		
				4.2E+01	i			0			Total Chromium (1:6 ratio Cr VI:Cr III)	2.1E+02	ca	4.5E+02	ca	1.6E-04	ca			4E+01	2E+00
		1.5E+00	i							16065-83-1	Chromium III	1.0E+05	max	1.0E+05	max			5.5E+04	nc		
		3.0E-03	i	2.9E+02	i			0		18540-29-9	**Chromium VI**	3.0E+01	ca**	6.4E+01	ca	2.3E-05	ca	1.1E+02	nc	4E+01	2E+00
											"CAL-Modified PRG" (PEA, 1994)	2.0E-01						2E-01			
		6.0E-02	n							7440-48-4	Cobalt	4.7E+03	nc	1.0E+05	max			2.2E+03	nc		
				2.2E+00	i			0		8007-45-2	Coke Oven Emissions					3.1E-03	ca				
		3.7E-02	h					0		7440-50-8	Copper and compounds	2.9E+03	nc	7.6E+04	nc			1.4E+03	nc		
1.9E+00	h			1.9E+00	r			1		123-73-9	Crotonaldehyde	5.3E-03	ca	1.1E-02	ca	3.5E-03	ca	5.9E-03	ca		
		1.0E-01	i			1.1E-01	i	1		98-82-8	Cumene (isopropylbenzene)	1.6E+02	nc	5.2E+02	nc	4.0E+02	nc	6.6E+02	nc		
8.4E-01	h	2.0E-03	h	8.4E-01	r	2.0E-03	r	0	0.10	21725-46-2	Cyanazine	5.8E-01	ca	2.9E+00	ca	8.0E-03	ca	8.0E-02	ca		
									n/a		Cyanides										
		1.0E-01	h					0	0.10	542-62-1	Barium cyanide	6.1E+03	nc	1.0E+05	max			3.6E+03	nc		
		4.0E-02	i					0	0.10	592-01-8	Calcium cyanide	2.4E+03	nc	3.5E+04	nc			1.5E+03	nc		
		5.0E-03	i					0	0.10	544-92-3	Copper cyanide	3.1E+02	nc	4.4E+03	nc			1.8E+02	nc		
		2.0E-02	i					0	0.10	57-12-5	Free cyanide	1.2E+03	nc	1.8E+04	nc			7.3E+02	nc	4E+01	2E+00
		2.0E-02	i			8.6E-04	i	1		74-90-8	Hydrogen cyanide	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc		
		5.0E-02	i					0	0.10	151-50-8	Potassium cyanide	3.1E+03	nc	4.4E+04	nc			1.8E+03	nc		
		2.0E-01	i					0	0.10	506-61-6	Potassium silver cyanide	1.2E+04	nc	1.0E+05	max			7.3E+03	nc		
		1.0E-01	i					0	0.10	506-64-9	Silver cyanide	6.1E+03	nc	8.8E+04	nc			3.6E+03	nc		
		4.0E-02	i					0	0.10	143-33-9	Sodium cyanide	2.4E+03	nc	3.5E+04	nc			1.5E+03	nc		
		5.0E-02	i					0	0.10	557-21-1	Zinc cyanide	3.1E+03	nc	4.4E+04	nc			1.8E+03	nc		
		4.0E-02	i			4.0E-02	r	1		460-19-5	**Cyanogen**	1.3E+02	nc	4.3E+02	nc	1.5E+02	nc	2.4E+02	nc		
		9.0E-02	i			9.0E-02	r	1		506-68-3	**Cyanogen bromide**	2.9E+02	nc	9.7E+02	nc	3.3E+02	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r	1		506-77-4	**Cyanogen chloride**	1.6E+02	nc	5.4E+02	nc	1.8E+02	nc	3.0E+02	nc		
		5.0E+00	i			5.0E+00	r	0	0.10	108-94-1	Cyclohexanone	1.0E+05	max	1.0E+05	max	1.8E+04	nc	1.8E+05	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	108-91-8	Cyclohexylamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	68085-85-8	Cyhalothrin/Karate	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	52315-07-8	Cypermethrin	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		7.5E-03	i			7.5E-03	r	0	0.10	66215-27-8	Cyromazine	4.6E+02	nc	6.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	1861-32-1	Dacthal	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	75-99-0	Dalapon	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
		2.5E-02	i			2.5E-02	r 0	0.10	39515-41-8	Danitol	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
2.4E-01	i			2.4E-01	r		0	0.03	72-54-8	DDD	2.4E+00	ca	1.7E+01	ca	2.8E-02	ca	2.8E-01	ca	2E+01	8E-01
3.4E-01	i			3.4E-01	r		0	0.03	72-55-9	DDE	1.7E+00	ca	1.2E+01	ca	2.0E-02	ca	2.0E-01	ca	5E+01	3E+00
3.4E-01	i	5.0E-04	i	3.4E-01	i	5.0E-04	r 0	0.03	50-29-3	DDT	1.7E+00	ca*	1.2E+01	ca*	2.0E-02	ca*	2.0E-01	ca*	3E+01	2E+00
		1.0E-02	i			1.0E-02	r 0	0.10	1163-19-5	Decabromodiphenyl ether	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		4.0E-05	i			4.0E-05	r 0	0.10	8065-48-3	Demeton	2.4E+00	nc	3.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
6.1E-02	h			6.1E-02	r		0	0.10	2303-16-4	Diallate	8.0E+00	ca	4.0E+01	ca	1.1E-01	ca	1.1E+00	ca		
		9.0E-04	h			9.0E-04	r 0	0.10	333-41-5	Diazinon	5.5E+01	nc	7.9E+02	nc	3.3E+00	nc	3.3E+01	nc		
		4.0E-03	x			4.0E-03	r 1		132-64-9	Dibenzofuran	2.9E+02	nc	5.1E+03	nc	1.5E+01	nc	2.4E+01	nc		
		1.0E-02	i			1.0E-02	r 0	0.10	106-37-6	1,4-Dibromobenzene	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
8.4E-02	i	2.0E-02	i	8.4E-02	r	2.0E-02	r 1		124-48-1	**Dibromochloromethane**	1.1E+00	ca	2.7E+00	ca	8.0E-02	ca	1.3E-01	ca	4E-01	2E-02
1.4E+00	h	5.7E-05	r	2.4E-03	h	5.7E-05	i 1		96-12-8	**1,2-Dibromo-3-chloropropane**	4.5E-01	ca**	4.0E+00	ca**	2.1E-01	nc	4.8E-02	ca**		
										"CAL-Modified PRG" (PEA, 1994)	6.0E-02				9.6E-04		4.7E-03			
8.5E+01	i	5.7E-05	r	7.7E-01	i	5.7E-05	h 1		106-93-4	1,2-Dibromoethane	6.9E-03	ca	4.8E-02	ca*	8.7E-03	ca*	7.6E-04	ca		
		1.0E-01	i			1.0E-01	r 0	0.10	84-74-2	Dibutyl phthalate	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	2E+03	3E+02
		3.0E-02	i			3.0E-02	r 0	0.10	1918-00-9	Dicamba	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		9.0E-02	i			5.7E-02	h 1		95-50-1	1,2-Dichlorobenzene	3.7E+02	sat	3.7E+02	sat	2.1E+02	nc	3.7E+02	nc	2E+01	9E-01
		9.00E-04	n			9.00E-04	r 1		541-73-1	**1,3-Dichlorobenzene**	1.3E+01	nc	5.2E+01	nc	3.3E+00	nc	5.5E+00	nc		
2.4E-02	h	3.00E-02	n	2.2E-02	n	3.00E-02	i 1		106-46-7	**1,4-Dichlorobenzene**	3.4E+00	ca	8.1E+00	ca	3.1E-01	ca	5.0E-01	ca	2E+00	1E-01
4.5E-01	i			4.5E-01	r		0	0.10	91-94-1	3,3-Dichlorobenzidine	1.1E+00	ca	5.5E+00	ca	1.5E-02	ca	1.5E-01	ca	7E-03	3E-04
9.3E+00	r			9.3E+00	h		1		764-41-0	1,4-Dichloro-2-butene	7.9E-03	ca	1.8E-02	ca	7.2E-04	ca	1.2E-03	ca		
		2.0E-01	i			5.7E-02	h 1		75-71-8	Dichlorodifluoromethane	9.4E+01	nc	3.1E+02	nc	2.1E+02	nc	3.9E+02	nc		
		1.0E-01	h			1.4E-01	h 1		75-34-3	1,1-Dichloroethane	5.9E+02	nc	2.1E+03	nc	5.2E+02	nc	8.1E+02	nc	2E+01	1E+00
9.1E-02	i	3.0E-02	n	9.1E-02	i	1.4E-03	n 1		107-06-2	1,2-Dichloroethane (EDC)	3.5E-01	ca*	7.6E-01	ca*	7.4E-02	ca*	1.2E-01	ca*	2E-02	1E-03
6.0E-01	i	9.0E-03	i	1.8E-01	i	9.0E-03	r 1		75-35-4	1,1-Dichloroethylene	5.4E-02	ca	1.2E-01	ca	3.8E-02	ca	4.6E-02	ca	6E-02	3E-03
		1.0E-02	h			1.0E-02	r 1		156-59-2	1,2-Dichloroethylene (cis)	4.3E+01	nc	1.5E+02	nc	3.7E+01	nc	6.1E+01	nc	4E-01	2E-02
		2.0E-02	i			2.0E-02	r 1		156-60-5	1,2-Dichloroethylene (trans)	6.3E+01	nc	2.1E+02	nc	7.3E+01	nc	1.2E+02	nc	7E-01	3E-02
		3.0E-03	i			3.0E-03	r 0	0.10	120-83-2	2,4-Dichlorophenol	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc	1E+00	5E-02
		8.0E-03	i			8.0E-03	r 0	0.10	94-82-6	4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
		1.0E-02	i			1.0E-02	r 0	0.05	94-75-7	2,4-Dichlorophenoxyacetic Acid (2,4-D)	6.9E+02	nc	1.2E+04	nc	3.7E+01	nc	3.6E+02	nc		
6.8E-02	h	1.1E-03	i	6.8E-02	r	1.1E-03	i 1		78-87-5	1,2-Dichloropropane	3.5E-01	ca*	7.7E-01	ca*	9.9E-02	ca*	1.6E-01	ca*	3E-02	1E-03
1.8E-01	h	3.0E-04	i	1.3E-01	h	5.7E-03	i 1		542-75-6	1,3-Dichloropropene	8.2E-02	ca	1.8E-01	ca	5.2E-02	ca	8.1E-02	ca	4E-03	2E-04
		3.0E-03	i			3.0E-03	r 0	0.10	616-23-9	2,3-Dichloropropanol	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
2.9E-01	i	5.0E-04	i	2.9E-01	r	1.4E-04	i 0	0.10	62-73-7	Dichlorvos	1.7E+00	ca*	8.5E+00	ca*	2.3E-02	ca*	2.3E-01	ca*		
4.4E-01	x			4.4E-01	r		0	0.10	115-32-2	Dicofol	1.1E+00	ca	5.6E+00	ca	1.5E-02	ca	1.5E-01	ca		
		3.0E-02	h			5.7E-05	h 1		77-73-6	Dicyclopentadiene	5.4E-01	nc	1.8E+00	nc	2.1E-01	nc	4.2E-01	nc		
1.6E+01	i	5.0E-05	i	1.6E+01	i	5.0E-05	r 0	0.10	60-57-1	Dieldrin	3.0E-02	ca	1.5E-01	ca	4.2E-04	ca	4.2E-03	ca	4E-03	2E-04
		5.7E-03	r			5.7E-03	h 0	0.10	112-34-5	Diethylene glycol, monobutyl ether	3.5E+02	nc	5.0E+03	nc	2.1E+01	nc	2.1E+02	nc		
		2.0E+00	h			2.0E+00	r 0	0.10	111-90-0	Diethylene glycol, monoethyl ether	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		1.1E-02	h			1.1E-02	r 0	0.10	617-84-5	Diethylformamide	6.7E+02	nc	9.7E+03	nc	4.0E+01	nc	4.0E+02	nc		
1.2E-03	i	6.0E-01	i	1.2E-03	r	6.0E-01	r 0	0.10	103-23-1	Di(2-ethylhexyl)adipate	4.1E+02	ca	2.1E+03	ca	5.6E+00	ca	5.6E+01	ca		
		8.0E-01	i			8.0E-01	r 0	0.10	84-66-2	Diethyl phthalate	4.9E+04	nc	1.0E+05	max	2.9E+03	nc	2.9E+04	nc		
4.7E+03	h			4.7E+03	r		0	0.10	56-53-1	Diethylstilbestrol	1.0E-04	ca	5.2E-04	ca	1.4E-06	ca	1.4E-05	ca		
		8.0E-02	i			8.0E-02	r 0	0.10	43222-48-6	Difenzoquat (Avenge)	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r 0	0.10	35367-38-5	Diflubenzuron	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.1E+01	r			1.1E+01	i 1		75-37-6	1,1-Difluoroethane					4.2E+04	nc	6.9E+04	nc		
		8.0E-02	i			8.0E-02	r 0	0.10	1445-75-6	Diisopropyl methylphosphonate	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r 0	0.10	55290-64-7	Dimethipin	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-04	i			2.0E-04	r 0	0.10	60-51-5	Dimethoate	1.2E+01	nc	1.8E+02	nc	7.3E-01	nc	7.3E+00	nc		
1.4E-02	h			1.4E-02	r		0	0.10	119-90-4	3,3'-Dimethoxybenzidine	3.5E+01	ca	1.8E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.7E-06	r			5.7E-06	x 1		124-40-3	Dimethylamine	6.7E-02	nc	2.5E-01	nc	2.1E-02	nc	3.5E-02	nc		
		2.0E-03	i			2.0E-03	r 0	0.10	121-69-7	N-N-Dimethylaniline	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
7.5E-01	h			7.5E-01	r		0	0.10	95-68-1	2,4-Dimethylaniline	6.5E-01	ca	3.3E+00	ca	9.0E-03	ca	9.0E-02	ca		
5.8E-01	h			5.8E-01	r		0	0.10	21436-96-4	2,4-Dimethylaniline hydrochloride	8.4E-01	ca	4.3E+00	ca	1.2E-02	ca	1.2E-01	ca		
9.2E+00	h			9.2E+00	r		0	0.10	119-93-7	3,3'-Dimethylbenzidine	5.3E-02	ca	2.7E-01	ca	7.3E-04	ca	7.3E-03	ca		
2.6E+00	x			3.5E+00	x		0	0.10	57-14-7	1,1-Dimethylhydrazine	1.9E-01	ca	9.5E-01	ca	1.9E-03	ca	2.6E-02	ca		

