03.11-12/07/94-00513

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1510 GILBERT ST
NORFOLK VA 23511-2699

TELEPHONE NO:
(804) 322-4783

IN REPLY REFER TO:
5090
1822:DMF:cag

DEC 07 1994

Commonwealth of Virginia
Department of Environmental Quality
Attn: Ms. Erica Dameron
629 East Main Street
Richmond, Virginia 23219

Re: ARARs Coordination, Remedial Action, Site 1, Camp Allen Landfill, Areas A and B, Naval Base, Norfolk, Virginia

Dear Ms. Dameron:

We are in receipt of the Virginia Department of Environmental Quality's (VDEQ) letter from Ms. Lisa Ellis dated April 22, 1994. Enclosed please find the ARARs proposed by the Navy for the subject project. Enclosure (1) provides a summary table of proposed ARARs for the Remedial Action at the subject site. Enclosure (2) provides the soil cleanup levels for Area A and backup calculations. Enclosure (3) provides the proposed discharge limits for the on-site water treatment system. Enclosure (4) provides the groundwater cleanup levels for the Yorktown and surficial aquifers and backup calculations.

If you have any questions, please contact the Remedial Project Manager, Mr. Dave Forsythe, at (804) 322-4783.

Sincerely,

James J Harris (for NMJ)

N. M. JOHNSON, P.E.
Head, Installation Restoration Section, North
Environmental Programs Branch
Environmental Quality Division
By direction of the Commander

Enclosures

Copy to:
VDEQ (Mr. Paul Spalding)
VDEQ Tidewater Regional Office (Mr. Carl Thomas)
EPA Region III (Mr. Robert Thomson, 3HW71)
Administrative Record File (Naval Base Norfolk)
COMNAVBASE Norfolk (N4, Ms. D. Bailey)
Baker Environmental (Ms. Jeri Tregaser)

Enclosure (1)
ARARs Table and TBCs

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
CAMP ALLEN LANDFILL, NORFOLK, VIRGINIA

Citation	Requirement	ARAR Determination	Comments
FEDERAL/CONTAMINANT-SPECIFIC			
Safe Drinking Water Act (42 USC 300(f)) a. Maximum Contaminant Levels (MCLs) 40 CFR 141.11-141.16 b. Maximum Contaminant Level Goals (MCLGs) 40 CFR 141.50-141.51	Standards for protection of drinking water sources serving at least 25 persons. MCLs consider health factors, as well as economic and technical feasibility of removing a contaminant; MCLGs do not consider the technical feasibility of contaminant removal. For a given contaminant, the more stringent of MCLs or MCLGs is applicable unless the MCLG is zero, in which case the MCL applies.	Relevant and appropriate in developing cleanup goals for contaminated groundwater and surface water that may potentially be used as a potable water supply.	MCLs will be used in developing cleanup goals for the Yorktown Aquifer (see Enclosure [4] for description of cleanup goals).
FEDERAL/LOCATION-SPECIFIC			
The Endangered Species Act of 1973 (16 USC 1531) (40 CFR Part 502)	Requires action to conserve endangered and threatened species and their critical habitats.	Applicable because peregrine falcons can be seen any time of year (Audet, 1989).	VADEQ has been notified of this project and the Navy requests the involvement of the Virginia Board of Game and Inland Fisheries for determination of endangered species or habitats.
Coastal Zone Management Act (16 USC 3501)	Conduct activities in a manner consistent with approved State management programs.	Relevant and appropriate to activities conducted within the Virginia coastal zone (Baker, 1988).	VADEQ has been notified of this project and the Navy requests that VADEQ provide requirements to comply with this ARAR.
National Historic Preservation Act (32 CFR Parts 229 and 229.4; 43 CFR Parts 107 and 171.1-5)	Develops procedures for the protection of archaeological resources.	Applicable to any excavation on site. If archaeological resources are encountered during soil excavation, they must be reviewed by Federal and State archaeologists.	Compliance can be met by submitting copies of work plans to the Virginia Department of Historic Resources (VDHR). The Navy requests that VDEQ provide coordination of this project with SHPO.
Executive Order 11988 (related to Floodplain Management)	Regulates activities located in a floodplain must comply with this Executive Order. Federal activities in floodplains must reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and preserve the natural and beneficial values served by floodplains.	Applicable for remedial actions involving activities with a floodplain.	Activities during construction will comply with requirements.

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
CAMP ALLEN LANDFILL, NORFOLK, VIRGINIA

Citation	Requirement	ARAR Determination	Comments
FEDERAL/ACTION-SPECIFIC			
DOT Rules for Hazardous Materials Transport (49 CFR Parts 107 and 171.1-500)	Regulates the transport of hazardous waste materials including packaging, shipping, and placarding.	Applicable for any action requiring off-site transportation of hazardous materials.	Remedial actions may include off-site treatment and disposal (e.g., off-site regeneration of activated carbon).
Resource Conservation and Recovery Act (RCRA) Subtitle C	Regulates the treatment, storage, and disposal of hazardous waste.	Applicable to remedial actions involving treatment, storage, or disposal of hazardous waste.	Remediation may involve treatment, storage, or disposal of hazardous waste.
Identification and Listing of Hazardous Waste (40 CFR Part 261)	Regulations concerning determination of whether or not a waste is hazardous based on characteristics or listing.	Applicable in determining waste classification.	Some site contaminants are considered listed wastes.
Treatment, Storage, and Disposal (TSD) of Hazardous Waste (40 CFR Parts 262-265, 266)	Regulates the treatment, storage, and disposal of hazardous waste.	Applicable in the event that wastes on site are classified as hazardous.	TSD activities related to hazardous waste will comply with regulations.
Manifest Systems, Recordkeeping, and Reporting (40 CFR Part 264, Subpart E)	Regulates manifest systems related to hazardous waste treatment, storage, and disposal.	Applicable to remedial actions where hazardous waste is generated or transported.	Remedial actions may include off-site disposal or treatment.
Releases from Solid Waste Management Unites (40 CFR Part 264, Subpart F)	Regulates releases from solid waste management units.	All solid waste management units on site shall comply with requirements.	Groundwater protection standards apply to solid waste management units.
Use and Management of Containers (40 CFR Part 264, Subpart I)	Regulates use and management of containers being stored at all hazardous waste facilities.	Applicable to containers stored on site.	Remedial actions may generate containerized waste. Investigation-derived waste (IDW) is containerized.
Resource Conservation and Recovery Act (RCRA) Subtitle D	Regulates the treatment, storage, and disposal of solid waste.	Applicable to remedial actions involving treatment, storage, or disposal of materials classified as solid waste.	Remediation may include treatment, storage, or disposal of solid waste.
National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR Part 61)	Standards promulgated under the Clean Air Act for significant sources of hazardous pollutants, such as vinyl chloride, benzene, trichloroethylene, dichlorobenzene, asbestos, and other hazardous substances. Considered for any source that has the potential to emit 10 tons of any hazardous air pollutant or 25 tons of a combination of hazardous air pollutants per year.	Applicable to releases or potential releases of hazardous pollutants. Remedial actions (e.g., air stripping) may result in release of hazardous air pollutants. The treatment design would include air emissions control equipment as required to comply with NESHAPs.	To be used during remedial design to determine that air emissions from the treatment facility will not exceed air emission standards.

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
CAMP ALLEN LANDFILL, NORFOLK, VIRGINIA

Citation	Requirement	ARAR Determination	Comments
STATE/CONTAMINANT-SPECIFIC			
Virginia Water Quality Standards (VR 680-21-00)	Surface water quality standards based on water use and criteria class of surface water.	Applicable to remedial actions requiring discharge to surface water.	Will be used to determine the discharge limit from the treatment facility.
Virginia Groundwater Standards Applicable Statewide (VR 680-21-04.3)	Establishes maximum contaminant concentrations to protect groundwater. In contrast to VR 680-21-05, these standards are mandatory.	Applicable in developing cleanup goals for contaminated groundwater.	Will be used in developing groundwater cleanup goals (see Enclosure [4] for description of cleanup goals).
Virginia Ambient Air Quality Standards (VAAQS) (VR 120-03-01)	Primary and secondary air quality standards for particulate matter, sulfur oxides, carbon monoxide, nitrogen dioxide, and lead.	Potentially applicable for remedial actions requiring discharge to the atmosphere.	Air emissions from the treatment facility will be monitored to comply with the substantive requirements of VAAQS provided by VADEQ.
Virginia Emission Standards for Toxic Pollutants (VR 120-01)	Establishes acceptable limits for toxic pollutants by applying a 1/40 correction factor to the occupational standard Threshold Limit Value-Ceiling (TLV-Ceiling).	These standards are applicable requirements for remedial actions requiring discharge to the atmosphere. Air calculations are provided in Appendix F that demonstrate compliance with standards.	To be used during remedial design to determine whether air emissions from the treatment facility will not exceed air emission standards.
Virginia Pollution Discharge Elimination System (VPDES) (VR 680-14-01) Regulation and Virginia Water Protection Permit Regulations (VR 680-15-01)	Regulated point-source discharges through the VPDES permitting program. Permit requirements include compliance with corresponding water quality standards, establishment of a discharge monitoring system, and completion of regular discharge monitoring records.	Applicable to discharge of treated water to surface water.	Substantive requirements of VPDES permit will be used to determine the discharge limits for the discharge of the treated water to surface water on site.
STATE/ACTION-SPECIFIC			
Virginia Solid Waste Management Regulations (VR 672-20-10)	Regulates the disposal of solid wastes.	Applicable for solid (nonhazardous) waste.	Remedial actions could include off-site disposal of nonhazardous waste.
Virginia Hazardous Waste Regulations (VR 72-30-1 and VR 672-10-1, Part VII)	Regulates the transport of hazardous waste materials including packaging, shipping, and placarding.	Applicable for any action requiring off-site transportation of hazardous materials.	Remedial actions may include off-site treatment and disposal (e.g., off-site regeneration of activated carbon).

TABLE 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
CAMP ALLEN LANDFILL, NORFOLK, VIRGINIA

Citation	Requirement	ARAR Determination	Comments
STATE/ACTION-SPECIFIC			
Virginia Hazardous Waste Management Regulations (VR 672-10-1)	Regulates the treatment, storage, and disposal of hazardous waste.	Applicable to remedial actions involving treatment, storage, or disposal of hazardous waste.	Remediation may include treatment, storage, or disposal of hazardous waste.
Identification and Listing of Hazardous Waste (VR 672-10-1, Part III)	Regulations concerning determination of whether or not a waste is hazardous based on characteristics or listing.	Applicable in determining waste classification.	Some site contaminants are considered listed wastes.
Manifest Systems, Recordkeeping, and Reporting (VR 672-10-1, Part X, Section 10.4)	Regulates manifest systems related to hazardous waste treatment, storage, and disposal.	Applicable to remedial actions where hazardous waste is generated or transported.	Remedial actions may include off-site disposal or treatment.
Releases from Solid Waste Management Unites (VR 672-10, Part X, Section 10.5)	Regulates releases from solid waste management units.	All solid waste management units on site shall comply with requirements.	Groundwater protection standards apply to solid waste management units.
Use and Management of Containers (VR 672-10, Part X, Section 10.8)	Regulates use and management of containers being stored at all hazardous waste facilities.	Applicable to containers stored on site.	Remedial actions may generate containerized waste. Investigation-derived waste (IDW) is containerized.
Virginia Stormwater Management Regulations (VR 215-02-00) and Virginia Erosion and Sediment Control Regulations (VR 625-02-00)	Regulates stormwater management and erosion/ sedimentation control practices that must be followed during land disturbing activities.	Applicable for remedial actions involving land disturbing activities.	Activities during construction will comply with the Virginia Storm Water Management Program. A sediment and erosion control plan will be submitted to LANTDIV for approval.
Virginia Endangered Species Act (Code of Virginia 29.1-563)	Requires action to conserve endangered and threatened species and their critical habitats.	Applicable because peregrine falcons can be seen any time of year (Audet, 1989).	VADEQ has been notified of this project. The Navy requests determination of endangered species or habitats from VADEQ.
Virginia Wetlands Regulations (VR 450-01-0051)	Regulates activities that impact tidal wetlands.	Relevant and appropriate to activities that could impact site wetlands.	Activities that could impact wetlands will comply with regulations.
Chesapeake Bay Preservation Area Designation and Management Regulations (VR 173-02--01)	Sets limitations in certain tidal and wetland areas for land-disturbing activities, removal of vegetation, use of impervious cover, E&S control, stormwater management, etc.	Potentially relevant and appropriate if site is within jurisdiction.	If required, plans will be submitted to the appropriate agency for approval.
Coastal Management Plan City of Norfolk	Activities within a Coastal Management Zone must be in compliance with local requirements.	Relevant and appropriate.	Remedial activities will comply with local requirements.