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION									CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C / skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg) / DAF 1 (mg/kg)
3.7E+01	x			3.7E+01	x			0 0.10	540-73-8	1,2-Dimethylhydrazine	1.3E-02	ca	6.7E-02	ca	1.8E-04	ca	1.8E-03	ca	
		1.0E-01	h			8.6E-03	i	0 0.10	68-12-2	N,N-Dimethylformamide	6.1E+03	nc	8.8E+04	nc	3.1E+01	nc	3.6E+03	nc	
		1.0E-03	n			1.0E-03	r	0 0.10	122-09-8	Dimethylphenethylamine	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc	
		2.0E-02	i			2.0E-02	r	0 0.10	105-67-9	2,4-Dimethylphenol	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc	9E+00 / 4E-01
		6.0E-04	i			6.0E-04	r	0 0.10	576-26-1	2,6-Dimethylphenol	3.7E+01	nc	5.3E+02	nc	2.2E+00	nc	2.2E+01	nc	
		1.0E-03	i			1.0E-03	r	0 0.10	95-65-8	3,4-Dimethylphenol	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc	
		1.0E+01	h			1.0E+01	r	0 0.10	131-11-3	Dimethyl phthalate	1.0E+05	max	1.0E+05	max	3.7E+04	nc	3.6E+05	nc	
		1.0E-01	i			1.0E-01	r	0 0.10	120-61-6	Dimethyl terephthalate	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	
		2.0E-03	i			2.0E-03	r	0 0.10	131-89-5	4,6-Dinitro-o-cyclohexyl phenol	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc	
		4.0E-04	h			4.0E-04	r	0 0.10	528-29-0	1,2-Dinitrobenzene	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc	
		1.0E-04	i			1.0E-04	r	0 0.10	99-65-0	1,3-Dinitrobenzene	6.1E+00	nc	8.8E+01	nc	3.7E-01	nc	3.6E+00	nc	
		4.0E-04	h			4.0E-04	r	0 0.10	100-25-4	1,4-Dinitrobenzene	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc	
		2.0E-03	i			2.0E-03	r	0 0.10	51-28-5	2,4-Dinitrophenol	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc	3E-01 / 1E-02
6.8E-01	i			6.8E-01	r			0 0.10	25321-14-6	Dinitrotoluene mixture	7.2E-01	ca	3.6E+00	ca	9.9E-03	ca	9.9E-02	ca	8E-04 / 4E-05
		2.0E-03	i			2.0E-03	r	0 0.10	121-14-2	2,4-Dinitrotoluene (also see Dinitrotoluene mixture)	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc	8E-04 / 4E-05
		1.0E-03	h			1.0E-03	r	0 0.10	606-20-2	2,6-Dinitrotoluene (also see Dinitrotoluene mixture)	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc	7E-04 / 3E-05
		1.0E-03	i			1.0E-03	r	0 0.10	88-85-7	Dinoseb	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc	
		2.0E-02	h			2.0E-02	r	0 0.10	117-84-0	di-n-Octyl phthalate	1.2E+03	nc	1.0E+04	sat	7.3E+01	nc	7.3E+02	nc	1E+04 / 1E+04
1.1E-02	i			1.1E-02	r			0 0.10	123-91-1	1,4-Dioxane	4.4E+01	ca	2.2E+02	ca	6.1E-01	ca	6.1E+00	ca	
1.5E+05	h			1.5E+05	h			0 0.03	1746-01-6	Dioxin (2,3,7,8-TCDD)	3.9E-06	ca	2.7E-05	ca	4.5E-08	ca	4.5E-07	ca	
		3.0E-02	i			3.0E-02	r	0 0.10	957-51-7	Diphenamid	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc	
		2.5E-02	i			2.5E-02	r	0 0.10	122-39-4	Diphenylamine	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc	
8.0E-01	i			7.7E-01	i			0 0.10	122-66-7	1,2-Diphenylhydrazine	6.1E-01	ca	3.1E+00	ca	8.7E-03	ca	8.4E-02	ca	
		9.0E-03	n			9.0E-03	r	0 0.10	127-63-9	Diphenyl sulfone	5.5E+02	nc	7.9E+03	nc	3.3E+01	nc	3.3E+02	nc	
		2.2E-03	i			2.2E-03	r	0 0.10	85-00-7	Diquat	1.3E+02	nc	1.9E+03	nc	8.0E+00	nc	8.0E+01	nc	
8.6E+00	h			8.6E+00	r			0 0.10	1937-37-7	Direct black 38	5.7E-02	ca	2.9E-01	ca	7.8E-04	ca	7.8E-03	ca	
8.1E+00	h			8.1E+00	r			0 0.10	2602-46-2	Direct blue 6	6.0E-02	ca	3.0E-01	ca	8.3E-04	ca	8.3E-03	ca	
9.3E+00	h			9.3E+00	r			0 0.10	16071-86-6	Direct brown 95	5.2E-02	ca	2.7E-01	ca	7.2E-04	ca	7.2E-03	ca	
		4.0E-05	i			4.0E-05	r	0 0.10	298-04-4	Disulfoton	2.4E+00	nc	3.5E+01	nc	1.5E-01	nc	1.5E+00	nc	
		1.0E-02	i			1.0E-02	r	0 0.10	505-29-3	1,4-Dithiane	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc	
		2.0E-03	i			2.0E-03	r	0 0.10	330-54-1	Diuron	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc	
		4.0E-03	i			4.0E-03	r	0 0.10	2439-10-3	Dodine	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc	
		6.0E-03	i			6.0E-03	r	0 0.10	115-29-7	Endosulfan	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc	2E+01 / 9E-01
		2.0E-02	i			2.0E-02	r	0 0.10	145-73-3	Endothall	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc	
		3.0E-04	i			3.0E-04	r	0 0.10	72-20-8	Endrin	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc	1E+00 / 5E-02
9.9E-03	i	2.0E-03	h	4.2E-03	i	2.9E-04	i	1	106-89-8	Epichlorohydrin	7.6E+00	nc	2.6E+01	nc	1.0E+00	nc	2.0E+00	nc	
		5.7E-03	r			5.7E-03	i	0 0.10	106-88-7	1,2-Epoxybutane	3.5E+02	nc	5.0E+03	nc	2.1E+01	nc	2.1E+02	nc	
		2.5E-02	i			2.5E-02	r	0 0.10	759-94-4	EPTC (S-Ethyl dipropylthiocarbamate)	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc	
		5.0E-03	i			5.0E-03	r	0 0.10	16672-87-0	Ethephon (2-chloroethyl phosphonic acid)	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc	
		5.0E-04	i			5.0E-04	r	0 0.10	563-12-2	Ethion	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc	
		4.0E-01	h			5.7E-02	i	0 0.10	110-80-5	2-Ethoxyethanol	2.4E+04	nc	1.0E+05	max	2.1E+02	nc	1.5E+04	nc	
		3.0E-01	h			3.0E-01	r	0 0.10	111-15-9	2-Ethoxyethanol acetate	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc	
		9.0E-01	i			9.0E-01	r	1	141-78-6	Ethyl acetate	1.9E+04	nc	3.7E+04	sat	3.3E+03	nc	5.5E+03	nc	
4.8E-02	h			4.8E-02	r			1	140-88-5	Ethyl acrylate	2.1E-01	ca	4.5E-01	ca	1.4E-01	ca	2.3E-01	ca	
		1.0E-01	i			2.9E-01	i	1	100-41-4	Ethylbenzene	2.3E+02	sat	2.3E+02	sat	1.1E+03	nc	1.3E+03	nc	1E+01 / 7E-01
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	1	75-00-3	**Ethyl chloride**	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca	
		3.0E-01	h			3.0E-01	r	0 0.10	109-78-4	Ethylene cyanohydrin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc	
		2.0E-02	h			2.0E-02	r	0 0.10	107-15-3	Ethylene diamine	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc	
		2.0E+00	i			2.0E+00	r	0 0.10	107-21-1	Ethylene glycol	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc	
		5.7E-03	r			5.7E-03	h	0 0.10	111-76-2	Ethylene glycol, monobutyl ether	3.5E+02	nc	5.0E+03	nc	2.1E+01	nc	2.1E+02	nc	
1.0E+00	h			3.5E-01	h			1	75-21-8	Ethylene oxide	1.4E-01	ca	3.6E-01	ca	1.9E-02	ca	2.4E-02	ca	
1.1E-01	h	8.0E-05	i	1.1E-01	r	8.0E-05	r	0 0.10	96-45-7	Ethylene thiourea (ETU)	4.4E+00	ca**	2.2E+01	ca**	6.1E-02	ca**	6.1E-01	ca**	
		2.0E-01	i			2.0E-01	r	1	60-29-7	Ethyl ether	1.8E+03	sat	1.8E+03	sat	7.3E+02	nc	1.2E+03	nc	
		9.0E-02	h			9.0E-02	r	1	97-63-2	Ethyl methacrylate	1.4E+02	sat	1.4E+02	sat	3.3E+02	nc	5.5E+02	nc	
		1.0E-05	i			1.0E-05	r	0 0.10	2104-64-5	Ethyl p-nitrophenyl phenylphosphorothioate	6.1E-01	nc	8.8E+00	nc	3.7E-02	nc	3.6E-01	nc	
		3.0E+00	i			3.0E+00	r	0 0.10	84-72-0	Ethylphthalyl ethyl glycolate	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc	

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
		8.0E-03	i			8.0E-03	r	0	0.10	101200-48-0	Express	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
		2.5E-04	i			2.5E-04	r	0	0.10	22224-92-6	Fenamiphos	1.5E+01	nc	2.2E+02	nc	9.1E-01	nc	9.1E+00	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	2164-17-2	Fluometuron	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		6.0E-02	i					0	0.10	16984-48-8	Flouride	3.7E+03	nc	5.3E+04	nc			2.2E+03	nc		
		8.0E-02	i			8.0E-02	r	0	0.10	59756-60-4	Fluoridone	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	56425-91-3	Flurprimidol	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-02	i			6.0E-02	r	0	0.10	66332-96-5	Flutolanil	3.7E+03	nc	5.3E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	69409-94-5	Fluvalinate	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
3.5E-03	i	1.0E-01	i	3.5E-03	r	1.0E-01	r	0	0.10	133-07-3	Folpet	1.4E+02	ca*	7.0E+02	ca	1.9E+00	ca	1.9E+01	ca		
1.9E-01	i			1.9E-01	r			0	0.10	72178-02-0	Fomesafen	2.6E+00	ca	1.3E+01	ca	3.5E-02	ca	3.5E-01	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	944-22-9	Fonofos	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.5E-01	i	4.6E-02	i			0	0.10	50-00-0	Formaldehyde	9.2E+03	nc	1.0E+05	nc	1.5E-01	ca	5.5E+03	nc		
		2.0E+00	h			2.0E+00	r	0	0.10	64-18-6	Formic Acid	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		3.0E+00	i			3.0E+00	r	0	0.10	39148-24-8	Fosetyl-al	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		1.0E-03	i			1.0E-03	r	1		110-00-9	Furan	2.5E+00	nc	8.5E+00	nc	3.7E+00	nc	6.1E+00	nc		
3.8E+00	h			3.8E+00	r			0	0.10	67-45-8	Furazolidone	1.3E-01	ca	6.5E-01	ca	1.8E-03	ca	1.8E-02	ca		
		3.0E-03	i			1.4E-02	h	0	0.10	98-01-1	Furfural	1.8E+02	nc	2.6E+03	nc	5.2E+01	nc	1.1E+02	nc		
5.0E+01	h			5.0E+01	r			0	0.10	531-82-8	Furium	9.7E-03	ca	4.9E-02	ca	1.3E-04	ca	1.3E-03	ca		
3.0E-02	i			3.0E-02	r			0	0.10	60568-05-0	Furmecyclox	1.6E+01	ca	8.2E+01	ca	2.2E-01	ca	2.2E+00	ca		
		4.0E-04	i			4.0E-04	r	0	0.10	77182-82-2	Glufosinate-ammonium	2.4E+01	nc	3.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
		4.0E-04	i			2.9E-04	h	0	0.10	765-34-4	Glycidaldehyde	2.4E+01	nc	3.5E+02	nc	1.0E+00	nc	1.5E+01	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	1071-83-6	Glyphosate	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		5.0E-05	i			5.0E-05	r	0	0.10	69806-40-2	Haloxyfop-methyl	3.1E+00	nc	4.4E+01	nc	1.8E-01	nc	1.8E+00	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	79277-27-3	Harmony	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
4.5E+00	i	5.0E-04	i	4.6E+00	i	5.0E-04	r	0	0.10	76-44-8	Heptachlor	1.1E-01	ca	5.5E-01	ca	1.5E-03	ca	1.5E-02	ca	2E+01	1E+00
9.1E+00	i	1.3E-05	i	9.1E+00	i	1.3E-05	r	0	0.10	1024-57-3	Heptachlor epoxide	5.3E-02	ca*	2.7E-01	ca*	7.4E-04	ca*	7.4E-03	ca*	7E-01	3E-02
		2.0E-03	i			2.0E-03	r	0	0.10	87-82-1	Hexabromobenzene	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
1.6E+00	i	8.0E-04	i	1.6E+00	i	8.0E-04	r	0	0.10	118-74-1	Hexachlorobenzene	3.0E-01	ca	1.5E+00	ca	4.2E-03	ca	4.2E-02	ca	2E+00	1E-01
7.8E-02	i	2.0E-04	h	7.8E-02	i	2.0E-04	r	0	0.10	87-68-3	Hexachlorobutadiene	6.2E+00	ca**	3.2E+01	ca**	8.6E-02	ca**	8.6E-01	ca**	2E+00	1E-01
6.3E+00	i			6.3E+00	i			0	0.04	319-84-6	HCH (alpha)	9.0E-02	ca	5.9E-01	ca	1.1E-03	ca	1.1E-02	ca	5E-04	3E-05
1.8E+00	i			1.8E+00	i			0	0.04	319-85-7	HCH (beta)	3.2E-01	ca	2.1E+00	ca	3.7E-03	ca	3.7E-02	ca	3E-03	1E-04
1.3E+00	h	3.0E-04	i	1.3E+00	r	3.0E-04	r	0	0.04	58-89-9	HCH (gamma) Lindane	4.4E-01	ca*	2.9E+00	ca	5.2E-03	ca	5.2E-02	ca	9E-03	5E-04
1.8E+00	i			1.8E+00	i			0	0.04	608-73-1	HCH-technical	3.2E-01	ca	2.1E+00	ca	3.8E-03	ca	3.7E-02	ca	3E-03	1E-04
		7.0E-03	i			2.0E-05	h	0	0.10	77-47-4	Hexachlorocyclopentadiene	4.2E+02	nc	5.9E+03	nc	7.3E-02	nc	2.6E+02	nc	4E+02	2E+01
6.2E+03	i			4.6E+03	i			0	0.10	19408-74-3	Hexachlorodibenzo-p-dioxin mixture (HxCDD)	7.8E-05	ca	4.0E-04	ca	1.5E-06	ca	1.1E-05	ca		
1.4E-02	i	1.0E-03	i	1.4E-02	i	1.0E-03	r	0	0.10	67-72-1	Hexachloroethane	3.5E+01	ca**	1.8E+02	ca**	4.8E-01	ca**	4.8E+00	ca**	5E-01	2E-02
		3.0E-04	i			3.0E-04	r	0	0.10	70-30-4	Hexachlorophene	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0	0.10	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4E+00	ca*	2.2E+01	ca	6.1E-02	ca	6.1E-01	ca		
		2.9E-06	r			2.9E-06	i	0	0.10	822-06-0	1,6-Hexamethylene diisocyanate	1.7E-01	nc	2.5E+00	nc	1.0E-02	nc	1.0E-01	nc		
		6.0E-02	h			5.7E-02	i	1		110-54-3	n-Hexane	1.1E+02	sat	1.1E+02	sat	2.1E+02	nc	3.5E+02	nc		
		3.3E-02	i			3.3E-02	r	0	0.10	51235-04-2	Hexazinone	2.0E+03	nc	2.9E+04	nc	1.2E+02	nc	1.2E+03	nc		
3.0E+00	i			1.7E+01	i			0	0.10	302-01-2	Hydrazine, hydrazine sulfate	1.6E-01	ca	8.2E-01	ca	3.9E-04	ca	2.2E-02	ca		
						5.7E-03	i			7647-01-0	Hydrogen chloride					2.1E+01	nc				
		3.0E-03	i			2.9E-04	i			7783-06-4	Hydrogen sulfide					1.0E+00	nc	1.1E+02	nc		
		4.0E-02	h			4.0E-02	r	0	0.10	123-31-9	p-Hydroquinone	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	35554-44-0	Imazalil	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		2.5E-01	i			2.5E-01	r	0	0.10	81335-37-7	Imazaquin	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		4.0E-02	i			4.0E-02	r	0	0.10	36734-19-7	Iprodione	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		3.0E-01	n					0		7439-89-6	Iron	2.3E+04	nc	1.0E+05	max			1.1E+04	nc		
		3.0E-01	i			3.0E-01	r	1		78-83-1	Isobutanol	1.3E+04	nc	4.0E+04	sat	1.1E+03	nc	1.8E+03	nc		
9.5E-04	i	2.0E-01	i	9.5E-04	r	2.0E-01	r	0	0.10	78-59-1	Isophorone	5.1E+02	ca*	2.6E+03	ca*	7.1E+00	ca	7.1E+01	ca	5E-01	3E-02
		1.5E-02	i			1.5E-02	r	0	0.10	33820-53-0	Isopropalin	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
		1.0E-01	i			1.1E-01	r	0	0.10	1832-54-8	Isopropyl methyl phosphonic acid	6.1E+03	nc	8.8E+04	nc	4.0E+02	nc	3.6E+03	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	82558-50-7	Isoxaben	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
1.8E+01	n			1.8E+01	r			0	0.10	143-50-0	Kepone	2.7E-02	ca	1.4E-01	ca	3.7E-04	ca	3.7E-03	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	77501-63-4	Lactofen	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		

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FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)	V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
PRGs Based on EPA Models, IEUBK (1994) and TRW (1996)									7439-92-1	Lead	4.0E+02	nc	1.0E+03	nc						
		1.0E-07	i				0	0.10	78-00-2	Lead (tetraethyl)	6.1E-03	nc	8.8E-02	nc			3.6E-03	nc		
		2.0E-03	i			2.0E-03	r 0	0.10	330-55-2	Linuron	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		2.0E-02	x				0		7439-93-2	Lithium	1.6E+03	nc	4.1E+04	nc			7.3E+02	nc		
		2.0E-01	i			2.0E-01	r 0	0.10	83055-99-6	Londax	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	i			2.0E-02	r 0	0.10	121-75-5	Malathion	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			1.0E-01	r 0	0.10	108-31-6	Maleic anhydride	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		5.0E-01	i			5.0E-01	r 1		123-33-1	Maleic hydrazide	1.7E+03	nc	2.4E+03	sat	1.8E+03	nc	3.0E+03	nc		
		2.0E-05	h			2.0E-05	r 0	0.10	109-77-3	Malononitrile	1.2E+00	nc	1.8E+01	nc	7.3E-02	nc	7.3E-01	nc		
		3.0E-02	h			3.0E-02	r 0	0.10	8018-01-7	Mancozeb	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
6.0E-02	o	5.0E-03	i	6.0E-02	r	5.0E-03	r 0	0.10	12427-38-2	Maneb	8.1E+00	ca*	4.1E+01	ca	1.1E-01	ca	1.1E+00	ca		
		2.4E-02	i			1.4E-05	i 0		7439-96-5	**Manganese and compounds**	1.8E+03	nc	3.2E+04	nc	5.1E-02	nc	8.8E+02	nc		
		9.0E-05	h			9.0E-05	r 0	0.10	950-10-7	Mephosfolan	5.5E+00	nc	7.9E+01	nc	3.3E-01	nc	3.3E+00	nc		
		3.0E-02	i			3.0E-02	r 0	0.10	24307-26-4	Mepiquat	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.9E-02	n	1.0E-01	n	2.9E-02	r	1.0E-01	r 0	0.10	149-30-4	2-Mercaptobenzothiazole	1.7E+01	ca	8.5E+01	ca	2.3E-01	ca	2.3E+00	ca		
		3.0E-04	i				0		7487-94-7	Mercury and compounds	2.3E+01	nc	6.1E+02	nc			1.1E+01	nc		
						8.6E-05	i		7439-97-6	Mercury (elemental)					3.1E-01	nc				
		1.0E-04	i				0	0.10	22967-92-6	Mercury (methyl)	6.1E+00	nc	8.8E+01	nc			3.6E+00	nc		
		3.0E-05	i			3.0E-05	r 0	0.10	150-50-5	Merphos	1.8E+00	nc	2.6E+01	nc	1.1E-01	nc	1.1E+00	nc		
		3.0E-05	i			3.0E-05	r 0	0.10	78-48-8	Merphos oxide	1.8E+00	nc	2.6E+01	nc	1.1E-01	nc	1.1E+00	nc		
		6.0E-02	i			6.0E-02	r 0	0.10	57837-19-1	Metalaxyl	3.7E+03	nc	5.3E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-04	i			2.0E-04	h 1		126-98-7	Methacrylonitrile	2.1E+00	nc	8.8E+00	nc	7.3E-01	nc	1.0E+00	nc		
		5.0E-05	i			5.0E-05	r 0	0.10	10265-92-6	Methamidophos	3.1E+00	nc	4.4E+01	nc	1.8E-01	nc	1.8E+00	nc		
		5.0E-01	i			5.0E-01	r 0	0.10	67-56-1	Methanol	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
		1.0E-03	i			1.0E-03	r 0	0.10	950-37-8	Methidathion	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r 1		16752-77-5	Methomyl	4.4E+01	nc	1.5E+02	nc	9.1E+01	nc	1.5E+02	nc		
		5.0E-03	i			5.0E-03	r 0	0.10	72-43-5	Methoxychlor	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc	2E+02	8E+00
		1.0E-03	h			5.7E-03	i 0	0.10	109-86-4	2-Methoxyethanol	6.1E+01	nc	8.8E+02	nc	2.1E+01	nc	3.6E+01	nc		
		2.0E-03	h			2.0E-03	r 0	0.10	110-49-6	2-Methoxyethanol acetate	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
4.6E-02	h			4.6E-02	r		0	0.10	99-59-2	2-Methoxy-5-nitroaniline	1.1E+01	ca	5.4E+01	ca	1.5E-01	ca	1.5E+00	ca		
		1.0E+00	h			1.0E+00	r 1		79-20-9	Methyl acetate	2.2E+04	nc	9.6E+04	nc	3.7E+03	nc	6.1E+03	nc		
		3.0E-02	h			3.0E-02	r 1		96-33-3	Methyl acrylate	7.0E+01	nc	2.3E+02	nc	1.1E+02	nc	1.8E+02	nc		
2.4E-01	h			2.4E-01	r		0	0.10	95-53-4	2-Methylaniline (o-toluidine)	2.0E+00	ca	1.0E+01	ca	2.8E-02	ca	2.8E-01	ca		
1.8E-01	h			1.8E-01	r		0	0.10	636-21-5	2-Methylaniline hydrochloride	2.7E+00	ca	1.4E+01	ca	3.7E-02	ca	3.7E-01	ca		
		1.0E+00	x			1.0E+00	r 0	0.10	79-22-1	Methyl chlorocarbonate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
		5.0E-04	i			5.0E-04	r 0	0.10	94-74-6	2-Methyl-4-chlorophenoxyacetic acid	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc		
		1.0E-02	i			1.0E-02	r 0	0.10	94-81-5	4-(2-Methyl-4-chlorophenoxy) butyric acid	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-03	i			1.0E-03	r 0	0.10	93-65-2	2-(2-Methyl-4-chlorophenoxy) propionic acid	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	i			1.0E-03	r 0	0.10	16484-77-8	2-(2-Methyl-1,4-chlorophenoxy) propionic acid	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		8.6E-01	r			8.6E-01	h 1		108-87-2	**Methylcyclohexane**	2.6E+03	nc	8.8E+03	nc	3.1E+03	nc	5.2E+03	nc		
2.5E-01	h			2.5E-01	r		0	0.10	101-77-9	4,4'-Methylenebisbenzeneamine	1.9E+00	ca	9.9E+00	ca	2.7E-02	ca	2.7E-01	ca		
1.3E-01	h	7.0E-04	h	1.3E-01	h	7.0E-04	r 0	0.10	101-14-4	4,4'-Methylene bis(2-chloroaniline)	3.7E+00	ca*	1.9E+01	ca*	5.2E-02	ca*	5.2E-01	ca*		
4.6E-02	i			4.6E-02	r		0	0.10	101-61-1	4,4'-Methylene bis(N,N'-dimethyl)aniline	1.1E+01	ca	5.4E+01	ca	1.5E-01	ca	1.5E+00	ca		
		1.0E-02	h			1.0E-02	r 1		74-95-3	**Methylene bromide**	6.7E+01	nc	2.4E+02	nc	3.7E+01	nc	6.1E+01	nc		
7.5E-03	i	6.0E-02	i	1.6E-03	i	8.6E-01	h 1		75-09-2	Methylene chloride	8.9E+00	ca	2.1E+01	ca	4.1E+00	ca	4.3E+00	ca	2E-02	1E-03
		1.7E-04	r			1.7E-04	i 0	0.10	101-68-8	4,4'-Methylene diphenyl diisocyanate	1.0E+01	nc	1.5E+02	nc	6.2E-01	nc	6.2E+00	nc		
		6.0E-01	i			2.9E-01	i 1		78-93-3	Methyl ethyl ketone	7.3E+03	nc	2.8E+04	nc	1.0E+03	nc	1.9E+03	nc		
1.1E+00	h			1.1E+00	r		0	0.10	60-34-4	Methyl hydrazine	4.4E-01	ca	2.2E+00	ca	6.1E-03	ca	6.1E-02	ca		
		8.0E-02	h			2.3E-02	h 1		108-10-1	Methyl isobutyl ketone	7.9E+02	nc	2.9E+03	nc	8.3E+01	nc	1.6E+02	nc		
		5.7E-04	r			5.7E-04	n 0	0.10	74-93-1	Methyl Mercaptan	3.5E+01	nc	5.0E+02	nc	2.1E+00	nc	2.1E+01	nc		
		1.4E+00	i			2.0E-01	i 1		80-62-6	Methyl methacrylate	2.2E+03	nc	2.7E+03	sat	7.3E+02	nc	1.4E+03	nc		
3.3E-02	h			3.3E-02	r		0	0.10	99-55-8	2-Methyl-5-nitroaniline	1.5E+01	ca	7.5E+01	ca	2.0E-01	ca	2.0E+00	ca		
		2.5E-04	i			2.5E-04	r 0	0.10	298-00-0	Methyl parathion	1.5E+01	nc	2.2E+02	nc	9.1E-01	nc	9.1E+00	nc		
		5.0E-02	i			5.0E-02	r 0	0.10	95-48-7	2-Methylphenol	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc	2E+01	8E-01
		5.0E-02	i			5.0E-02	r 0	0.10	108-39-4	3-Methylphenol	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	h			5.0E-03	r 0	0.10	106-44-5	4-Methylphenol	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		