TABLE 2

TO BE CONSIDERED (TBC) REQUIREMENTS
CAMP ALLEN LANDFILL, NORFOLK, VIRGINIA

Citation	Requirement	TBC Determination	Comments
FEDERAL/CONTAMINANT-SPECIFIC			
Reference Doses (RfDs), EPA Office of Research and Development	Presents non-enforceable toxicity data for specific chemicals for use in public health assessments to characterize risks due to exposure to contaminants.	To be considered (TBC) requirement in the public health assessment.	Will be used in evaluating human health risks at the site.
Carcinogenic Potency Factors, EPA Environmental Criteria and Assessment Office; EPA Carcinogen Assessment Group	Presents non-enforceable toxicity data for specific chemicals for use in public health assessments to compute the individual incremental cancer risk resulting from exposure to carcinogens.	TBC requirement in the public health assessment.	Will be used in evaluating human health risks at the site.
Health Advisories, EPA Office of Drinking Water	Non-enforceable guidelines for chemicals that may intermittently be encountered in public water supply systems. Available for short- or long-term exposure for a child and/or adult.	TBC requirement in the public health assessment.	Will be used in evaluating human health risks at the site.
FEDERAL/LOCATION-SPECIFIC			
RCRA Subtitle C Landfills (40 CFR Part 264, Subpart N)	Regulates owners and operators of facilities that dispose hazardous wastes in landfills.	TBC to evaluate compliance of off-site landfills.	TBC for remedial actions that involve off-site landfill of hazardous waste (sludge or IDW).
Groundwater Protection Strategy	EPA policy to protect groundwater for its highest present or potential beneficial use. The strategy designates three categories of groundwater: Class 1 - Special Ground Waters Class 2 - Current and Potential Sources of Drinking Water and Waters Having Other Beneficial Uses Class 3 - Groundwater Not a Potential Source of Drinking Water and of Limited Beneficial Use	TBC requirement.	Groundwater in the Yorktown Aquifer is considered a Class 2 given its historical, current, and expected future use. Groundwater in the surficial (water table) aquifer is considered a Class 3.

TABLE 2 (Continued)

TO BE CONSIDERED (TBC) REQUIREMENTS
CAMP ALLEN LANDFILL, NORFOLK, VIRGINIA

Citation	Requirement	TBC Determination	Comments
FEDERAL/ACTION-SPECIFIC			
National Ambient Air Quality Standards (NAAQS) (40 CFR 50)	Standards for the following six criteria pollutants: particulates matter; sulfur dioxide; carbon monoxide; ozone; nitrogen dioxide; and lead. The attainment and maintenance of these standards are required to protect the public health and welfare.	TBC requirements for remedial actions requiring discharge to the atmosphere. The treatment design would include air emissions control equipment as required to comply with NAAQS.	Air emissions from the treatment plant will be monitored to comply with the substantive requirements of NAAQS.
Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites (OSWER Directive 9355.0-28)	Guidance that establishes criteria as to whether air emission controls are necessary for air strippers. A maximum 3 lbs/hr or 15 lbs/day or 10 tons/yr of VOC emissions is allowable; air pollution controls are recommended for any emissions in excess of these quantities.	TBC requirement.	TBC as remedial action includes air stripping.
National Ambient Air Quality Standards (NAAQS) (40 CFR 50)	Standards for the following six criteria pollutants: particulates matter; sulfur dioxide; carbon monoxide; ozone; nitrogen dioxide; and lead. The attainment and maintenance of these standards are required to protect the public health and welfare.	TBC requirements for remedial actions requiring discharge to the atmosphere. The treatment design would include air emissions control equipment as required to comply with NAAQS.	Air emissions from the treatment plant will be monitored to comply with the substantive requirements of NAAQS.
STATE/LOCATION-SPECIFIC			
RCRA Subtitle C Landfills (VR 672-10, Part X, Section 10.13)	Regulates owners and operators of facilities that dispose hazardous wastes in landfills.	TBC to evaluate compliance of off-site landfills.	TBC for remedial actions that involve off-site landfill of hazardous waste (sludge or IDW).

Enclosure (2)
Soil Cleanup Levels and Calculations

INTRODUCTION

Soil analytical data obtained during the Camp Allen Landfill predesign investigation (Baker, 1994) indicate the presence of the volatile organic compounds (VOCs) in subsurface soils in Areas A1 and A2. The VOCs detected in test pit samples collected during the predesign investigation include; toluene, ethylbenzene, xylenes, vinyl chloride, trichloroethene, tetrachloroethene and 1,2 dichloroethenes. Under the influence of infiltrating precipitation, these VOCs may migrate through the unsaturated zone soils in Areas A1 and A2 could potentially act as sources of continuing contamination to underlying groundwater.

OBJECTIVE

The objective of the cleanup level development is to determine subsurface soil cleanup goals for the Feasibility Study based on the potential for the VOCs to vertically migrate (i.e. leach) to the water table aquifer in Areas A1 and A2 at the Camp Allen Landfill. The modeling approach used to determine the soils cleanup goals for the Feasibility Study is presented in the following section.

MODELING APPROACH

Soil cleanup goals have been developed based on the results of the subsurface soil (i.e., test pit) predesign investigation . Test pit locations and analytical results for the VOCs in Areas A1 and A2 are provided in Figures 2-3 and 2-4, respectively, in the Draft Final Remedial Design Work Plan (Baker 1994).

Soil remediation areas for Areas A1 and A2 are provided in Figures 2-5 and 2-6, respectively, in the Draft Final Remedial Design Work Plan. As shown in Figure 2-5, the source area for Area A1 was determined to encompass an area of approximately 152 meters in length by 53 meters in width, producing a total area of approximately 8,100 square meters. As shown in Figure 2-6, the potential source area for area A2 was estimated to be approximately 787 square meters, which corresponds to the area around test pits A2-TPW05 and A2-TPW07.

A spreadsheet-based transport model described by Summers et. al (USEPA, 1980) was developed to determine the potential soil cleanup goals. The Summers Model is a one-dimensional advective transport model that estimates the potential contaminant concentration in leachate (emanating from the source area) at the top of the shallow aquifer. The general input data for the spreadsheet model include: contaminant characteristics; unsaturated zone characteristics; hydrogeological properties of the shallow aquifer; and annual precipitation data. Site-specific data were obtained from the predesign investigation as well as from previous field investigations. Multiple data descriptors were used to describe depth to the saturated zone, organic carbon content and vertical hydraulic conductivity. Site data not available were obtained from USEPA source documents.

A more detailed description of the Summers Model is included in Attachment I. The specific modeling inputs and their sources used in the spreadsheet calculation of soils cleanup goals are also provided in Attachment I.

SOIL CLEANUP GOALS

The soil cleanup goals developed using the Summers Model for the contaminants of concern in Areas A1 and A2 are listed in the attached Table.

The soil cleanup goals shown were based on attainment of Maximum Contaminant Levels (MCLs) in shallow groundwater immediately below the source area in order to protect the lower Yorktown Aquifer to its potential future beneficial use (i.e., drinking water supply). Since the MCLs for the contaminants of concern are less than the federal Ambient Water Quality Criteria and Virginia Water Quality Standards, soil cleanup goals are also protective of surface water.

The developed soil cleanup goals will be used to estimate remediation areas of concern for the Feasibility Study. It should be noted that since Area A is a landfill, the remedial action objective (RAO) for the soils is groundwater protection rather than soil cleanup. Therefore, achievement of this RAO will not necessarily be based on attainment of the developed soil cleanup goals since they represent theoretical values calculated through modeling. The draft cleanup goals were developed using conservative assumptions (see Attachment I) and may not be representative of actual site conditions. Therefore, achievement of groundwater protection will determined through evaluation actual environmental monitoring results (i.e., via ongoing monitoring of contaminant goals in groundwater and in the extracted vapors from the in situ vacuum extraction system, the preferred treatment alternative for the soils).

SOIL CLEANUP GOALS
CAMP ALLEN LANDFILL SITE, NORFOLK, VIRGINIA

CONTAMINANTS OF CONCERN	GROUNDWATER GOAL* (ppm)	SOIL CLEANUP GOAL (ppm)
1,2-Dichloroethane	0.005	0.05
1,2-Dichloroethene	0.005	0.3
1,1,1-Trichloroethane	0.200	3.0
Benzene	0.005	1.0
Ethylbenzene	0.700	72.00
Tetrachloroethene	0.005	0.3
Toluene	1.000	220.0
Trichloroethene	0.005	1.0
Vinyl Chloride	0.002	0.01
Xylenes	10.00	650.0

* Soil cleanup goals are derived from groundwater goals, which are based on Federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs), USEPA, May 1993.

Attachment I

POTENTIAL CONTAMINANT LEACHING

The potential concentration of a contaminant in source area soil leachate eminating from the unsaturated zone was estimated using a one-dimensional advective transport model described by Summers et. al (USEPA 1980). The Summers model utilizes a saturated flow equation to approximate flow in the unsaturated zone. The governing equation describing one dimensional advective transport with dispersion and adsorption is:

$$D \frac{\delta^2 c}{\delta z^2} - V_S \frac{\delta c}{\delta z} = \frac{\delta c}{\delta t} + \left(\frac{1}{s}\right) \frac{\delta n}{\delta t}$$

Where:

c = contaminant concentration in the fluid stream

n = amount of contaminant adsorbed by the soil

V_s = the seepage velocity of leachate through soil

t = time

z = depth of the unsaturated soil column

D = the dispersion coefficient

s = the fractional soil voids volume

The terms in the governing equation represent, from left to right, transport because of dispersion, transport associated with advection, the time rate of change in contaminant concentration and the last term describes contaminant adsorption by the soil matrix. The n term is derived by multiplying c by an emperically derived adsorption coefficient (k). The use of a linear estimate of n implies that the assumption of equilibrium exists between solute in leachate and adsorbed solute. This approximation approaches actual adsorption conditions when typically unsaturated soils are saturated during precipitation events or when seepage velocities are low. When n = kc the general solution for the governing equation becomes:

$$\frac{C(z,t)}{Co} = \frac{1}{2}\left[1 + erf\left(\frac{R - y}{(4\ RyS)^{0.5}}\right) + e^{1/s}\ erfc\left(\frac{R + y}{(4\ RyS)^{0.5}}\right)\right]$$

Where:

$C_{(z,t)}$ = the contaminant concentration at depth z, and time t

C_o = initial contaminant concentration at z = 0

y = a dimensionless adsorption factor

R = a dimensionless time variable

S = a dimensionless mixing factor

z = distance to the saturated zone

erf(x) = the error function of x

erfc(x) = the complementary error function

If dispersion is considered negligable with respect to seepage velocity, the following equation is used:

$$\frac{C(z,t)}{C_o} = \frac{1}{2}\left[1 + erf\left(\frac{R-y}{(4RyS)^{0.5}}\right)\right]$$

This equation was used to calculate leachate concentrations at specific depths below the surface. The initial concentration term, C_o, was modified to account for source strength decay using the following equation:

$$C = C_o * e^{-kt}$$

Where:

k = source decay factor

Source decay was assumed to be equivalent to the thirty year time frame for soil treatability.

A spreadsheet based Summers model was developed to determine the potential soil cleanup goal protective of leaching to the saturated zone under the influence of infiltrating precipitation. Spreadsheet output is presented in Attatchment II. Mixing in the shallow zone was also considered in the form of a mass balance equation, however, relatively low estimates of seepage velocity and the limited thickness of the shallow aquifer does not provide significant dilution for either area A1 or A2. Therefore, mass balance mixing in the shallow aquifer is only presented on the first Attatchment II spreadsheet.

Modeling Inputs

The general input data for the spreadsheet included contaminant characteristics, unsaturated zone characteristics, hydrogeological properties of the shallow aquifer and annual precipitation data. Site specific data were obtained from the most recent RI report. Site data not available in the RI was obtained from USEPA source documents.

The model was used to predict potential leaching over a ten year duration. A source area decay value of 30 years was used to represent the amount of time necessary for the completion of potential remediation activities. Table A1-1 presents the modeling inputs and their respective sources used in the spreadsheet calculation of soils cleanup goals.

Table A1-1
Inputs to the Summers Model
Camp Allen Landfill Site
Norfolk, Virginia

INPUTS	VALUE	REFERENCE
Source Area (m2)	8100/787	1
Yearly Precipitation	111	2
Unsaturated Zone Depth (m)	0.5 - 3.0	2
Fraction Organic Carbon	0.01 - 0.1	1
Soil Bulk Density (Kg/L)	2.65	3, 5
Porosity	0.3	3, 5
Vertical Hydraulic Cond. (m/d)	0.005 - 0.5	3, 5
Soil Decay Coeff. (d-1)	*	4
Water Decay Coeff. (d-1)	*	4
Time (d)	3650	5
Source Decay (d-1)	0.00009	5

References:
1 - Draft Test Pit Data (Baker, 1994)
2 - Draft Final Remedial Investigation Report (Baker, 1993)
3 - USEPA Water Quality Assessment. EPA/600/6-85/002a
4 - USEPA Handbook of Environmental Degradation Rates. Howard et al., 1991
5 - Predesign Investigations and Field Observations
* - Chemical dependent value. See Attachment II

MCL values were selected as a cleanup endpoint for shallow zone groundwater in order to utilize this model. Shallow groundwater is not currently being used as a potable water supply in the vicinity of the Camp Allen Landfill. The use of MCLs as cleanup standards in conjunction with shallow groundwater remediation strategies should protect the shallow aquifer from further degradation when site remediation is complete. Protecting the shallow zone from further degradation will also assure that the deeper Yorktown aquifer (which could be used for potable purposes) is not adversely affected upon completion remediation activities.

Contamination detected in the shallow aquifer is, in general, significantly higher than contaminant concentrations detected in the underlying Yorktown aquifer. This attenuation is afforded by the discontinuous clay layer between the two water bearing units in addition to simple dilution in the larger Yorktown water bearing unit. Attenuation of contaminant concentrations by migration from the shallow aquifer to the Yorktown aquifer was not considered in this modeling effort.

Uncertainties

Uncertainties are inherent in determining soil cleanup goals through the use of spreadsheet based models. These uncertainties stem from the assumption that a model can represent the physical transport system throughout an entire source area using generalized inputs such as vertical seepage velocities and porosity's. To prevent an underestimation of contaminant leaching at the site, conservative inputs were used. These inputs may overestimate the potential for contaminant leaching in the unsaturated zone.

The use of a one-dimensional advective transport model considering adsorption and dispersion in porous media was used to approximate the potential leaching of contaminants from and through the unsaturated zone. Flow properties of unsaturated porous media are a function of the soil water content of site soils. The one-dimensional model is conservative because it assumes that the greatest potential for contaminant migration through the unsaturated zone occurs when unsaturated zone soil moisture contents are at maximum capacity. It does not consider situations where soils in the unsaturated zone are less than saturated, nor does the model consider the potential evapotranspiration of the study area. Therefore, leaching, as predicted by the model, is likely to be greater than actual site leaching.

The Summers Model estimates the potential contaminant concentration in leachate (eminating from the source area) at the top of the shallow aquifer. In order to determine corresponding soil concentrations, an estimate of retardation must be applied to modify the leachate concentration. Retardation is estimated using USEPA octanol-water partitioning coefficients and estimates of soil organic carbon content. An organic carbon content of 1 percent (.01) was used to approximate subsurface soil fraction of organic carbon content . Analytical data suggest that subsurface soil values of f may be somewhat higher. These values may be attributable to the presence of site associated contaminants, therefore, a lessor value was selected. Using an f of 1 percent instead of some higher value increases the likelihood of overestimating source area leaching potential.

Attachment II
Summer's Model Spreadsheet Calculations

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = 1,1,1-Trichloroethane

	Inputs
z = Unsat. depth (m)	1.75
a = Dispersivity (m)	0.2
Cs = Soil Conc. (mg/Kg)	0.36
Koc = Oct/H2O coeff. (L/Kg)	152
foc = Organic Carbon	0.055
sb = soil bulk density (Kg/L)	2.65
por = soil porosity	0.3
Ksat = Vert. Hydraulic Cond. (m/d)	0.185
k1 = Soil decay (d-1)	0.0111
k2 = Water decay (d-1)	0.0111
t = time (d)	3650
ks = Source decay rate (d-1)	0.00009

	Values	
vz = Seepage Vel. (m/d)	0.617	
Kd = Koc*foc (L/Kg)	8.360	
Rd = Retardation ()	74.85	
D = Dipersion Coeff. (m2/d)	0.123	
k = Overall decay (d-1)	0.0111	
Co = Initial Conc. (mg/L)	0.005	
R =	1286.190	
S =	0.114	
A1 =	5.774	
A2 =	6.488	
erf(A1) =	1.00000000	*
erf(A2) =	1.00000000	*
erfc(A2) =	0.00000000	*
C = Conc. at"z" (mg/L)	0.003463212	

** PRG For Leaching **

Chemical = 1,1,1-Trichloroethane

CGW = Groundwater PRG (mg/L)	0.2
Csoil = Soil PRG (mg/Kg)	20.790

ELEMENT NUMBER 2. MIXING IN THE SATURATED ZONE BENEATH THE SOURCE AREA. (used only with Element III option)

Assume average moisture case and 5 day anticedent precipitation is 0.

Days	1	5	6	7	8
Rainfall (cm)	0.00	0.00	4.72	10.00	6.55

From SCS curves.

CN2 =	Curve Number 2	79
CN1 =	Curve Number 1	62
CN3 =	Curve Number 3	91
S =	Water Retention (cm)	16
IA =	Initial Abstraction (cm)	3.2
Q1 =	Day 1 runoff (cm)	0.142
S2 =	Water Retention (cm)	6.8
IA2 =	Day 2 Abstraction (cm)	1.4
Q2 =	Day 2 runoff (cm)	0.000
S3 =	Water Retention (cm)	2.6
IA3 =	Day 3 Abstraction (cm)	0.5
Q3 =	Day 3 runoff (cm)	4.237

Runoff (cm)	4.379
Rainfall (cm)	21.27
% Infiltrate	79%

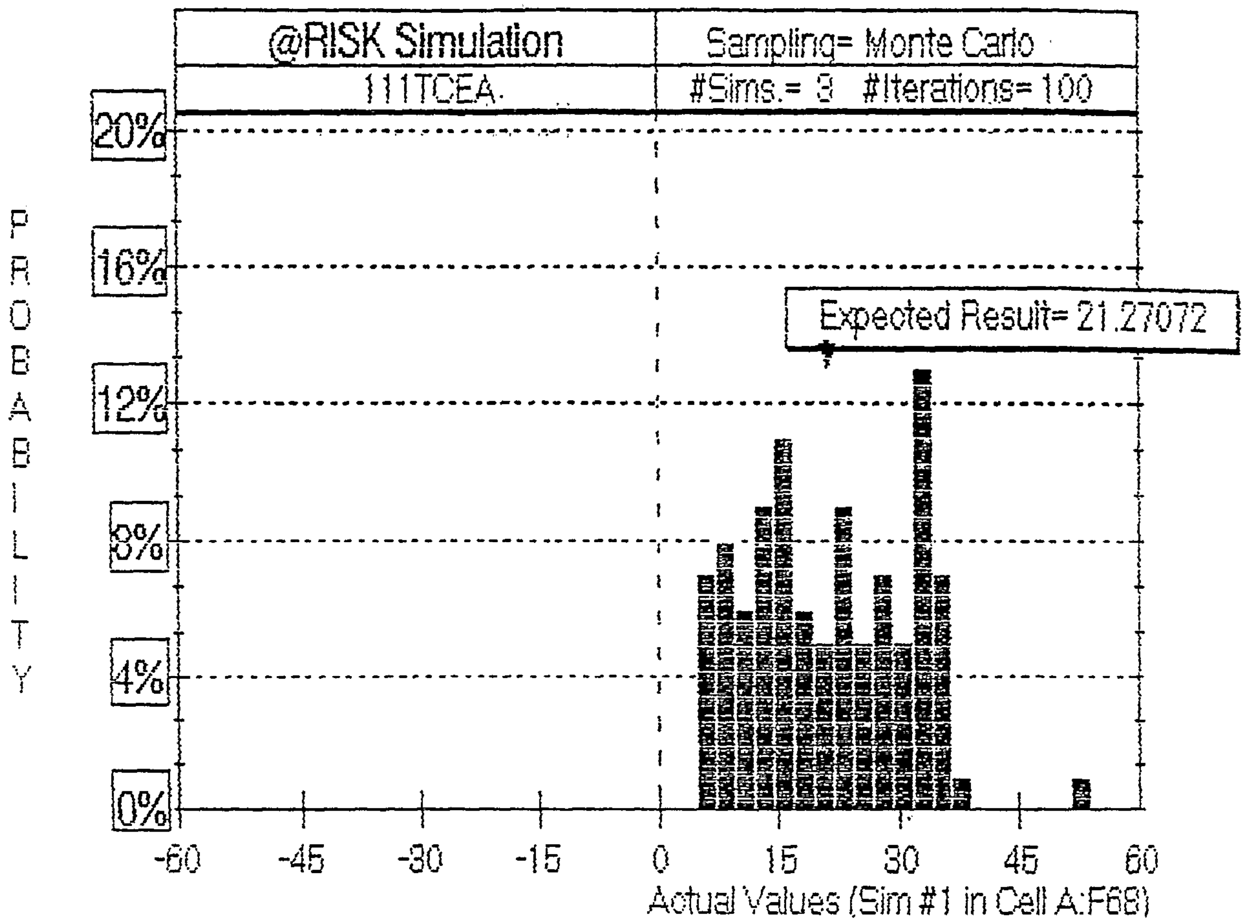
Assume that all yearly rain events follow the moisture curve profile.