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FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)										SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
		2.0E-02	n			2.0E-02	r	0	0.10	993-13-5	Methyl phosphonic acid	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-03	h			1.1E-02	h	1		25013-15-4	Methyl styrene (mixture)	1.3E+02	nc	5.6E+02	nc	4.2E+01	nc	6.0E+01	nc		
		7.0E-02	h			7.0E-02	r	1		98-83-9	Methyl styrene (alpha)	6.8E+02	sat	6.8E+02	sat	2.6E+02	nc	4.3E+02	nc		
						8.6E-01	i	1		1634-04-4	Methyl tertbutyl ether (MTBE)					3.1E+03	nc	2.0E+01	nc/ca		
		1.5E-01	i			1.5E-01	r	0	0.10	51218-45-2	Metolaclor (Dual)	9.2E+03	nc	1.0E+05	max	5.5E+02	nc	5.5E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	21087-64-9	Metribuzin	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.8E+00	x	2.0E-04	i	1.8E+00	r	2.0E-04	r	0	0.10	2385-85-5	Mirex	2.7E-01	ca*	1.4E+00	ca	3.7E-03	ca	3.7E-02	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	2212-67-1	Molinate	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-03	h					0		7439-98-7	Molybdenum	3.9E+02	nc	1.0E+04	nc			1.8E+02	nc		
		1.0E-01	h			1.0E-01	h	0	0.10	10599-90-3	Monochloramine	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	300-76-5	Naled	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	15299-99-7	Napropamide	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-02	i					0		7440-02-0	Nickel (soluble salts)	1.6E+03	nc	4.1E+04	nc			7.3E+02	nc	1E+02	7E+00
											"CAL-Modified PRG" (PEA, 1994)	1.5E+02									
				8.4E-01	i			0			Nickel refinery dust					8.0E-03	ca				
				1.7E+00	i			0		12035-72-2	Nickel subsulfide			1.1E+04	ca	4.0E-03	ca				
		1.5E-03	x			1.5E-03	r	0	0.10	1929-82-4	Nitrapyrin	9.2E+01	nc	1.3E+03	nc	5.5E+00	nc	5.5E+01	nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)										14797-55-8	Nitrate							1.0E+04	nc		
		1.0E-01	x							10102-43-9	Nitric Oxide	7.8E+03	nc	1.0E+05	max			3.6E+03	nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)										14797-65-0	Nitrite							1.0E+03	nc		
		5.7E-05	r			5.7E-05	h	0	0.10	88-74-4	2-Nitroaniline	3.5E+00	nc	5.0E+01	nc	2.1E-01	nc	2.1E+00	nc		
		5.0E-04	i			5.7E-04	h	1		98-95-3	Nitrobenzene	2.0E+01	nc	1.1E+02	nc	2.1E+00	nc	3.4E+00	nc	1E-01	7E-03
		7.0E-02	h			7.0E-02	r	0	0.10	67-20-9	Nitrofurantoin	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
1.5E+00	h			9.4E+00	h			0	0.10	59-87-0	Nitrofurazone	3.2E-01	ca	1.6E+00	ca	7.2E-04	ca	4.5E-02	ca		
1.4E-02	n			1.4E-02	r			0	0.10	55-63-0	**Nitroglycerin**	3.5E+01	ca	1.8E+02	ca	4.8E-01	ca	4.8E+00	ca		
		1.0E-01	i			1.0E-01	r	0	0.10	556-88-7	Nitroguanidine	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc		
		8.0E-03	n			8.00E-03	r	0	0.10	100-02-7	**4-Nitrophenol**	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
9.4E+00	r	5.7E-03	r	9.4E+00	h	5.7E-03	i	1		79-46-9	2-Nitropropane					7.2E-04	ca	1.2E-03	ca		
5.4E+00	i			5.6E+00	i			1		924-16-3	N-Nitrosodi-n-butylamine	2.4E-02	ca	6.1E-02	ca	1.2E-03	ca	2.0E-03	ca		
2.8E+00	i			2.8E+00	r			0	0.10	1116-54-7	N-Nitrosodiethanolamine	1.7E-01	ca	8.8E-01	ca	2.4E-03	ca	2.4E-02	ca		
1.5E+02	i			1.5E+02	i			0	0.10	55-18-5	N-Nitrosodiethylamine	3.2E-03	ca	1.6E-02	ca	4.5E-05	ca	4.5E-04	ca		
5.1E+01	i			4.9E+01	i			0	0.10	62-75-9	N-Nitrosodimethylamine	9.5E-03	ca	4.8E-02	ca	1.4E-04	ca	1.3E-03	ca		
4.9E-03	i			4.9E-03	r			0	0.10	86-30-6	N-Nitrosodiphenylamine	9.9E+01	ca	5.0E+02	ca	1.4E+00	ca	1.4E+01	ca	1E+00	6E-02
7.0E+00	i			7.0E+00	r			0	0.10	621-64-7	N-Nitroso di-n-propylamine	6.9E-02	ca	3.5E-01	ca	9.6E-04	ca	9.6E-03	ca	5E-05	2E-06
2.2E+01	i			2.2E+01	r			0	0.10	10595-95-6	N-Nitroso-N-methylethylamine	2.2E-02	ca	1.1E-01	ca	3.1E-04	ca	3.1E-03	ca		
2.1E+00	i			2.1E+00	i			0	0.10	930-55-2	N-Nitrosopyrrolidine	2.3E-01	ca	1.2E+00	ca	3.1E-03	ca	3.2E-02	ca		
		1.0E-02	h			1.0E-02	r	1		99-08-1	**m-Nitrotoluene**	3.7E+02	nc	1.00E+03	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	h			1.0E-02	r	1		99-08-1	**o-Nitrotoluene**	3.7E+02	nc	1.00E+03	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	h			1.0E-02	r	1		99-99-0	**p-Nitrotoluene**	3.7E+02	nc	1.00E+03	sat	3.7E+01	nc	6.1E+01	nc		
		4.0E-02	i			4.0E-02	r	0	0.10	27314-13-2	Norflurazon	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		7.0E-04	i			7.0E-04	r	0	0.10	85509-19-9	NuStar	4.3E+01	nc	6.2E+02	nc	2.6E+00	nc	2.6E+01	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	32536-52-0	Octabromodiphenyl ether	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	2691-41-0	Octahydro-1357-tetranitro-1357- tetrazocine (HMX)	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.0E-03	h			2.0E-03	r	0	0.10	152-16-9	Octamethylpyrophosphoramide	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	19044-88-3	Oryzalin	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	19666-30-9	Oxadiazon	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	23135-22-0	Oxamyl	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	42874-03-3	Oxyfluorfen	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	76738-62-0	Paclobutrazol	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		4.5E-03	i			4.5E-03	r	0	0.10	4685-14-7	Paraquat	2.7E+02	nc	4.0E+03	nc	1.6E+01	nc	1.6E+02	nc		
		6.0E-03	h			6.0E-03	r	0	0.10	56-38-2	Parathion	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc		
		5.0E-02	h			5.0E-02	r	0	0.10	1114-71-2	Pebulate	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-02	i			4.0E-02	r	0	0.10	40487-42-1	Pendimethalin	2.4E+03	nc	3.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
2.3E-02	h			2.3E-02	r			0	0.10	87-84-3	Pentabromo-6-chloro cyclohexane	2.1E+01	ca	1.1E+02	ca	2.9E-01	ca	2.9E+00	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	32534-81-9	Pentabromodiphenyl ether	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		8.0E-04	i			8.0E-04	r	0	0.10	608-93-5	Pentachlorobenzene	4.9E+01	nc	7.0E+02	nc	2.9E+00	nc	2.9E+01	nc		