Total Yearly Precip. (cm)	111
Evapotranspiration (cm)	0
Infiltration (m/yr)	0.881468259

MASS BALANCE EQUATION

		Inputs
Ksat =	Aquifer hyd. cond. (m/d)	0.05
I =	Hydraulic Grad. (ft/ft)	0.01
n =	Aquifer Por.	0.3
l =	Length of source area (m)	100
w =	Width of source area (m)	250
h =	Depth of the aquifer (m)	10
Ca =	Upgradient Conc. (mg/L)	0

		Values
vd =	Darcy Velocity (m/d)	0.001666667
Qp =	Flow from unsat. zone (L/d)	1.5E+07
C =	Concentration (mg/L)	0.00
Qa =	Flow in the sat.zone (L/d)	4.2
Cgw =	Mixed sat. zone conc (mg/L)	3.46E-03
DF =	Dil. in underlying Aquifer	1.00000027
**PRG =	Soil Cleanup Goal (mg/Kg)	20.790



@RISK Simulation
Sampling= Monte Carlo
111TCEA
#Sims.= 3 #Iterations= 100
Expected Result= 21.27072
PROBABILITY
20%
16%
12%
8%
4%
0%
-60
-45
-30
-15
0
15
30
45
60
Actual Values (Sim #1 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = Vinyl Chloride

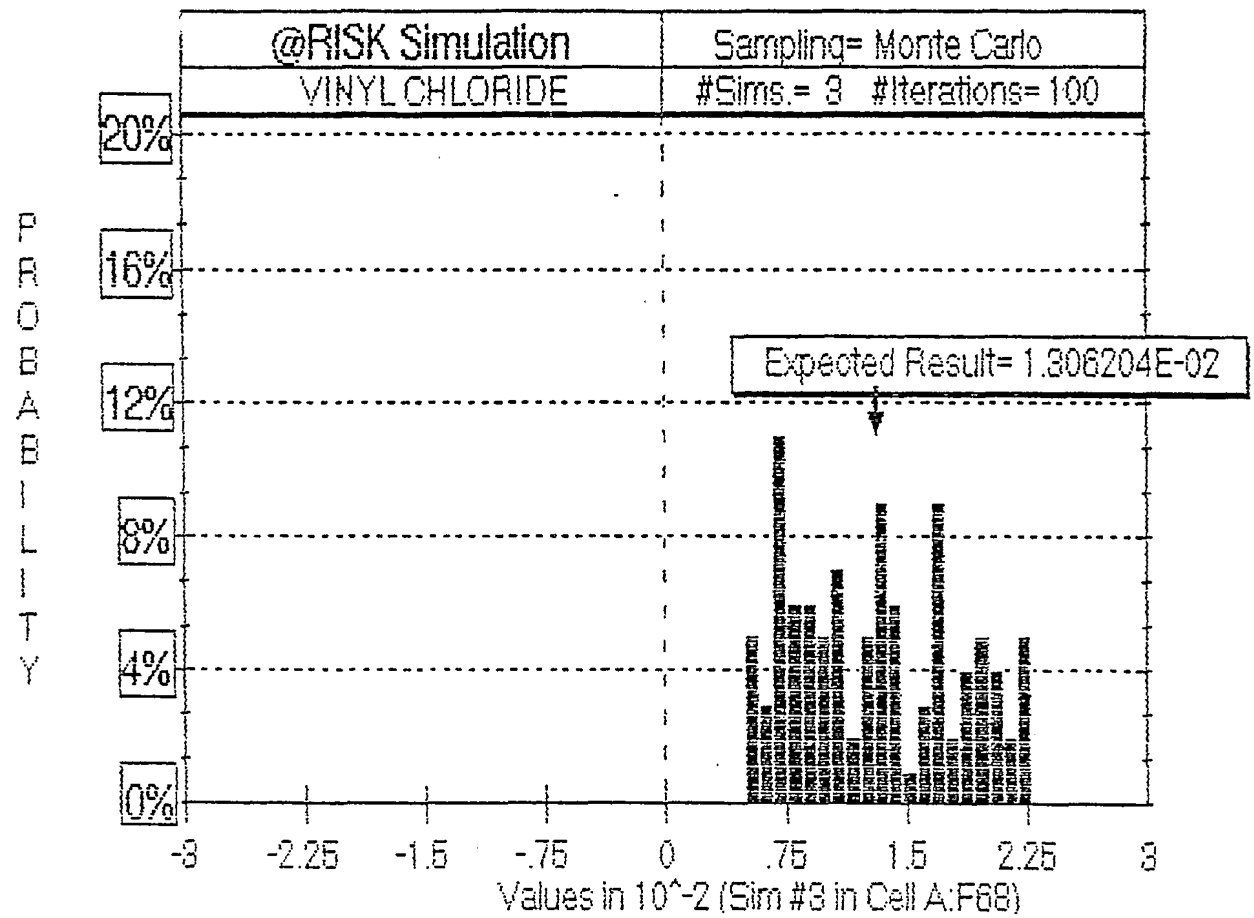
		Inputs
z =	Unsat. depth (m)	1.75
a =	Dispersivity (m)	0.2
Cs =	Soil Conc. (mg/Kg)	0.36
Koc =	Oct/H2O coeff. (L/Kg)	8.2
foc =	Organic Carbon	0.055
sb =	soil bulk density (Kg/L)	2.65
por =	soil porosity	0.3
Ksat =	Vert. Hydraulic Cond. (m/d)	0.185
k1 =	Soil decay (d-1)	0.2
k2 =	Water decay (d-1)	0.2
t =	time (d)	3650
ks =	Source decay rate (d-1)	0.00009

		Values
vz =	Seepage Vel. (m/d)	0.617
Kd =	Koc*foc (L/Kg)	0.451
Rd =	Retardation ()	4.98
D =	Dipersion Coeff. (m2/d)	0.123
k =	Overall decay (d-1)	0.2000
Co =	Initial Conc. (mg/L)	0.072
R =		1286.190
S =		0.114
A1 =		23.668
A2 =		23.852
erf(A1) =		1.00000000 *
erf(A2) =		1.00000000 *
erfc(A2) =		0.00000000 *
C =	Conc. at"z" (mg/L)	0.052010143

** PRG For Leaching **

Chemical = Vinyl Chloride

CGW =	Groundwater PRG (mg/L)	0.002
Csoil =	Soil PRG (mg/Kg)	0.014



@RISK Simulation
Sampling= Monte Carlo
VINYL CHLORIDE
#Sims.= 3 #Iterations= 100
PROBABILITY
20%
16%
12%
8%
4%
0%
Expected Result= 1.306204E-02
-3
-2.25
-1.5
-.75
0
.75
1.5
2.25
3
Values in 10^-2 (Sim #3 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = Trichloroethene (TCE)

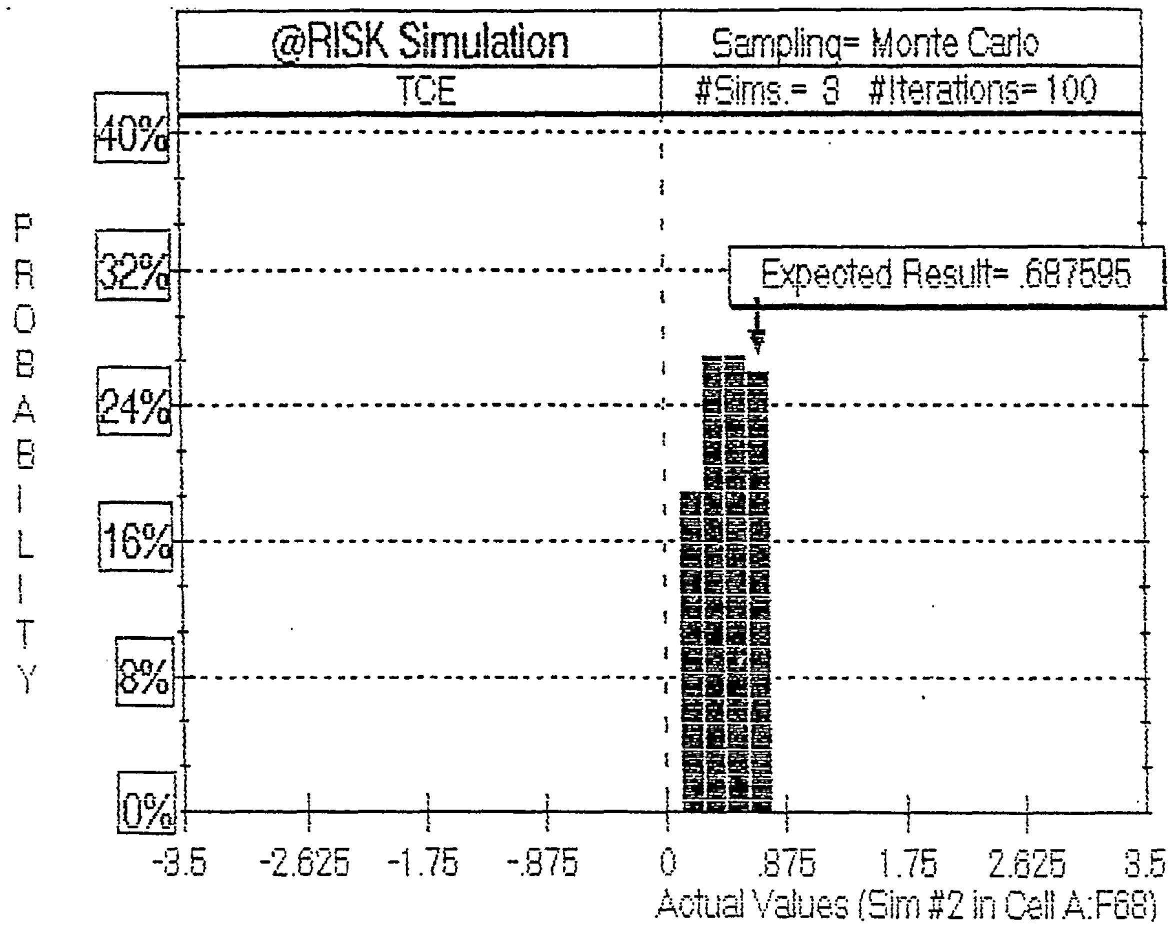
		Inputs
z =	Unsat. depth (m)	3
a =	Dispersivity (m)	0.2
Cs =	Soil Conc. (mg/Kg)	0.36
Koc =	Oct/H2O coeff. (L/Kg)	126
foc =	Organic Carbon	0.055
sb =	soil bulk density (Kg/L)	2.65
por =	soil porosity	0.3
Ksat =	Vert. Hydraulic Cond. (m/d)	0.185
k1 =	Soil decay (d-1)	0.0111
k2 =	Water decay (d-1)	0.0111
t =	time (d)	3650
ks =	Source decay rate (d-1)	0.00009

		Values
vz =	Seepage Vel. (m/d)	0.617
Kd =	Koc*foc (L/Kg)	6.930
Rd =	Retardation ()	62.22
D =	Dipersion Coeff. (m2/d)	0.123
k =	Overall decay (d-1)	0.0111
Co =	Initial Conc. (mg/L)	0.006
R =		750.278
S =		0.067
A1 =		6.167
A2 =		7.282
erf(A1) =		1.00000000 *
erf(A2) =		1.00000000 *
erfc(A2) =		0.00000000 *
C =	Conc. at"z" (mg/L)	0.004166357

** PRG For Leaching **

Chemical = Trichloroethene (TCE)

CGW =	Groundwater PRG (mg/L)	0.005
Csoil =	Soil PRG (mg/Kg)	0.432



@RISK Simulation
Sampling= Monte Carlo
TCE
#Sims.= 3 #Iterations= 100
Expected Result= .687595
PROBABILITY
40%
32%
24%
16%
8%
0%
-3.5
-2.625
-1.75
-.875
0
.875
1.75
2.625
3.5
Actual Values (Sim #2 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = Tetrachloroethene (PCE)