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FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)										SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
2.6E-01	h	3.0E-03	i	2.6E-01	r	3.0E-03	r	0	0.10	82-68-8	Pentachloronitrobenzene	1.9E+00	ca*	9.5E+00	ca	2.6E-02	ca	2.6E-01	ca		
1.2E-01	i	3.0E-02	i	1.2E-01	r	3.0E-02	r	0	0.25	87-86-5	Pentachlorophenol	3.0E+00	ca	1.1E+01	ca	5.6E-02	ca	5.6E-01	ca	3E-02	1E-03
		5.0E-04	x					0		7601-90-3	Perchlorate	3.9E+01	nc	1.0E+03	nc			1.8E+01	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	52645-53-1	Permethrin	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.5E-01	i			2.5E-01	r	0	0.10	13684-63-4	Phenmedipham	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		6.0E-01	i			6.0E-01	r	0	0.10	108-95-2	Phenol	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc	1E+02	5E+00
		2.0E-03	n			2.0E-03	r	0	0.10	92-84-2	Phenothiazine	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		6.0E-03	i			6.0E-03	r	0	0.10	108-45-2	m-Phenylenediamine	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc		
		1.9E-01	h			1.9E-01	r	0	0.10	106-50-3	p-Phenylenediamine	1.2E+04	nc	1.0E+05	max	6.9E+02	nc	6.9E+03	nc		
		8.0E-05	i			8.0E-05	r	0	0.10	62-38-4	Phenylmercuric acetate	4.9E+00	nc	7.0E+01	nc	2.9E-01	nc	2.9E+00	nc		
1.9E-03	h			1.9E-03	r			0	0.10	90-43-7	2-Phenylphenol	2.5E+02	ca	1.3E+03	ca	3.5E+00	ca	3.5E+01	ca		
		2.0E-04	h			2.0E-04	r	0	0.10	298-02-2	Phorate	1.2E+01	nc	1.8E+02	nc	7.3E-01	nc	7.3E+00	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	732-11-6	Phosmet	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		3.0E-04	h			8.6E-05	i	0	0.10	7803-51-2	Phosphine	1.8E+01	nc	2.6E+02	nc	3.1E-01	nc	1.1E+01	nc		
						2.9E-03	i			7664-38-2	Phosphoric acid					1.0E+01	nc				
		2.0E-05	i					0		7723-14-0	Phosphorus (white)	1.6E+00	nc	4.1E+01	nc			7.3E-01	nc		
		1.0E+00	h			1.0E+00	r	0	0.10	100-21-0	p-Phthalic acid	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
		2.0E+00	i			3.4E-02	h	0	0.10	85-44-9	Phthalic anhydride	1.0E+05	max	1.0E+05	max	1.2E+02	nc	7.3E+04	nc		
		7.0E-02	i			7.0E-02	r	0	0.10	1918-02-1	Picloram	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	23505-41-1	Pirimiphos-methyl	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
8.9E+00	h	7.0E-06	h	8.9E+00	r	7.0E-06	r	0	0.10		Polybrominated biphenyls	5.5E-02	ca**	2.8E-01	ca*	7.6E-04	ca*	7.6E-03	ca*		
2.0E+00	i			2.0E+00	i			0	0.14	1336-36-3	Polychlorinated biphenyls (PCBs)	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
7.0E-02	i	7.0E-05	i	7.0E-02	i	7.0E-05	r	0	0.14	12674-11-2	**Aroclor 1016**	3.9E+00	nc	2.9E+01	ca**	9.6E-02	ca**	9.6E-01	ca**		
2.0E+00	i			2.0E+00	i			0	0.14	11104-28-2	**Aroclor 1221**	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i			2.0E+00	i			0	0.14	11141-16-5	**Aroclor 1232**	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i			2.0E+00	i			0	0.14	53469-21-9	**Aroclor 1242**	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i			2.0E+00	i			0	0.14	12672-29-6	**Aroclor 1248**	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i	2.0E-05	i	2.0E+00	i	2.0E-05	r	0	0.14	11097-69-1	**Aroclor 1254**	2.2E-01	ca**	1.0E+00	ca*	3.4E-03	ca*	3.4E-02	ca*		
2.0E+00	i			2.0E+00	i			0	0.14	11096-82-5	**Aroclor 1260**	2.2E-01	ca	1.0E+00	ca	3.4E-03	ca	3.4E-02	ca		
									0.13		Polynuclear aromatic hydrocarbons (PAHs)										
		6.0E-02	i			6.0E-02	r	1		83-32-9	Acenaphthene	3.7E+03	nc	3.8E+04	nc	2.2E+02	nc	3.7E+02	nc	6E+02	3E+01
		3.0E-01	i			3.0E-01	r	1		120-12-7	Anthracene	2.2E+04	nc	1.0E+05	max	1.1E+03	nc	1.8E+03	nc	1E+04	6E+02
7.3E-01	n			3.1E-01	n			0	0.13	56-55-3	Benz[a]anthracene	6.2E-01	ca	2.9E+00	ca	2.2E-02	ca	9.2E-02	ca	2E+00	8E-02
7.3E-01	n			3.1E-01	n			0	0.13	205-99-2	Benzo[b]fluoranthene	6.2E-01	ca	2.9E+00	ca	2.2E-02	ca	9.2E-02	ca	5E+00	2E-01
7.3E-02	n			3.1E-02	n			0	0.13	207-08-9	Benzo[k]fluoranthene	6.2E+00	ca	2.9E+01	ca	2.2E-01	ca	9.2E-01	ca	5E+01	2E+00
											"CAL-Modified PRG" (PEA, 1994)	6.1E-01									
7.3E+00	i			3.1E+00	n			0	0.13	50-32-8	Benzo[a]pyrene	6.2E-02	ca	2.9E-01	ca	2.2E-03	ca	9.2E-03	ca	8E+00	4E-01
											"CAL-Modified PRG" (PEA, 1994)							1.5E-03			
7.3E-03	n			3.1E-03	n			0	0.13	218-01-9	Chrysene	6.2E+01	ca	2.9E+02	ca	2.2E+00	ca	9.2E+00	ca	2E+02	8E+00
											"CAL-Modified PRG" (PEA, 1994)	6.1E+00									
7.3E+00	n			3.1E+00	n			0	0.13	53-70-3	Dibenz[ah]anthracene	6.2E-02	ca	2.9E-01	ca	2.2E-03	ca	9.2E-03	ca	2E+00	8E-02
		4.0E-02	i			4.0E-02	r	0	0.13	206-44-0	Fluoranthene	2.3E+03	nc	3.0E+04	nc	1.5E+02	nc	1.5E+03	nc	4E+03	2E+02
		4.0E-02	i			4.0E-02	r	1		86-73-7	Fluorene	2.6E+03	nc	3.3E+04	nc	1.5E+02	nc	2.4E+02	nc	6E+02	3E+01
7.3E-01	n			3.1E-01	n			0	0.13	193-39-5	Indeno[1,2,3-cd]pyrene	6.2E-01	ca	2.9E+00	ca	2.2E-02	ca	9.2E-02	ca	1E+01	7E-01
		2.0E-02	i			8.6E-04	i	1		91-20-3	Naphthalene	5.6E+01	nc	1.9E+02	nc	3.1E+00	nc	6.2E+00	nc	8E+01	4E+00
		3.0E-02	i			3.0E-02	r	1		129-00-0	Pyrene	2.3E+03	nc	5.4E+04	nc	1.1E+02	nc	1.8E+02	nc	4E+03	2E+02
1.5E-01	i	9.0E-03	i	1.5E-01	r	9.0E-03	r	0	0.10	67747-09-5	Prochloraz	3.2E+00	ca	1.6E+01	ca	4.5E-02	ca	4.5E-01	ca		
		6.0E-03	h			6.0E-03	r	0	0.10	26399-36-0	Profluralin	3.7E+02	nc	5.3E+03	nc	2.2E+01	nc	2.2E+02	nc		
		1.5E-02	i			1.5E-02	r	0	0.10	1610-18-0	Prometon	9.2E+02	nc	1.3E+04	nc	5.5E+01	nc	5.5E+02	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	7287-19-6	Prometryn	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		7.5E-02	i			7.5E-02	r	0	0.10	23950-58-5	Pronamide	4.6E+03	nc	6.6E+04	nc	2.7E+02	nc	2.7E+03	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	1918-16-7	Propachlor	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	709-98-8	Propanil	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	2312-35-8	Propargite	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	107-19-7	Propargyl alcohol	1.2E+02	nc	1.8E+03	nc	7.3E+00	nc	7.3E+01	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	139-40-2	Propazine	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
		2.0E-02	i			2.0E-02	r	0	0.10	122-42-9	Propham	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	60207-90-1	Propiconazole	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		1.0E-01	i			1.1E-01	i	1		98-82-8	Isopropylbenzene (Cumene)	1.6E+02	nc	5.2E+02	nc	4.0E+02	nc	6.6E+02	nc		
		1.0E-02	n			1.0E-02	r	1		103-65-1	n-Propylbenzene	1.4E+02	nc	2.4E+02	sat	3.7E+01	nc	6.1E+01	nc		
		2.0E+01	h			2.0E+01	r	0	0.10	57-55-6	Propylene glycol	1.0E+05	max	1.0E+05	max	7.3E+04	nc	7.3E+05	nc		
		7.0E-01	h			7.0E-01	r	0	0.10	111-35-3	Propylene glycol, monoethyl ether	4.3E+04	nc	1.0E+05	max	2.6E+03	nc	2.6E+04	nc		
		7.0E-01	h			5.7E-01	i	0	0.10	107-98-2	Propylene glycol, monomethyl ether	4.3E+04	nc	1.0E+05	max	2.1E+03	nc	2.6E+04	nc		
2.4E-01	i	8.6E-03	r	1.3E-02	i	8.6E-03	i	1		75-56-9	Propylene oxide	1.9E+00	ca*	9.1E+00	ca*	5.2E-01	ca*	2.2E-01	ca		
		2.5E-01	i			2.5E-01	r	0	0.10	81335-77-5	Pursuit	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	51630-58-1	Pydrin	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	110-86-1	Pyridine	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		5.0E-04	i			5.0E-04	r	0	0.10	13593-03-8	Quinalphos	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc		
1.2E+01	h			1.2E+01	r			0	0.10	91-22-5	Quinoline	4.1E-02	ca	2.1E-01	ca	5.6E-04	ca	5.6E-03	ca		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0	0.10	121-82-4	RDX (Cyclonite)	4.4E+00	ca*	2.2E+01	ca	6.1E-02	ca	6.1E-01	ca		
		3.0E-02	i			3.0E-02	r	0	0.10	10453-86-8	Resmethrin	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		5.0E-02	h			5.0E-02	r	0	0.10	299-84-3	Ronnel	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	83-79-4	Rotenone	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	78587-05-0	Savey	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		5.0E-03	i					0	0.10	7783-00-8	Selenious Acid	3.1E+02	nc	4.4E+03	nc			1.8E+02	nc		
		5.0E-03	i					0		7782-49-2	Selenium	3.9E+02	nc	1.0E+04	nc			1.8E+02	nc	5E+00	3E-01
		5.0E-03	h					0	0.10	630-10-4	Selenourea	3.1E+02	nc	4.4E+03	nc			1.8E+02	nc		
		9.0E-02	i			9.0E-02	r	0	0.10	74051-80-2	Sethoxydim	5.5E+03	nc	7.9E+04	nc	3.3E+02	nc	3.3E+03	nc		
		5.0E-03	i					0		7440-22-4	Silver and compounds	3.9E+02	nc	1.0E+04	nc			1.8E+02	nc	3E+01	2E+00
1.2E-01	h	5.0E-03	i	1.2E-01	r	2.0E-03	r	0	0.10	122-34-9	Simazine	4.1E+00	ca*	2.1E+01	ca	5.6E-02	ca	5.6E-01	ca		
		4.0E-03	i			4.0E-03	r	0	0.10	26628-22-8	Sodium azide	2.4E+02	nc	3.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
2.7E-01	h	3.0E-02	i	2.7E-01	r	3.0E-02	r	0	0.10	148-18-5	Sodium diethyldithiocarbamate	1.8E+00	ca	9.1E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-05	i			2.0E-05	r	0	0.10	62-74-8	Sodium fluoroacetate	1.2E+00	nc	1.8E+01	nc	7.3E-02	nc	7.3E-01	nc		
		1.0E-03	h			1.0E-03	r	0	0.10	13718-26-8	Sodium metavanadate	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		6.0E-01	i					0		7440-24-6	Strontium, stable	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	57-24-9	Strychnine	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E-01	i			2.9E-01	i	1		100-42-5	Styrene	1.7E+03	sat	1.7E+03	sat	1.1E+03	nc	1.6E+03	nc	4E+00	2E-01
		2.5E-02	i			2.5E-02	r	0	0.10	88671-89-0	Systhane	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.5E+05	h			1.5E+05	h			0	0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.9E-06	ca	2.7E-05	ca	4.5E-08	ca	4.5E-07	ca		
		7.0E-02	i			7.0E-02	r	0	0.10	34014-18-1	Tebuthiuron	4.3E+03	nc	6.2E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-02	h			2.0E-02	r	0	0.10	3383-96-8	Temephos	1.2E+03	nc	1.8E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	5902-51-2	Terbacil	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		2.5E-05	h			2.5E-05	r	0	0.10	13071-79-9	Terbufos	1.5E+00	nc	2.2E+01	nc	9.1E-02	nc	9.1E-01	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	886-50-0	Terbutryn	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	95-94-3	1,2,4,5-Tetrachlorobenzene	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
2.6E-02	i	3.0E-02	i	2.6E-02	i	3.0E-02	r	1		630-20-6	1,1,1,2-Tetrachloroethane	3.0E+00	ca	7.0E+00	ca	2.6E-01	ca	4.3E-01	ca		
2.0E-01	i	6.00E-02	n	2.0E-01	i	6.00E-02	r	1		79-34-5	**1,1,2,2-Tetrachloroethane**	3.8E-01	ca	9.0E-01	ca	3.3E-02	ca	5.5E-02	ca	3E-03	2E-04
5.2E-02	n	1.0E-02	i	2.0E-03	n	1.1E-01	n	1		127-18-4	Tetrachloroethylene (PCE)	5.7E+00	ca*	1.9E+01	ca*	3.3E+00	ca	1.1E+00	ca	6E-02	3E-03
											"CAL-Modified PRG" (PEA, 1994)					3.2E-01						
		3.0E-02	i			3.0E-02	r	0	0.10	58-90-2	2,3,4,6-Tetrachlorophenol	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.0E+01	h			2.0E+01	r			0	0.10	5216-25-1	p,a,a,a-Tetrachlorotoluene	2.4E-02	ca	1.2E-01	ca	3.4E-04	ca	3.4E-03	ca		
2.4E-02	h	3.0E-02	i	2.4E-02	r	3.0E-02	r	0	0.10	961-11-5	Tetrachlorovinphos	2.0E+01	ca*	1.0E+02	ca	2.8E-01	ca	2.8E+00	ca		
		5.0E-04	i			5.0E-04	r	0	0.10	3689-24-5	Tetraethyldithiopyrophosphate	3.1E+01	nc	4.4E+02	nc	1.8E+00	nc	1.8E+01	nc		
7.6E-03	n	2.1E-01	n	6.8E-03	n	8.6E-02	n	0	0.10	109-99-9	**Tetrahydrofuran**	6.4E+01	ca	3.2E+02	ca	9.9E-01	ca	8.8E+00	ca		
		7.0E-05	x					0		1314-32-5	Thallic oxide	5.5E+00	nc	1.4E+02	nc			2.6E+00	nc		
		9.0E-05	i					0		563-68-8	Thallium acetate	7.0E+00	nc	1.8E+02	nc			3.3E+00	nc	7E-01	4E-01
		8.0E-05	i					0		6533-73-9	Thallium carbonate	6.3E+00	nc	1.6E+02	nc			2.9E+00	nc	7E-01	4E-01
		8.0E-05	i					0		7791-12-0	Thallium chloride	6.3E+00	nc	1.6E+02	nc			2.9E+00	nc	7E-01	4E-01
		9.0E-05	i					0		10102-45-1	Thallium nitrate	7.0E+00	nc	1.8E+02	nc			3.3E+00	nc	7E-01	4E-01
		9.0E-05	x					0		12039-52-0	Thallium selenite	7.0E+00	nc	1.8E+02	nc			3.3E+00	nc	7E-01	4E-01
		8.0E-05	i					0		7446-18-6	Thallium sulfate	6.3E+00	nc	1.6E+02	nc			2.9E+00	nc	7E-01	4E-01
		1.0E-02	i			1.0E-02	r	0	0.10	28249-77-6	Thiobencarb	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		