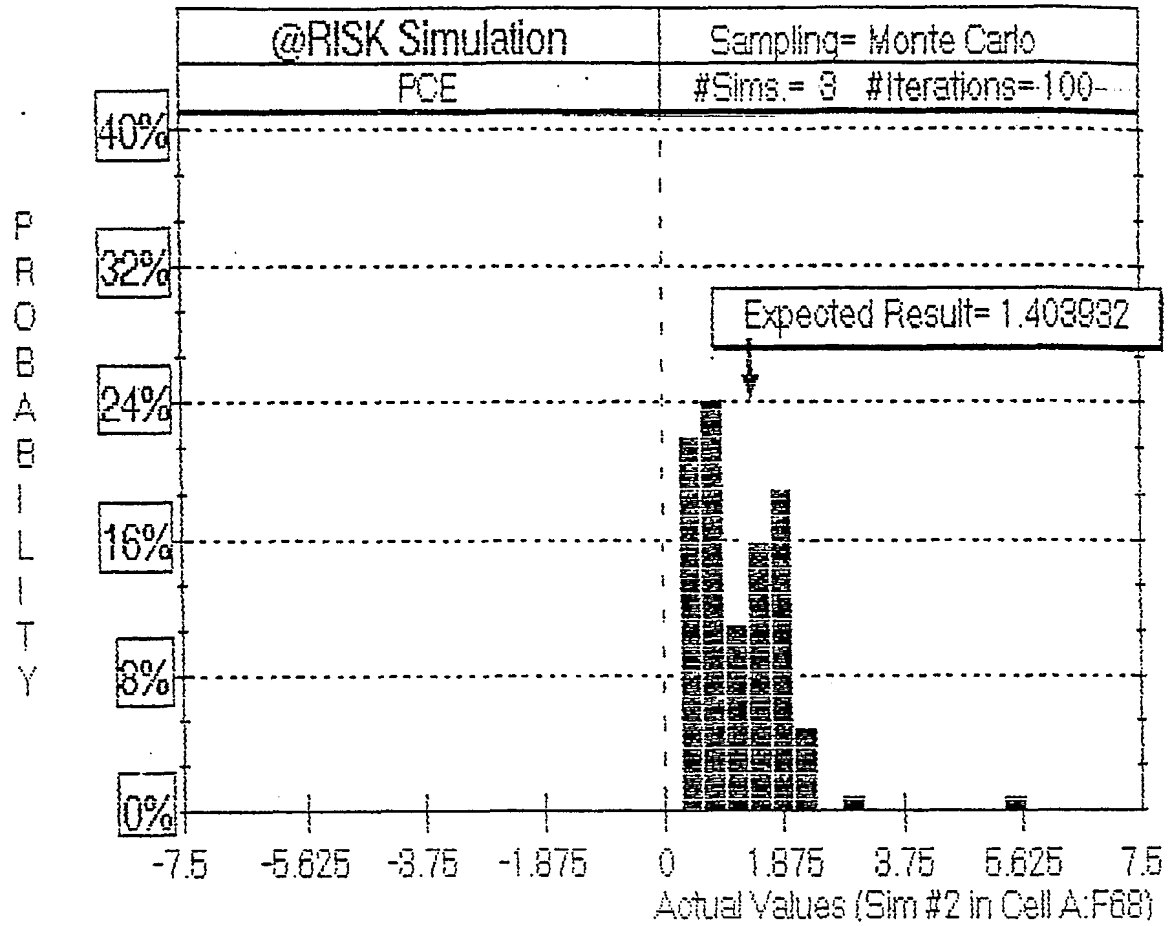
		Inputs
z =	Unsat. depth (m)	1.75
a =	Dispersivity (m)	0.2
Cs =	Soil Conc. (mg/Kg)	0.36
Koc =	Oct/H2O coeff. (L/Kg)	364
foc =	Organic Carbon	0.055
sb =	soil bulk density (Kg/L)	2.65
por =	soil porosity	0.3
Ksat =	Vert. Hydraulic Cond. (m/d)	0.185
k1 =	Soil decay (d-1)	0.0111
k2 =	Water decay (d-1)	0.0111
t =	time (d)	3650
ks =	Source decay rate (d-1)	0.00009

		Values
vz =	Seepage Vel. (m/d)	0.617
Kd =	Koc*foc (L/Kg)	20.020
Rd =	Retardation ()	177.84
D =	Dipersion Coeff. (m2/d)	0.123
k =	Overall decay (d-1)	0.0111
Co =	Initial Conc. (mg/L)	0.002
R =		1286.190
S =		0.114
A1 =		3.428
A2 =		4.527
erf(A1) =		0.99998571 *
erf(A2) =		0.99999997 *
erfc(A2) =		0.00000003 *
C =	Conc. at"z" (mg/L)	0.001457508

** PRG For Leaching **

Chemical = Tetrachloroethene (PCE)

CGW =	Groundwater PRG (mg/L)	0.005
Csoil =	Soil PRG (mg/Kg)	1.235


@RISK Simulation
Sampling= Monte Carlo
PCE
#Sims.= 3 #Iterations=100
PROBABILITY
40%
32%
24%
16%
8%
0%
Expected Result= 1.403932
-7.5
-5.625
-3.75
-1.875
0
1.875
3.75
5.625
7.5
Actual Values (Sim #2 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = 1,2-Dichloroethane

		Inputs
z =	Unsat. depth (m)	1.75
a =	Dispersivity (m)	0.2
Cs =	Soil Conc. (mg/Kg)	0.36
Koc =	Oct/H2O coeff. (L/Kg)	14
foc =	Organic Carbon	0.055
sb =	soil bulk density (Kg/L)	2.65
por =	soil porosity	0.3
Ksat =	Vert. Hydraulic Cond. (m/d)	0.185
k1 =	Soil decay (d-1)	0.2
k2 =	Water decay (d-1)	0.2
t =	time (d)	3650
ks =	Source decay rate (d-1)	0.00009

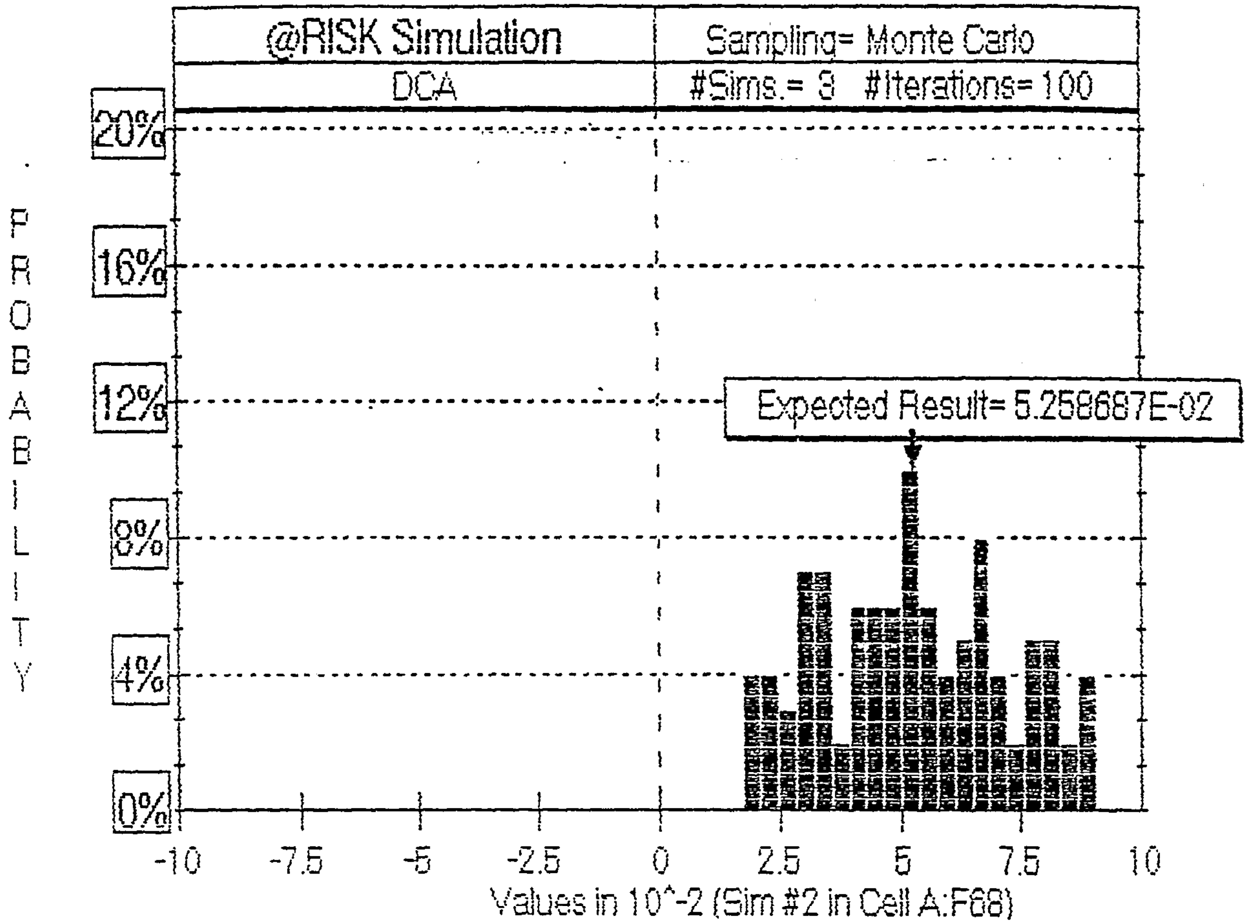
		Values
vz =	Seepage Vel. (m/d)	0.617
Kd =	Koc*foc (L/Kg)	0.770
Rd =	Retardation ()	7.80
D =	Dipersion Coeff. (m2/d)	0.123
k =	Overall decay (d-1)	0.2000
Co =	Initial Conc. (mg/L)	0.046

R =	1286.190	
S =	0.114	
A1 =	18.875	
A2 =	19.106	
erf(A1) =	1.00000000	*
erf(A2) =	1.00000000	*
erfc(A2) =	0.00000000	*
C = Conc. at"z" (mg/L)	0.033224937	

** PRG For Leaching **

Chemical = 1,2-Dichloroethane

CGW =	Groundwater PRG (mg/L)	0.005
Csoil =	Soil PRG (mg/Kg)	0.054



@RISK Simulation
Sampling= Monte Carlo
DCA
#Sims.= 3 #Iterations= 100
PROBABILITY
20%
16%
12%
8%
4%
0%
Expected Result= 5.258687E-02
-10
-7.5
-5
-2.5
0
2.5
5
7.5
10
Values in 10^-2 (Sim #2 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = Benzene

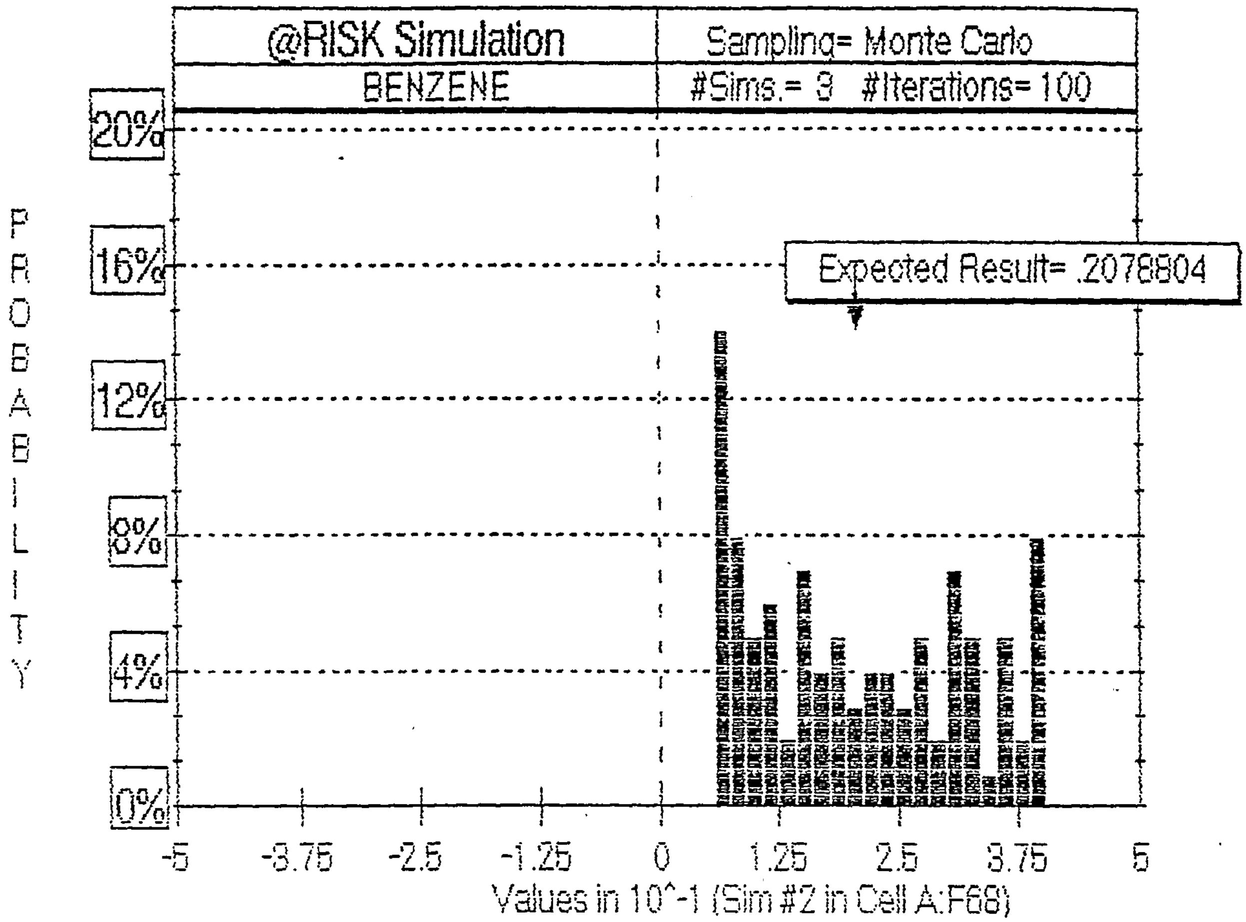
	Inputs
z = Unsat. depth (m)	1.75
a = Dispersivity (m)	0.2
Cs = Soil Conc. (mg/Kg)	0.36
Koc = Oct/H2O coeff. (L/Kg)	65
foc = Organic Carbon	0.055
sb = soil bulk density (Kg/L)	2.65
por = soil porosity	0.3
Ksat = Vert. Hydraulic Cond. (m/d)	0.185
k1 = Soil decay (d-1)	0.0625
k2 = Water decay (d-1)	0.00893
t = time (d)	3650
ks = Source decay rate (d-1)	0.00009