Key : i=IRIS n=NCEA h=HEAST x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIATION GOALS (PRGs)								SOIL SCREENING LEVELS	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		Migration to Ground Water DAF 20 (mg/kg)	DAF 1 (mg/kg)
		1.0E-01	n			1.0E-01	r	0	0.10	N/A	Thiocyanate	6.1E+03	nc	1.0E+05	max	3.7E+02	nc	3.6E+03	nc		
		3.0E-04	h			3.0E-04	r	0	0.10	39196-18-4	Thiofanox	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		8.0E-02	i			8.0E-02	r	0	0.10	23564-05-8	Thiophanate-methyl	4.9E+03	nc	7.0E+04	nc	2.9E+02	nc	2.9E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	137-26-8	Thiram	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		6.0E-01	h					0			Tin (inorganic, see tributyltin oxide for organic tin)	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		2.0E-01	i			1.1E-01	h	1		108-88-3	Toluene	5.2E+02	sat	5.2E+02	sat	4.0E+02	nc	7.2E+02	nc	1E+01	6E-01
3.2E+00	h			3.2E+00	r			0	0.10	95-80-7	Toluene-2,4-diamine	1.5E-01	ca	7.7E-01	ca	2.1E-03	ca	2.1E-02	ca		
		6.0E-01	h			6.0E-01	r	0	0.10	95-70-5	Toluene-2,5-diamine	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc		
		2.0E-01	h			2.0E-01	r	0	0.10	823-40-5	Toluene-2,6-diamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
2E-01	i			2E-01	r			0	0.10	106-49-0	p-Toluidine	2.6E+00	ca	1.3E+01	ca	3.5E-02	ca	3.5E-01	ca		
1.1E+00	i			1.1E+00	i			0	0.10	8001-35-2	Toxaphene	4.4E-01	ca	2.2E+00	ca	6.0E-03	ca	6.1E-02	ca	3E+01	2E+00
		7.5E-03	i			7.5E-03	r	0	0.10	66841-25-6	Tralomethrin	4.6E+02	nc	6.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	2303-17-5	Triallate	7.9E+02	nc	1.1E+04	nc	4.7E+01	nc	4.7E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	82097-50-5	Triasulfuron	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	615-54-3	1,2,4-Tribromobenzene	3.1E+02	nc	4.4E+03	nc	1.8E+01	nc	1.8E+02	nc		
		3.0E-04	i					0	0.10	56-35-9	Tributyltin oxide (TBTO)	1.8E+01	nc	2.6E+02	nc			1.1E+01	nc		
3.4E-02	h			3.4E-02	r			0	0.10	634-93-5	2,4,6-Trichloroaniline	1.4E+01	ca	7.3E+01	ca	2.0E-01	ca	2.0E+00	ca		
2.9E-02	h			2.9E-02	r			0	0.10	33663-50-2	2,4,6-Trichloroaniline hydrochloride	1.7E+01	ca	8.5E+01	ca	2.3E-01	ca	2.3E+00	ca		
		1.0E-02	i			5.7E-02	h	1		120-82-1	1,2,4-Trichlorobenzene	6.5E+02	nc	3.00E+03	sat	2.1E+02	nc	1.9E+02	nc	5E+00	3E-01
		3.5E-02	n			2.9E-01	n	1		71-55-6	1,1,1-Trichloroethane	7.7E+02	nc	1.4E+03	sat	1.0E+03	nc	7.9E+02	nc	2E+00	1E-01
5.7E-02	i	4.0E-03	i	5.6E-02	i	4.0E-03	r	1		79-00-5	1,1,2-Trichloroethane	8.4E-01	ca*	1.9E+00	ca*	1.2E-01	ca	2.0E-01	ca	2E-02	9E-04
1.1E-02	n	6.0E-03	x	6.0E-03	n	6.0E-03	r	1		79-01-6	Trichloroethylene (TCE)	2.8E+00	ca**	6.1E+00	ca*	1.1E+00	ca*	1.6E+00	ca*	6E-02	3E-03
		3.0E-01	i			2.0E-01	h	1		75-69-4	Trichlorofluoromethane	3.9E+02	nc	2.00E+03	sat	7.3E+02	nc	1.3E+03	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	95-95-4	2,4,5-Trichlorophenol	6.1E+03	nc	8.8E+04	nc	3.7E+02	nc	3.6E+03	nc	3E+02	1E+01
1.1E-02	i			1.1E-02	i			0	0.10	88-06-2	2,4,6-Trichlorophenol	4.4E+01	ca	2.2E+02	ca	6.2E-01	ca	6.1E+00	ca	2E-01	8E-03
		1.0E-02	i			1.0E-02	r	0	0.10	93-76-5	2,4,5-Trichlorophenoxyacetic Acid	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
		8.0E-03	i			8.0E-03	r	0	0.10	93-72-1	2-(2,4,5-Trichlorophenoxy) propionic acid	4.9E+02	nc	7.0E+03	nc	2.9E+01	nc	2.9E+02	nc		
		5.0E-03	i			5.0E-03	r	1		598-77-6	1,1,2-Trichloropropane	1.5E+01	nc	5.1E+01	nc	1.8E+01	nc	3.0E+01	nc		
7.0E+00	h	6.0E-03	i	7.0E+00	r	5.0E-03	r	1		96-18-4	1,2,3-Trichloropropane	1.4E-03	ca	3.1E-03	ca	9.6E-04	ca	1.6E-03	ca		
		5.0E-03	h			5.0E-03	r	1		96-19-5	1,2,3-Trichloropropene	1.2E+01	nc	3.9E+01	nc	1.8E+01	nc	3.0E+01	nc		
		3.0E+01	i			8.6E+00	h	1		76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	5.6E+03	sat	5.6E+03	sat	3.1E+04	nc	5.9E+04	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	58138-08-2	Tridiphane	1.8E+02	nc	2.6E+03	nc	1.1E+01	nc	1.1E+02	nc		
		2.0E-03	r			2.0E-03	i	1		121-44-8	Triethylamine	2.3E+01	nc	8.8E+01	nc	7.3E+00	nc	1.2E+01	nc		
7.7E-03	i	7.5E-03	i	7.7E-03	r	7.5E-03	r	0	0.10	1582-09-8	Trifluralin	6.3E+01	ca**	3.2E+02	ca*	8.7E-01	ca*	8.7E+00	ca*		
		5.0E-02	n			1.7E-03	n	1		95-63-6	1,2,4-Trimethylbenzene	5.7E+00	sat	5.7E+00	sat	6.2E+00	nc	1.2E+01	nc		
		5.0E-02	n			1.7E-03	n	1		108-67-8	1,3,5-Trimethylbenzene	2.1E+01	nc	7.0E+01	nc	6.2E+00	nc	1.2E+01	nc		
3.7E-02	h			3.7E-02	r			0	0.10	512-56-1	Trimethyl phosphate	1.3E+01	ca	6.7E+01	ca	1.8E-01	ca	1.8E+00	ca		
		3.0E-02	i			3.0E-02	r	0	0.10	99-35-4	1,3,5-Trinitrobenzene	1.8E+03	nc	2.6E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-02	h			1.0E-02	r	0	0.10	479-45-8	Trinitrophenylmethylnitramine	6.1E+02	nc	8.8E+03	nc	3.7E+01	nc	3.6E+02	nc		
3E-02	i	5.0E-04	i	3E-02	r	5.0E-04	r	0	0.10	118-96-7	2,4,6-Trinitrotoluene	1.6E+01	ca**	8.2E+01	ca**	2.2E-01	ca**	2.2E+00	ca**		
		7.0E-03	h					0		7440-62-2	Vanadium	5.5E+02	nc	1.4E+04	nc			2.6E+02	nc	6E+03	3E+02
		9.0E-03	i					0		1314-62-1	Vanadium pentoxide	7.0E+02	nc	1.8E+04	nc			3.3E+02	nc	6E+03	3E+02
		2.0E-02	h					0		13701-70-7	Vanadium sulfate	1.6E+03	nc	4.1E+04	nc			7.3E+02	nc	6E+03	3E+02
		1.0E-03	i			1.0E-03	r	0	0.10	1929-77-7	Vernam	6.1E+01	nc	8.8E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	50471-44-8	Vinclozolin	1.5E+03	nc	2.2E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E+00	h			5.7E-02	i	1		108-05-4	Vinyl acetate	4.3E+02	nc	1.4E+03	nc	2.1E+02	nc	4.1E+02	nc	2E+02	8E+00
1.1E-01	r	8.6E-04	r	1.1E-01	h	8.6E-04	i	1		593-60-2	Vinyl bromide (bromoethene)	1.9E-01	ca*	4.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*		
1.9E+00	h			3.0E-01	h			1		75-01-4	Vinyl chloride	2.2E-02	ca	4.9E-02	ca	2.2E-02	ca	2.0E-02	ca	1E-02	7E-04
		3.0E-04	i			3.0E-04	r	0	0.10	81-81-2	Warfarin	1.8E+01	nc	2.6E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E+00	i			2.0E-01	x	1	0.10	1330-20-7	Xylenes	2.1E+02	sat	2.1E+02	sat	7.3E+02	nc	1.4E+03	nc	2E+02	1E+01
		3.0E-01	i					0		7440-66-6	Zinc	2.3E+04	nc	1.0E+05	max			1.1E+04	nc	1E+04	6E+02
		3.0E-04	i					0		1314-84-7	Zinc phosphide	2.3E+01	nc	6.1E+02	nc			1.1E+01	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	12122-67-7	Zineb	3.1E+03	nc	4.4E+04	nc	1.8E+02	nc	1.8E+03	nc		

Appendix D

Plate 1. Areas Sampled at the Former KPC Pulp Mill

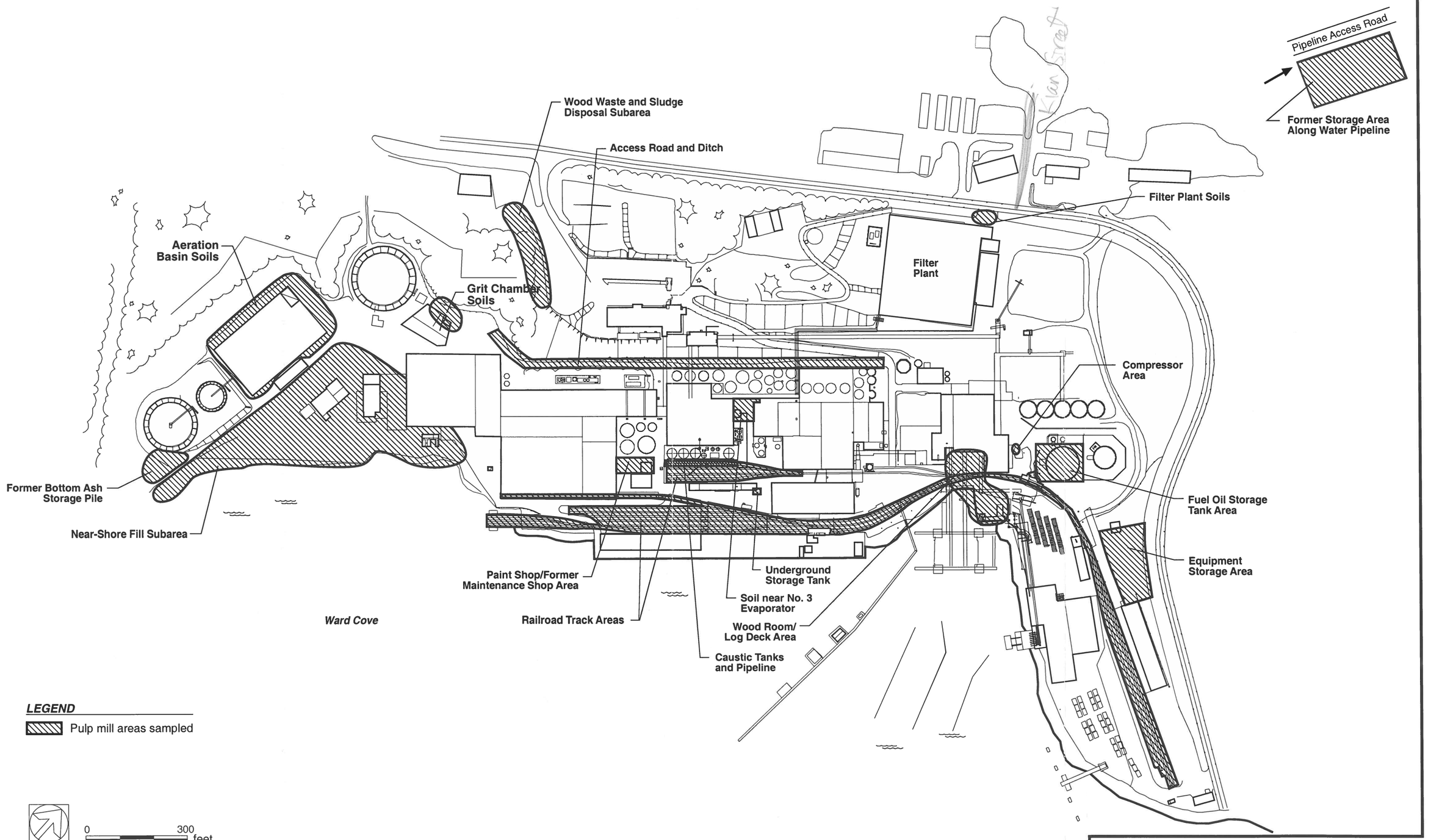

Figure B-2. Sampling areas at the pulp mill area.