	Values
vz = Seepage Vel. (m/d)	0.617
Kd = Koc*foc (L/Kg)	3.575
Rd = Retardation ()	32.58
D = Dipersion Coeff. (m2/d)	0.123
k = Overall decay (d-1)	0.0609
Co = Initial Conc. (mg/L)	0.011
R =	1286.190
S =	0.114
A1 =	9.058
A2 =	9.528
erf(A1) =	1.00000000 *
erf(A2) =	1.00000000 *
erfc(A2) =	0.00000000 *
C = Conc. at"z" (mg/L)	0.007956308

** PRG For Leaching **

Chemical = Benzene

CGW = Groundwater PRG (mg/L)	0.005
Csoil = Soil PRG (mg/Kg)	0.226



@RISK Simulation
Sampling= Monte Carlo
BENZENE
#Sims.= 3 #Iterations= 100
Expected Result= .2078804
PROBABILITY
20%
16%
12%
8%
4%
0%
-5
-3.75
-2.5
-1.25
0
1.25
2.5
3.75
5
Values in 10^-1 (Sim #2 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = 1,2-(t)Dichloroethene

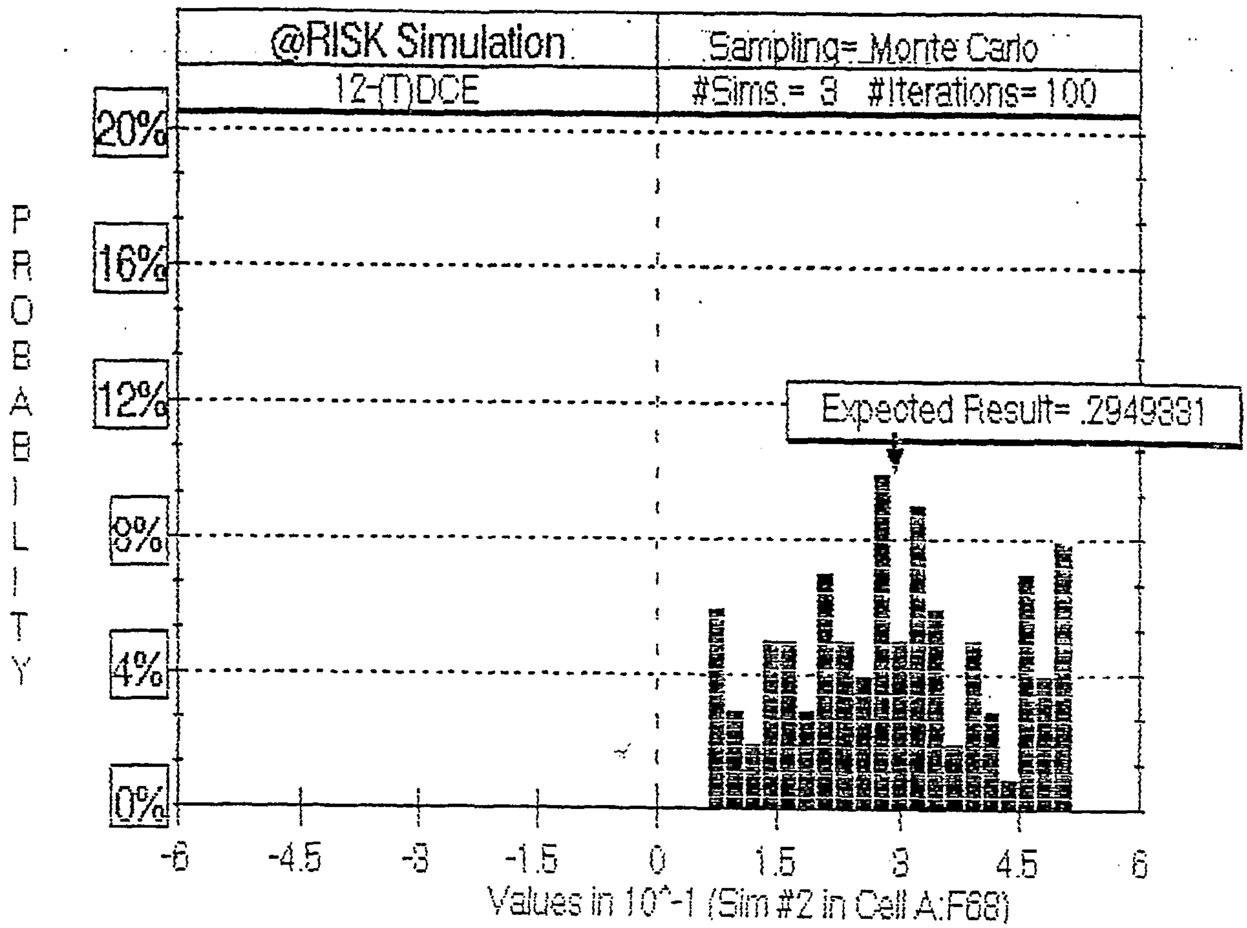
	Inputs
z = Unsat. depth (m)	1.75
a = Dispersivity (m)	0.2
Cs = Soil Conc. (mg/Kg)	0.36
Koc = Oct/H2O coeff. (L/Kg)	59
foc = Organic Carbon	0.055
sb = soil bulk density (Kg/L)	2.65
por = soil porosity	0.3
Ksat = Vert. Hydraulic Cond. (m/d)	0.185
k1 = Soil decay (d-1)	0.0111
k2 = Water decay (d-1)	0.0111
t = time (d)	3650
ks = Source decay rate (d-1)	0.00009

	Values
vz = Seepage Vel. (m/d)	0.617
Kd = Koc*foc (L/Kg)	3.245
Rd = Retardation ()	29.66
D = Dipersion Coeff. (m2/d)	0.123
k = Overall decay (d-1)	0.0111
Co = Initial Conc. (mg/L)	0.012
R =	1286.190
S =	0.114
A1 =	9.514
A2 =	9.964
erf(A1) =	1.00000000 *
erf(A2) =	1.00000000 *
erfc(A2) =	0.00000000 *
C = Conc. at"z" (mg/L)	0.008738148

** PRG For Leaching **

Chemical = 1,2-(t)Dichloroethene

CGW = Groundwater PRG (mg/L)	0.007
Csoil = Soil PRG (mg/Kg)	0.288


@RISK Simulation
Sampling= Monte Carlo
12-(T)DCE
#Sims.= 3 #Iterations= 100
PROBABILITY
20%
16%
12%
8%
4%
0%
Expected Result= .2949331
-6
-4.5
-3
-1.5
0
1.5
3
4.5
6
Values in 10^-1 (Sim #2 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = 1,1-Dichloroethene

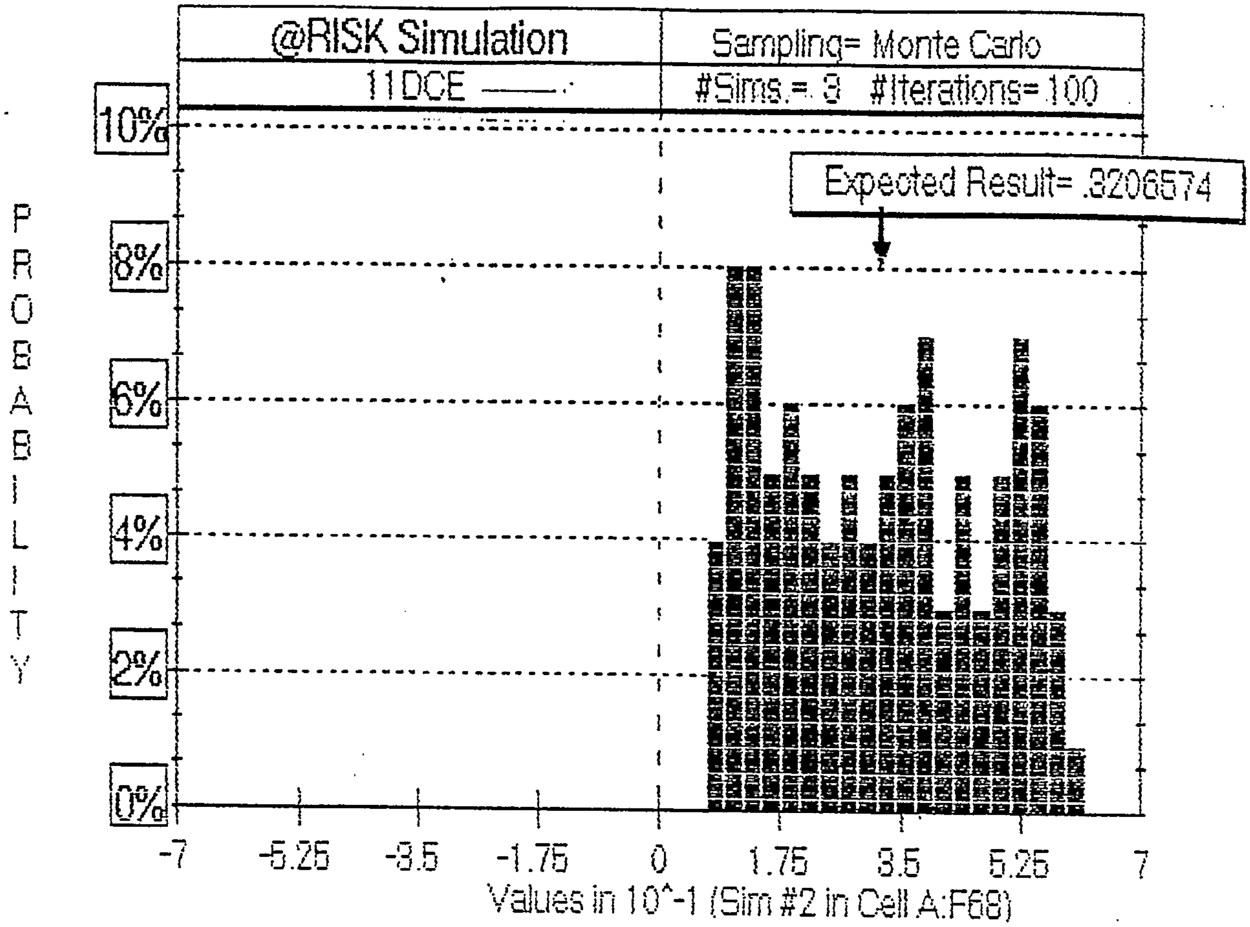
		Inputs
z =	Unsat. depth (m)	1.75
a =	Dispersivity (m)	0.2
Cs =	Soil Conc. (mg/Kg)	0.36
Koc =	Oct/H2O coeff. (L/Kg)	65
foc =	Organic Carbon	0.055
sb =	soil bulk density (Kg/L)	2.65
por =	soil porosity	0.3
Ksat =	Vert. Hydraulic Cond. (m/d)	0.185
k1 =	Soil decay (d-1)	0.0111
k2 =	Water decay (d-1)	0.0111
t =	time (d)	3650
ks =	Source decay rate (d-1)	0.00009

		Values	
vz =	Seepage Vel. (m/d)	0.617	
Kd =	Koc*foc (L/Kg)	3.575	
Rd =	Retardation ()	32.58	
D =	Dipersion Coeff. (m2/d)	0.123	
k =	Overall decay (d-1)	0.0111	
Co =	Initial Conc. (mg/L)	0.011	
R =		1286.190	
S =		0.114	
A1 =		9.058	
A2 =		9.528	
erf(A1) =		1.00000000	*
erf(A2) =		1.00000000	*
erfc(A2) =		0.00000000	*
C =	Conc. at"z" (mg/L)	0.007956308	

** PRG For Leaching **

Chemical = 1,1-Dichloroethene

CGW =	Groundwater PRG (mg/L)	0.007
Csoil =	Soil PRG (mg/Kg)	0.317


@RISK Simulation
Sampling= Monte Carlo
11DCE
#Sims.= 3 #Iterations= 100
Expected Result= .3206574
PROBABILITY
10%
8%
6%
4%
2%
0%
-7
-5.25
-3.5
-1.75
0
1.75
3.5
5.25
7
Values in 10^-1 (Sim #2 in Cell A:F68)

ELEMENT NUMBER 1. ONE-DIMENSIONAL MASS TRANSPORT THROUGH THE UNSATURATED ZONE.