Figures

Figure 1. Location of Ward Cove and former KPC facility.

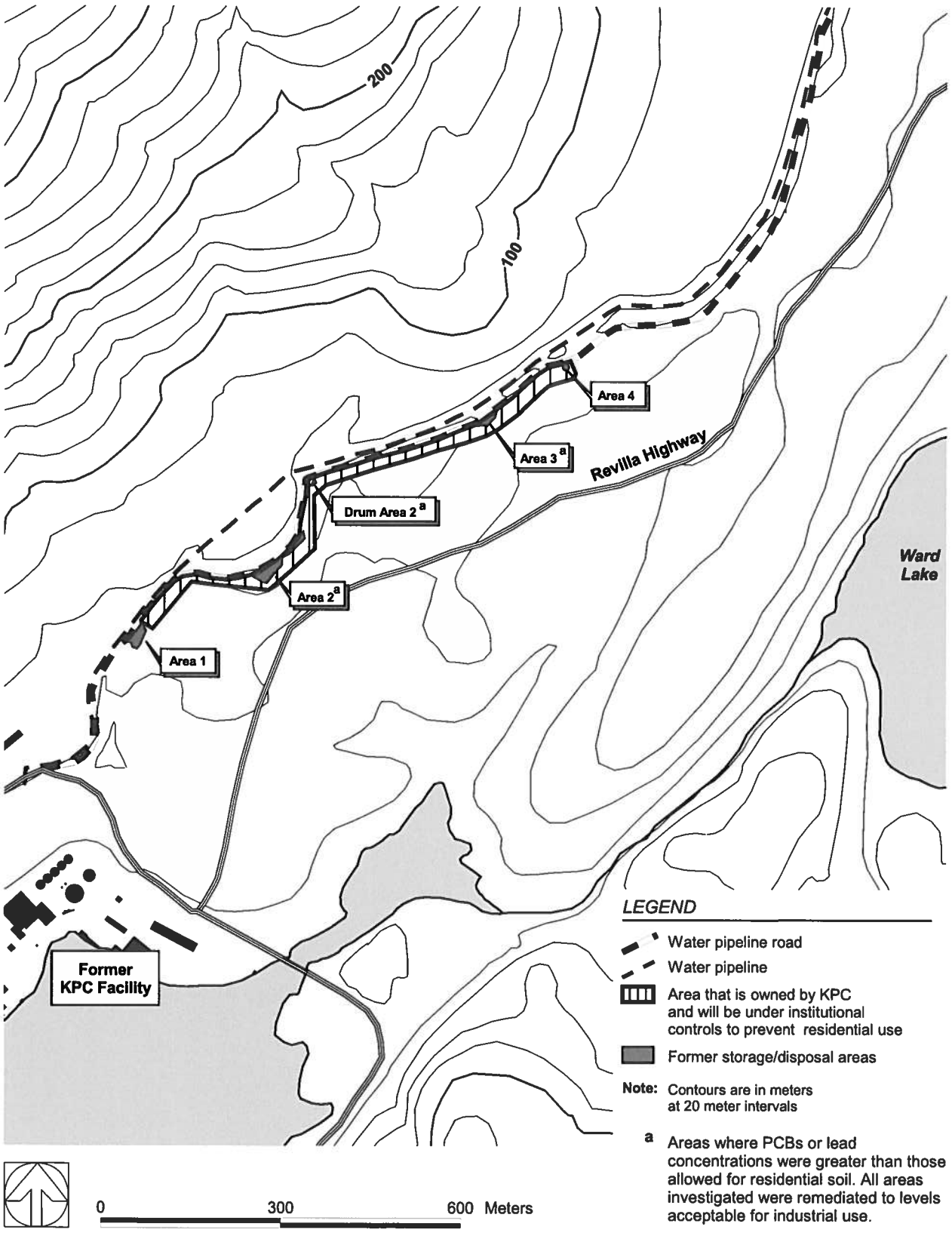

Figure 3. Water pipeline road.

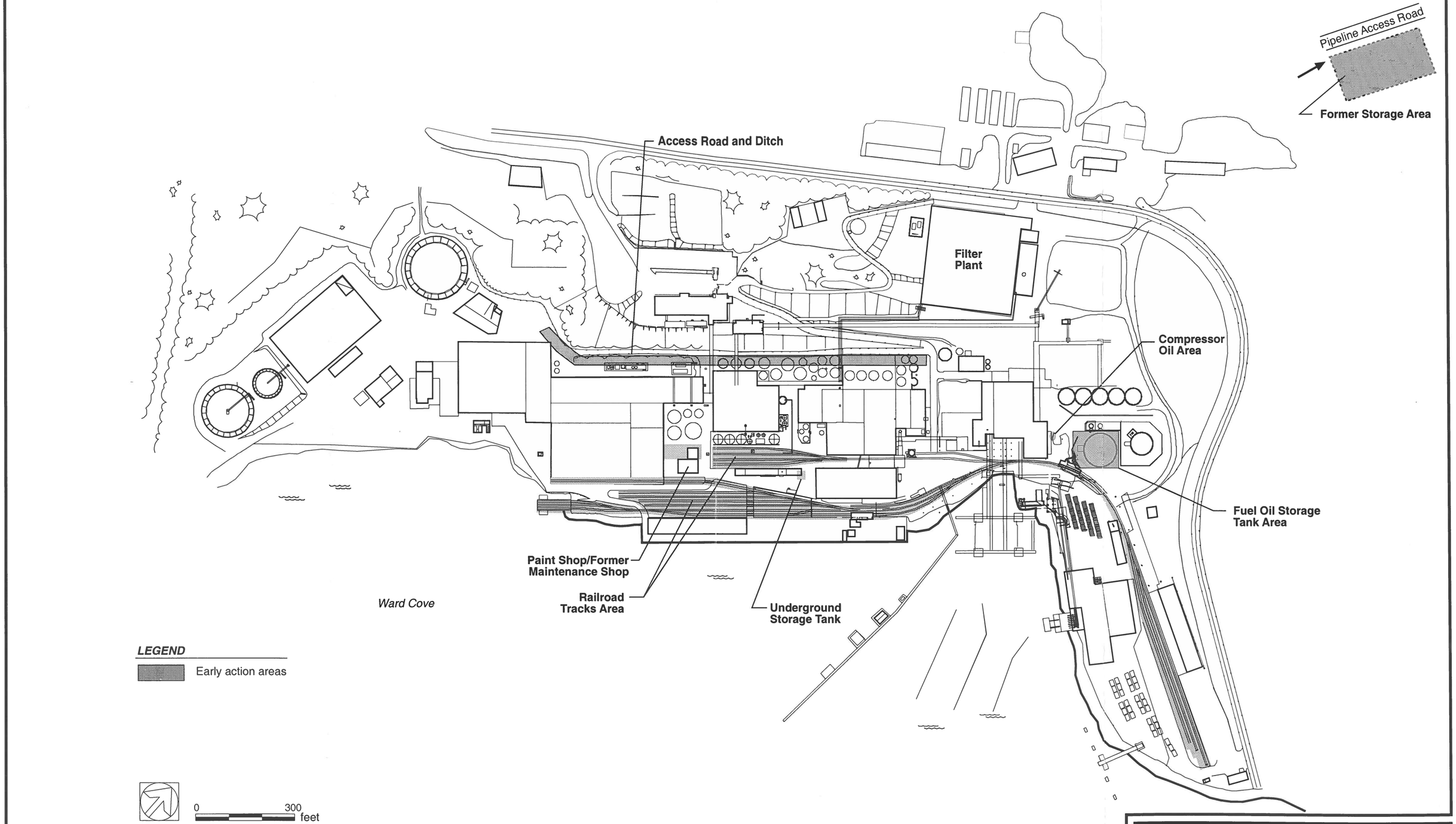

Figure 4. Early action areas.

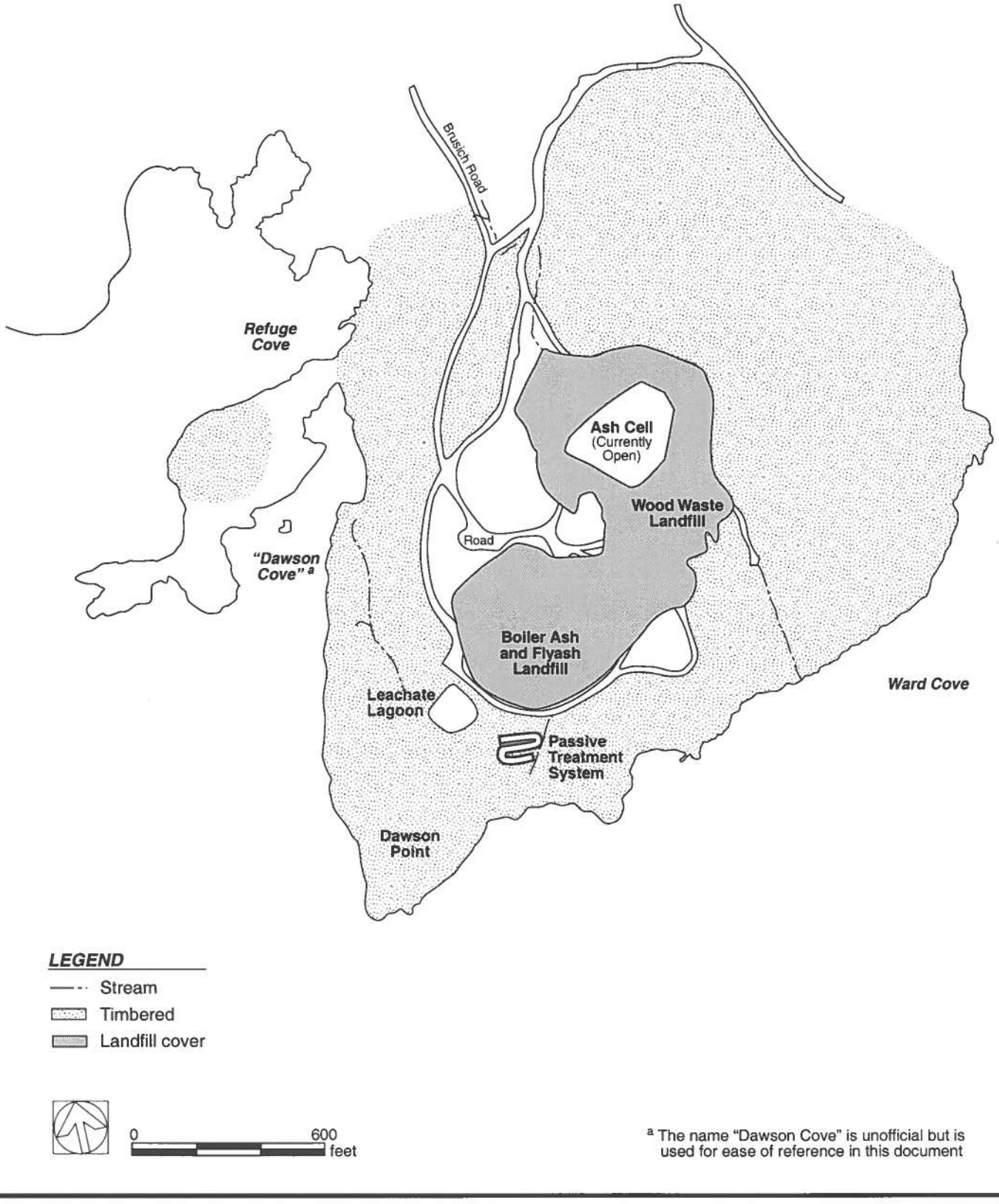

Figure 5. Wood waste and ash disposal landfill.

Tables

Table 1. Summary of chemical concentrations, risk estimates, early actions, and residual concentrations and risks

Area (scenario/pathways evaluated)	Chemicals above Screening Levels	Baseline				Residual	
		Concentration Range	Screening Level[a]	Excess Risk Estimate	Action or Note	Residual Concentration Range	Residual Risk
Pulp Mill Area							
Process Subarea							
Access Road and Ditch (occupational)	Arsenic[b]	56–182 mg/kg	7.6 mg/kg	4×10^{-5}	Ditch sediment removed in 1998 as part of early action, some fill added to road with regrading.	5.5–157 mg/kg	4×10^{-5}
	PCDD/F	5.5–162 ng/kg (TEC)	38 ng/kg (TEC)	5×10^{-6}	No Cleanup Level	8.2–30.2 ng/kg (TEC)	9×10^{-7}
Wood Room/Log Deck Area (occupational)	Arsenic[b]	84 mg/kg	7.6 mg/kg	2×10^{-5}		84 mg/kg	2×10^{-5}
Wood Room/Log Deck Seep Water (migration to Ward Cove)	Manganese	0.267 mg/L (seep water)	0.0285 mg/L background[c]		Hog fuel removed in spring 1998[c]	--	--
Soils near Evaporator No. 3 (occupational)	Arsenic[b]	65 mg/kg	7.6 mg/kg	1×10^{-5}		65 mg/kg	1×10^{-5}
Mill Support Subarea							
Aeration Basin Soils (occupational)	Arsenic[b]	1.3–90 mg/kg	7.6 mg/kg	2×10^{-5}		1.3–90 mg/kg	2×10^{-5}
Grit Chamber Soils (occupational)	Arsenic[b]	10–100 mg/kg	7.6 mg/kg	2×10^{-5}		10–100 mg/kg	2×10^{-5}
Paint Shop/Former Maintenance Shop (occupational)	Arsenic[b]	0.94–670 mg/kg	7.6 mg/kg	2×10^{-4}	Soil removed in 1999 as part of early action. Cleanup Levels:	1.53–33.9 mg/kg	8×10^{-6}
	Lead	<10–4,270 mg/kg	1,000 mg/kg		1,000 mg/kg	<10–274 mg/kg	--
	Benzo[a]pyrene (cPAH RPC)	<0.013–4.42 mg/kg	0.90 mg/kg	5×10^{-6}	0.90 mg/kg	0.0143–0.0444 mg/kg	1×10^{-7}
	PCBs	<0.050–499 mg/kg	10 mg/kg	1×10^{-4}	10 mg/kg	<0.067–8.46 mg/kg	8×10^{-6}[d]
Former Bottom Ash Storage Pile (occupational)	Arsenic[b]	4.9 and 44 mg/kg[e]	7.6 mg/kg	5×10^{-6}		4.9 and 44 mg/kg[e]	5×10^{-6}
Caustic Tanks and Pipeline (occupational)	None					None	--
Equipment Storage Area (occupational)	None					None	--
Filter Plant Soils (occupational)	None					None	--
Near-shore Fill Subarea (occupational)	Arsenic[b]	0.5–132 mg/kg	7.6 mg/kg	3×10^{-5}		0.5–132 mg/kg	3×10^{-5}
	PCBs	0.49 µg/L (undissolved)[f]	0.00017 µg/L[f]			0.49 µg/L (undissolved)[f]	--
Wood Waste and Sludge Disposal Area (occupational)	Arsenic[b]	1–22 mg/kg	7.6 mg/kg	5×10^{-6}		1–22 mg/kg	5×10^{-6}

Table 1. (cont.)

Area (scenario/pathways evaluated)	Chemicals above Screening Levels	Baseline: Concentration Range	Baseline: Screening Level[a]	Baseline: Excess Risk Estimate	Action or Note	Residual: Residual Concentration Range	Residual: Residual Risk
Petroleum Soils Areas							
Railroad Tracks Area (comparison with ADEC regulations)	Benz[a] anthracene	<0.007–56 mg/kg	9 mg/kg	--	Soil removed in 1999 as part of early action. Cleanup Level: 9,000 ug/kg	<0.0067–1.18 mg/kg	--
	Benzo[b] fluoranthene	<0.007–28 mμg/kg	9 mg/kg	--	9 mg/kg	<0.0067–1.2 mg/kg	--
	Benzo[a]pyrene	<.007–16 mg/kg	0.9 mg/kg	--	0.9 mg/kg	<0.0067–0.73 mg/kg	--
	Dibenz[a,h] anthracene	<.007–2 mg/kg	0.9 mg/kg	--	0.9 mg/kg	<0.0134–0.204 mg/kg	--
Compressor Area (comparison with ADEC regulations)	DRO	17,000–50,000 mg/kg	8,250 mg/kg	--	Soil removed in 1999 as part of early action. Cleanup Level: 8,250 mg/kg	885–8,960 mg/kg	--
	RRO	39,000–120,000 mg/kg	8,300 mg/kg	--	8,300 mg/kg	2,160–22,800 mg/kg	--
Bulk Fuel Tank Area (comparison with ADEC regulations)	DRO	8.4–31,000 mg/kg	8,250 mg/kg	--	Soil removed in 1999 as part of early action. Cleanup Level: 8,250 mg/kg	<25–14,500 mg/kg	--
	RRO	23–36,000 mg/kg	8,300 mg/kg	--	8,300 mg/kg	<50–14,200 mg/kg	--
	Benz[a] anthracene	0.120–24 mg/kg	9 mg/kg	--	9 mg/kg	0.00978 mg/kg	--
	Benzo[a]pyrene	0.110–19 mg/kg	0.9 mg/kg	--	0.9 mg/kg	0.0132–22.7 mg/kg	--
Dredge Spoils Area (occupational)	None					None	--
Wood Waste and Ash Disposal Landfill (occupational/recreational)	None					None	--
Former Storage Area along the Water Pipeline Road							
(occupational)	Arsenic[b]	1.21–72.6 mg/kg	7.6 mg/kg	6×10^{-6}	Soil removed in 1999 as part of early action.	<0.5–89.5 mg/kg	9×10^{-6}
	Lead	<10–2,210 mg/kg	1,000 mg/kg	--	Cleanup Level:1,000 mg/kg	<10–2,210 mg/kg	--
	PCBs	<0.400–6,410 mg/kg	10 mg/kg	1×10^{-5}	10 mg/kg	0.468–7.9 mg/kg	4×10^{-6}
	TPH–oil	1–34,000 mg/kg	9,700 mg/kg	--	9,700 mg/kg	None	--
Aerial Deposition Areas							
Forested and Developed Area Soils (residential/ingestion, dermal contact, produce consumption)	Arsenic[b]	2.4–138 mg/kg	7.6 mg/kg	2×10^{-5}		2.4–138 mg/kg	2×10^{-5}
	PCDD/F	0.89–137 ng/kg (TEC)	7.4 ng/kg	1×10^{-5}		0.89–137 ng/kg (TEC)	1×10^{-5}
Grit in Residential Yards (residential/ingestion, dermal contact, produce consumption)	Arsenic[b]	3.73–7.9 mg/kg	7.6 mg/kg	--		3.73–7.9 mg/kg	--
	PCDD/F	5.1–28.2 ng/kg (TEC)	7.4 ng/kg	2×10^{-6}		5.1–28.2 ng/kg (TEC)	2×10^{-6}

Footnotes continued on following page.

Table 1. (cont.)

Note: Boxes indicate those areas where soil has been removed.

--	-	not applicable
ADEC	-	Alaska Department of Environmental Conservation
cPAH	-	carcinogenic polycyclic aromatic hydrocarbon
DRO	-	diesel-range organics
EPA	-	U.S. Environmental Protection Agency
PAH	-	polycyclic aromatic hydrocarbon
PCB	-	polychlorinated biphenyl
PCDD/F	-	polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran
RPC	-	relative potency concentration
RRO	-	residual-range organics
TEC	-	toxic equivalent concentration
TPH	-	total petroleum hydrocarbon

[a] Screening levels were as follows: EPA Region 10 PCB risk-based cleanup level for nonresidential soils of 10 mg/kg; EPA OSWER guidance for lead in nonresidential soils of 1,000 mg/kg (U.S. EPA 1989); ADEC TPH soil cleanup standard for protection of groundwater (18 AAC 75); EPA risk-based concentrations for PCDD/F in industrial soils (U.S. EPA 1998). Screening levels for arsenic onsite and offsite based on background concentrations. Screening level for PCDD/F in grit based on background concentrations.

[b] Arsenic levels are addressed in the arsenic management plan (Exponent 1998). Arsenic bioavailability estimates described in the arsenic management plan suggest that risks associated with exposure to arsenic in soil may be much lower than those shown here.

[c] Screening level based on background in Tongass Narrows (E&E 1991). Hog fuel was identified as a source of manganese. Removal of hog fuel from the site in spring of 1998 eliminated this source. In addition, manganese was not identified as a chemical of potential concern in the Ward Cove investigation. For these reasons, manganese was not carried through the risk assessment.

[d] Two additional samples with PCB concentrations of 60.2 and 13.5 mg/kg, which were collected from rock at the bottom of the excavation, were not included in the residual risk calculations given their inaccessibility and low volume.

[e] Field duplicate results.

[f] Screening level based on marine human health criteria (U.S. EPA 1999). During the remedial investigation, dissolved concentrations of PCBs were estimated to reach 0.00017 µg/L within 0.1 meter of the shoreline.

Table 2. Summary of early cleanup actions

Source	Cleanup Objectives	Cleanup Action	Reference
Access Road Ditch	Cleanup completed as part of site renovations, not as a result of contaminant levels	400 yd^3 of sediments excavated and disposed of at the KPC landfill.	Exponent (1998f, 1999g)
Railroad Tracks Area	DRO–8,250 mg/kg; RRO–8,300 mg/kg	320 yd^3 of soil excavated and disposed offsite.	Exponent (1998c, 1999a,f,k, 2000b)
Compressor Area	DRO–8,250 mg/kg; RRO–8,300 mg/kg	6 yd^3 of soil excavated and disposed offsite.	Exponent (1999f,k)
Paint Shop/Former Maintenance Shop	Benzo[a]pyrene–1.0 mg/kg; Lead–1,000 mg/kg; PCBs–10 mg/kg	480 yd^3 of soil excavated and disposed offsite.	Exponent (1998b, 1999c,e,h,m)
Former Bulk Fuel Area	DRO–8,250 mg/kg; RRO–8,300 mg/kg	440 yd^3 of soil excavated and disposed offsite.	Exponent (1999i.l)
Former Storage Area along Water Pipeline	PCBs–10 mg/kg; TPH (as RRO)–9,700 mg/kg; Lead–1,000 mg/kg	Approximately 300 yd^3 of soil,115 yd^3 of debris, one set of capacitors, and 43 drums excavated and disposed offsite.	Exponent (1998a,c, 1999b,d,j, 2000a)

Note: DRO - diesel-range organics
PCB - polychlorinated biphenyl
RRO - residual-range organics
TPH - total petroleum hydrocarbon

Table 3. Program organization and responsibilities

Organization	Responsibilities
Gateway Forest Products (current owner of pulp mill) 7559 North Tongass Highway Ketchikan, Alaska 99901 (907) 247-1647	May conduct routine maintenance that involves soil excavation; identifies demolition work to be conducted; oversees demolition contractors; notifies agencies as needed; ensures permits are current; maintains records; files deed restrictions. Responsible for institutional controls and any required monitoring at pulp mill area.
Ketchikan Pulp Company[a] P.O. Box 6600 Ketchikan, Alaska 99901	As landfill owner, responsible for institutional controls and any required monitoring of the landfill. As owner of former water pipeline storage Areas 2, 3, 4, and Drum Area 2, will be responsible for institutional controls.
Demolition Contractor (determined on a case-by-case basis)	Conducts demolition work, including providing or subcontracting for a qualified person responsible for collecting soil samples for characterization and profiling for disposal.
Contract Laboratory (determined on a case-by-case basis)	Analyzes soil samples for characterization and profiling for disposal.
Ketchikan Gateway Borough 344 Front Street Ketchikan, Alaska 99901 (907) 228-6610	Identifies and maintains land use zoning throughout the Borough.
ADEC Contaminated Sites and Remediation Program Division of Spill Prevention and Response 410 Willoughby Avenue, Suite 105 Juneau, Alaska 99801-1795 (907) 465-5390	Oversees the remediation of the pulp mill area(including characterization of soil beneath structures during demolition activities), the wood waste and ash disposal landfill, and the water pipeline storage area.
ADEC Hazardous Waste Notification Contaminated Sites and Remediation Program Division of Spill Prevention and Response 410 Willoughby Avenue, Suite 105 Juneau, Alaska 99801-1795 (907) 465-5390	Oversees characterization and disposal of hazardous waste.
ADEC Division of Environmental Health Solid Waste Program 410 Willoughby Avenue, Suite 105 Juneau, Alaska 99801-1795 (907) 465-5350	Oversees activities associated with the wood waste and ash disposal landfill.
U.S. EPA, Region 10 Alaska Operations Office 222 W. Seventh Avenue Rm. 537, Box 19 Anchorage, Alaska 99513-7588 (907) 271-5083	Oversees the remediation of the pulp mill area (including characterization of soil beneath structures during demolition activities), the wood waste and ash disposal landfill, and the water pipeline storage area.

[a] Parent company is Louisiana-Pacific Corporation, 111 SW Fifth Avenue, Portland, Oregon 97204, (503) 221-0800.