Chemical Name = Toluene

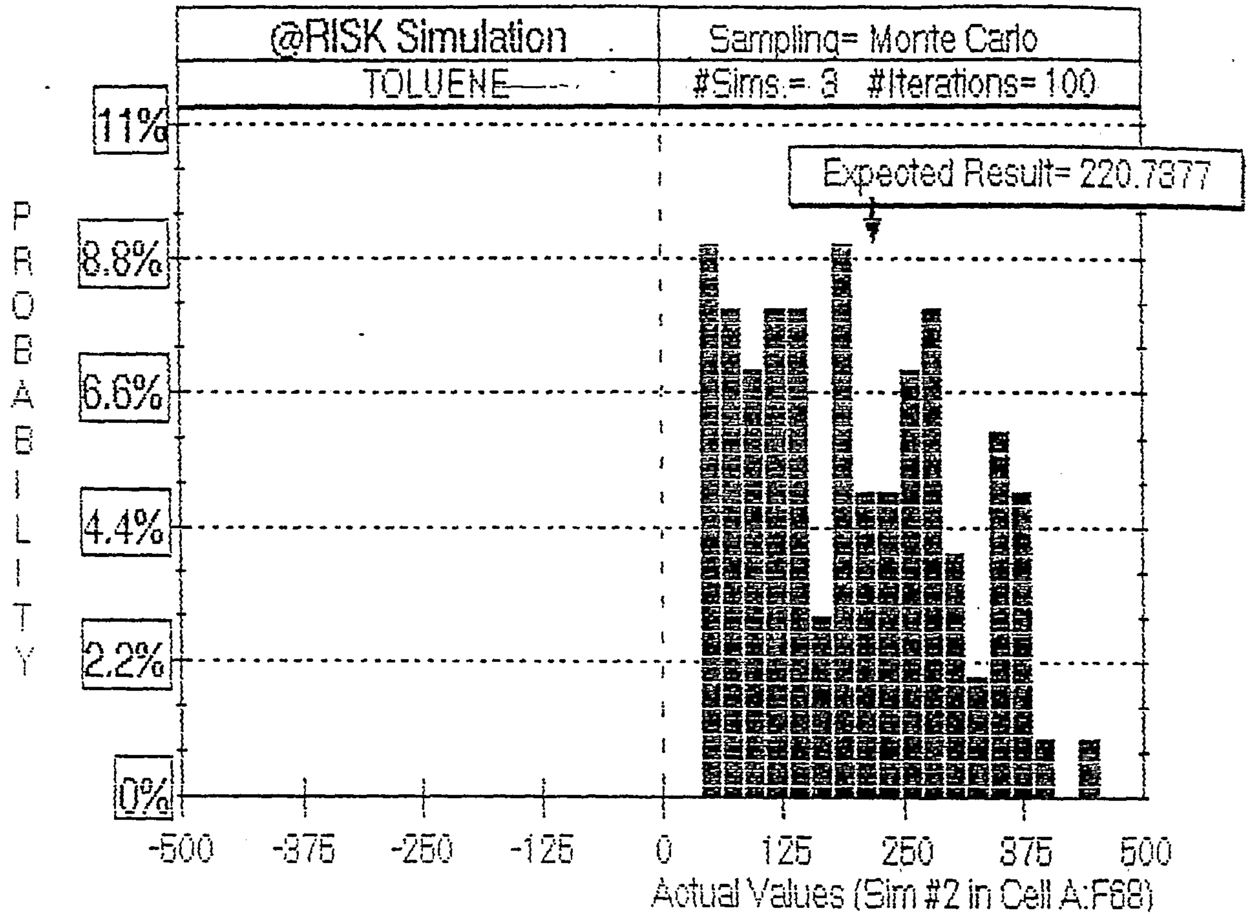
	Inputs
z = Unsat. depth (m)	1.75
a = Dispersivity (m)	0.2
Cs = Soil Conc. (mg/Kg)	0.36
Koc = Oct/H2O coeff. (L/Kg)	300
foc = Organic Carbon	0.055
sb = soil bulk density (Kg/L)	2.65
por = soil porosity	0.3
Ksat = Vert. Hydraulic Cond. (m/d)	0.185
k1 = Soil decay (d-1)	0.0455
k2 = Water decay (d-1)	0.00476
t = time (d)	3650
ks = Source decay rate (d-1)	0.00009

	Values	
vz = Seepage Vel. (m/d)	0.617	
Kd = Koc*foc (L/Kg)	16.500	
Rd = Retardation ()	146.75	
D = Dipersion Coeff. (m2/d)	0.123	
k = Overall decay (d-1)	0.0452	
Co = Initial Conc. (mg/L)	0.002	
R =	1286.190	
S =	0.114	
A1 =	3.879	
A2 =	4.878	
erf(A1) =	0.99999874	*
erf(A2) =	1.00000000	*
erfc(A2) =	0.00000000	*
C = Conc. at"z" (mg/L)	0.001766335	

** PRG For Leaching **

Chemical = Toluene

CGW = Groundwater PRG (mg/L)	1
Csoil = Soil PRG (mg/Kg)	203.812


@RISK Simulation
Sampling= Monte Carlo
TOLUENE
#Sims = 3 #Iterations= 100
Expected Result= 220.7377
PROBABILITY
11%
8.8%
6.6%
4.4%
2.2%
0%
-500
-375
-250
-125
0
125
250
375
500
Actual Values (Sim #2 in Cell A:F68)

Enclosure (3)
Proposed Direct Discharge Effluent Limits

PROPOSED DIRECT DISCHARGE EFFLUENT LIMITS
CAMP ALLEN LANDFILL SOIL AND GROUNDWATER REMEDIATION
SOIL VAPOR EXTRACTION AND PUMP AND TREAT
NAVAL BASE, NORFOLK, VIRGINIA

FACILITY NAME AND ADDRESS:	Naval Base, Norfolk Attn: Code N4, Ms. C. Barnett 1530 Gilbert Street, Suite 200 Norfolk, Virginia 23511-2797
OWNER CONTACT:	Commander Naval Base Norfolk 1530 Gilbert Street Norfolk, Virginia 23511-2797 Phone: (804) 444-4221
WATER TREATMENT SYSTEM:	Schematic attached.
SOURCE OF DISCHARGE:	Pump and treat of groundwater and soil vapor extraction
DISCHARGE FLOW RATE:	50,000 to 570,000 gallons per day
DISCHARGE POINT:	Bousch Creek State Plane Coordinate System N 225,000 E 2,641,500

CONTAMINANTS DETECTED:

acetone
benzene
2-butanone
chlorobenzene
chloroethane
chloroform
dichlorodifluoromethane
1,2- dichloroethane
1,2- dichloroethene
ethylbenzene
tetrachloroethene
toluene
1,1,1- trichloroethane
trichloroethene
trichlorofluoromethane
vinyl chloride
xylenes
phenol

Note: The above list is all the contaminants detected during the Remedial Investigation of this site. The discharge level that follows is based on VR 680-14, Water Quality Standards for discharge to surface water and does not include all the contaminants detected. See SPECIAL CONDITIONS for further explanation.

PROPOSED DIRECT DISCHARGE EFFLUENT LIMITS
CAMP ALLEN LANDFILL SOIL AND GROUNDWATER REMEDIATION
SOIL VAPOR EXTRACTION AND PUMP AND TREAT
NAVAL BASE, NORFOLK, VIRGINIA

DISCHARGE LEVEL: Trichloroethene 807 ug/l (based on Va WQ Stds for Surface Discharge)

Note: The Va WQ Stds are used as an end of pipe limit specifically for the low flow condition that exists at the site.

ESTIMATED DATE TO BEGIN DISCHARGE: August 1995

ESTIMATED DURATION OF DISCHARGE: 15 Years

TESTING FREQUENCY:

All test samples will be a single grab sample. Testing will done for Trichloroethene on a monthly basis for the first 2 years of operation. Thereafter, testing will be performed on a quarterly basis. Testing for additional contaminants will be done on a yearly basis for the first 5 years. Thereafter, only if any contaminant has been detected above Va WQ Stds for the last two years. The additional contaminants are being tested for based on the results of the Remedial Investigation, however, they do not exceed any Applicable, or Relevant and Appropriate Requirement (ARAR) applicable to this site (see SPECIAL CONDITIONS section). Testing results will be submitted monthly to DEQ TRO.

TEST METHOD OR ANALYSIS OF CONTAMINANTS MONITORED: 40 CFR 136 (See chart below)

Contaminant	***Test Method***	***Frequency***
Volatiles		
Trichloroethene	EPA 601	Monthly
Benzene	EPA 602	Yearly
Chloroform	EPA 601	Yearly
1,2-Dichloroethane	EPA 601	Yearly
1,2-Dichloroethene	EPA 601	Yearly
Ethylbenzene	EPA 601	Yearly
Tetrachloroethene	EPA 601	Yearly
Toluene	EPA 601	Yearly
1,1,1-Trichloroethane	EPA 601	Yearly
Vinyl Chloride	EPA 601	Yearly
Semi-Volatiles		
Phenol	EPA 604	Yearly
Other		
Total Suspended Solids	EPA 160.2	Yearly

PROPOSED DIRECT DISCHARGE EFFLUENT LIMITS
CAMP ALLEN LANDFILL SOIL AND GROUNDWATER REMEDIATION
SOIL VAPOR EXTRACTION AND PUMP AND TREAT
NAVAL BASE, NORFOLK, VIRGINIA

SPECIAL CONDITIONS:

The following list of contaminants were detected during the Remedial Investigation phase of the Camp Allen Landfill (see references listed below chart) and were not included in the discharge levels for the following reasons:

(1) There were low levels of the contaminants detected, as well as infrequent detections;
(2) These contaminants do not have Va water quality standards associated with them.

CONTAMINANT	**REASON FOR NOT INCLUDING DISCHARGE LEVEL**	**Maximum Concen-tration Found** **ug/l (ppb)**	**VA Water Quality Standards** **ug/l**	**Number of wells where detected** (out of 52 wells total)
acetone	No Va WQ Std exists for this contaminant.	1400	NA	2
2-butanone	No Va WQ Std exists for this contaminant.	3	NA	1
chlorobenzene	No Va WQ Std exists for this contaminant.	15	NA	1
chloroethane	No Va WQ Std exists for this contaminant.	240	NA	2
dichlorodifluoro-methane	No Va WQ Std exists for this contaminant.	5.4	NA	3
trichlorofluoro-methane	No Va WQ Std exists for this contaminant.	840	NA	2
xylenes	No Va WQ Std exists for this contaminant.	62	NA	4

<u>References</u>:

(a) *Final Camp Allen Landfill Remedial Investigation Report, Norfolk Naval Base, Norfolk, Virginia (Baker Environmental, July 1994)*
(b) *Final Remedial Design Work Plan, Camp Allen Landfill, Naval Base Norfolk, Virginia (Baker Environmental, May 1994)*

PROPOSED DIRECT DISCHARGE EFFLUENT LIMITS
CAMP ALLEN LANDFILL SOIL AND GROUNDWATER REMEDIATION
SOIL VAPOR EXTRACTION AND PUMP AND TREAT
NAVAL BASE, NORFOLK, VIRGINIA

SPECIAL CONDITIONS (cont'd)

The following contaminants listed are to be ***tested yearly***. They are not included in the discharge levels because they do not exceed the Va Water Quality Standards. However, their maximum concentrations and frequency of detection warrant further testing during the remedial action. The maximum anticipated influent concentration to the treatment system is also provided. The rationale for the anticipated maximum influent concentration is provided in Note 1 at the end of the table.

CONTAMINANT	**REASON FOR NOT INCLUDING DISCHARGE LEVEL**	**Anticipated Maximum Influent Concentration** **ug/l**	**Maximum Concentration Found (*)** **ug/l**	**VA Water Quality Stds** **ug/l**	**Number of wells where detected** (out of 52 wells total)
benzene	The Va WQ Stds are higher than the anticipated maximum influent concentration (Note 1)	47.4	210	710	9
chloroform	The Va WQ Stds are higher than the anticipated maximum influent concentration. (Note 1)	1.2	1.7	4,700	1
1,2-dichloroethane	The Va WQ Stds are higher than the anticipated maximum influent concentration (Note 1)	37	660	990	9
1,2-dichloroethene	No Va WQ Std exists for this contaminant.	895	2200	NA	22
ethylbenzene	The Va WQ Stds are higher than the anticipated maximum influent concentration. (Note 1)	0.003	3.9	29,000	1
tetrachloro-ethene	The Va WQ Stds are higher than the anticipated maximum influent concentration (Note 1)	0.81	3.7	3,519	1

PROPOSED DIRECT DISCHARGE EFFLUENT LIMITS
CAMP ALLEN LANDFILL SOIL AND GROUNDWATER REMEDIATION
SOIL VAPOR EXTRACTION AND PUMP AND TREAT
NAVAL BASE, NORFOLK, VIRGINIA

SPECIAL CONDITIONS (cont'd)
Table (cont'd)

CONTAMINANT	**REASON FOR NOT INCLUDING DISCHARGE LEVEL**	**Anticipated Maximum Influent Concentration** **ug/l**	**Maximum Concentration Found (*)** **ug/l**	**VA Water Quality Stds** **ug/l**	**Number of wells where detected** (out of 52 wells total)
toluene	The Va WQ Stds are higher than the anticipated maximum influent concentration (Note 1)	0.45	8	200,000	4
1,1,1-trichloroethane	The Va WQ Stds are higher than the anticipated maximum influent concentration (Note 1)	0.3	1.6	807	3
vinyl chloride	The Va WQ Stds are higher than the anticipated maximum influent concentration (Note 1)	556	1600	5,250	11
phenol	The Va WQ Stds are higher than the anticipated maximum influent concentration.	1800 (Worst Case Assumption)	1800**	4,600,000	1**

* - Reference the *Final Remedial Design Work Plan, Camp Allen Landfill, Naval Base Norfolk, Virginia (Baker Environmental, May 1994)*

** - Reference the *Final Camp Allen Landfill Remedial Investigation Report, Norfolk Naval Base, Norfolk, Virginia (Baker Environmental, July 1994)*

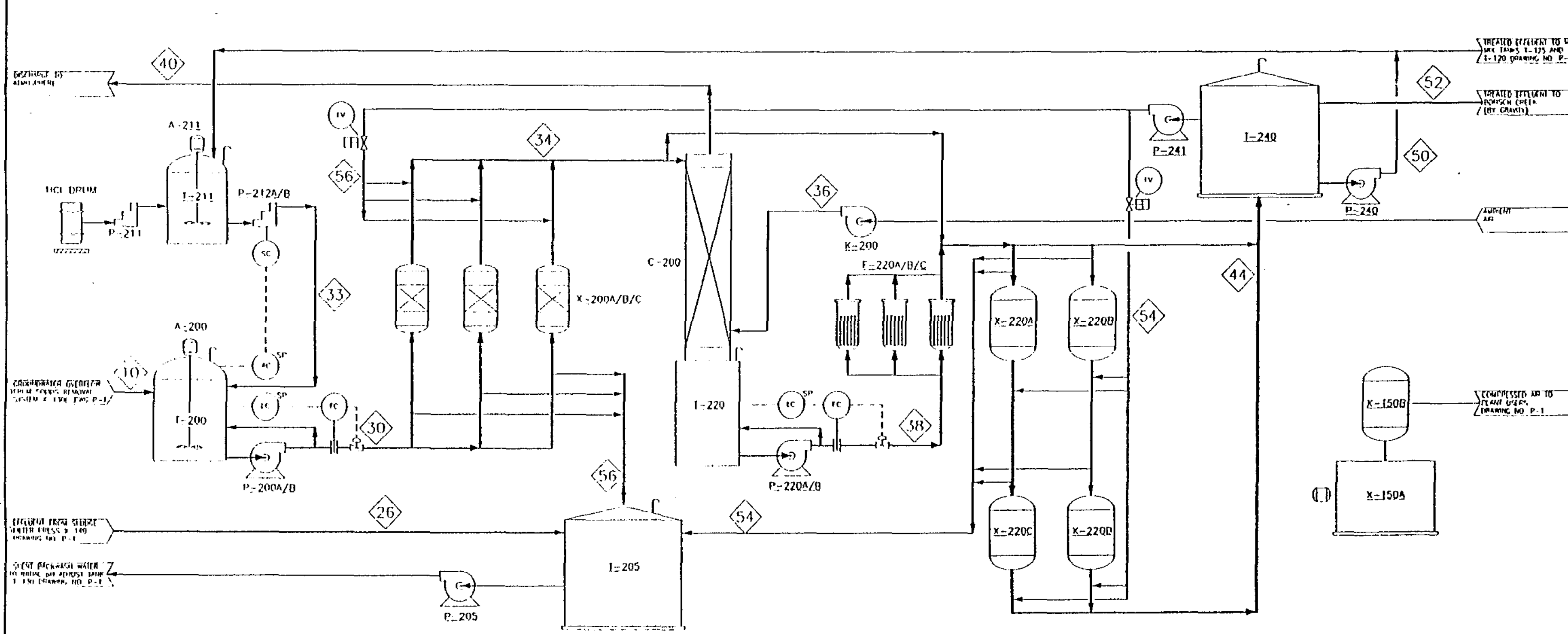
NOTE 1: Calculation of the Maximum Anticipated Influent Concentration

The final round of groundwater sampling was designated as the "Pre-design groundwater sampling." The results of the pre-design groundwater sampling (See Table 3) were divided into six aquifer categories for purposes of composite influent criteria. Those aquifer categories were as follows:

Area A1 Shallow and Deep Aquifer
Area A2 Shallow and Deep Aquifer
Area B Shallow and Deep Aquifer

Areas A1 and B were used to develop the influent characteristics for the treatment plant. From each aquifer category, the average concentration of each VOC was multiplied by the estimated flow contribution from that aquifer (see Table 1). The result was totaled with the other categories and the total was then divided by the total flow to the treatment plant. The result was the composited average concentration (See Table 2). The same calculation was performed for the peak concentration of VOCs in each aquifer category to estimate the "***Maximum Anticipated Influent Concentration***" of each VOC.

X-150A RECIPROCATING AIR COMPRESSOR/DRYER | X-150B COMPRESSED AIR RECEIVER TANK | C-200 AIR STRIPPING COLUMN | K-200 AIR STRIPPING COLUMN FAN | P-200A/B AIR STRIPPER FEED PUMPS | T-200 FINAL pH ADJUST TANK | X-200A/B/C SAND FILTERS | P-205 SPENT BACKWASH PUMP | T-205 SPENT BACKWASH HOLDING TANK | P-211 37% HCl FEED PUMP | A-211 HCl MIX TANK AGITATOR | T-211 HCl MIX TANK | P-212A/B 10% HCl FEED PUMPS | F-220A/B/C CARTRIDGE FILTERS | P-220A/B GAC FEED PUMPS | T-220 AIR STRIPPER EFFLUENT HOLDING TANK | X-220A/B/C/D LIQUID PHASE GAC ADSORBERS | P-240 CHEMICAL MIX TANK FEED PUMP | T-240 TREATED EFFLUENT HOLDING TANK | P-241 BACKWASH WATER PUMP



SYSTEM MATERIAL BALANCE

Design Basis / Stream	Units	10	30	33	34	36	38	40	44	*50	52	***54	***56
Mass Flow	lb/hr	150,612.7	150,615.2	2.49	150,615.2	13,500.0	150,605.2	13,510.3	150,605.2	1,085.4	149,519.8	100,107.0	150,160.4
Volume Flow	gpm (acfm)	300.9	300.9	0.0050	300.9	(3,000.0)	300.9	(3,000.0)	300.9	130.1	298.7	200.0	300.0
Temperature	F	60.0	60.0	60.0	60.0	60.0	30.0	55.0	25.0	60.0	60.0	60.0	60.0
Pressure	psig (W.C.)	0.0	50.0	20.0	40.0	(20.0)	40.0	(30.0)	35.0	50.0	50.0	50.0	50.0
Density	lb/ft3 (SG)	62.4	62.4	62.4	62.4	0.075	62.4	0.080	62.4	62.4	62.4	62.4	62.4
Molecular Weight		NA	NA	NA	NA	29.0	NA	29.0	NA	NA	NA	NA	NA
Viscosity	cp	1.0	1.0	1.2	1.0	NA	1.0	NA	1.0	1.0	1.0	1.0	1.0
pH		9.5	7.0	11	7.0	NA	7.0	NA	7.0	7.0	7.0	7.0	7.0
Composition													
H2O	wt%	> 99	> 99	>89	> 99	0.8	> 99	0.9	> 99	> 99	> 99	> 99	> 99
Acetone	ug/l	262	262	236.07	262.3	0	236.1	293	236.07	236.07	236.07	236.07	236.07
Benzene	ug/l	47	47	5	47	0	2.37	502	5	5	5	5	5
Chlorobenzene	ug/l	3	3	0.14	3	0	0.14	30	0.14	0.14	0.14	0.14	0.14
Chloroethane	ug/l	19	19	0.97	19	0	0.97	205	0.97	0.97	0.97	0.97	0.97
Chloroform	ug/l	1	1	0.06	1	0	0.06	13	0.06	0.06	0.06	0.06	0.06
Dichlorofluoromethane	ug/l	1	1	0.05	1	0	0.05	11	0.05	0.05	0.05	0.05	0.05
1,2 Dichloroethane	ug/l	37	37	5	37	0	1.85	392	5	5	5	5	5
1,2 Dichloroethene	ug/l	895	895	7	895	0	44.8	9,486	7	7	7	7	7
Tetrachloroethane	ug/l	1	1	0.04	0.81	0	0.04	9	0.04	0.04	0.04	0.04	0.04
Toluene	ug/l	0.45	0.45	0.02	0.45	0	0.02	5	0.02	0.02	0.02	0.02	0.02
1,1,1-Trichloroethane	ug/l	0.30	0.30	0.02	0.3	0	0.02	3	0.02	0.02	0.02	0.02	0.02
Trichloroethene	ug/l	76	76	3.81	76.2	0	3.81	808	3.81	3.81	3.81	3.81	3.81
Trichlorofluoromethane	ug/l	157	157	100	157	0	7.85	1,664	100	100	100	100	100
Vinyl Chloride	ug/l	556	556	2	556	0	27.8	5,893	2	2	2	2	2
Xylenes	ug/l	12	12	0.59	11.8	0	0.59	125	0.59	0.59	0.59	0.59	0.59
Iron	ppm	0	0	0.30	0.30	0	0.30	0	0.30	0.30	0.30	0.30	0.30
Solids	ppm (%)	5	5	<1	<1	0	<1	0	<1	<1	<1	<1	<1
Polymer	wt%	0	0	0	0	0	0	0	0	0	0	0	0
HCl	wt%	0	0	10	0	0	0	0	0	0	0	0	0
NaOH	wt%	0	0	0	0	0	0	0	0	0	0	0	0
Air	wt%	0	0	0	0	99	0	>99	0	0	0	0	0

NOTES:

1. THE "*" INDICATES THAT THE FLOW SHOWN HAPPENS ONLY WHEN MIXING A NEW BATCH OF POLYMER, ACID OR CAUSTIC SOLUTION.
2. THE "***" INDICATES THAT THIS IS A BACKWASH WATER FLOWRATE THAT IS INTERMITTENT.

THIS DRAWING IS DIAGRAMMATIC AND REQUIRES FURTHER DEVELOPMENT IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

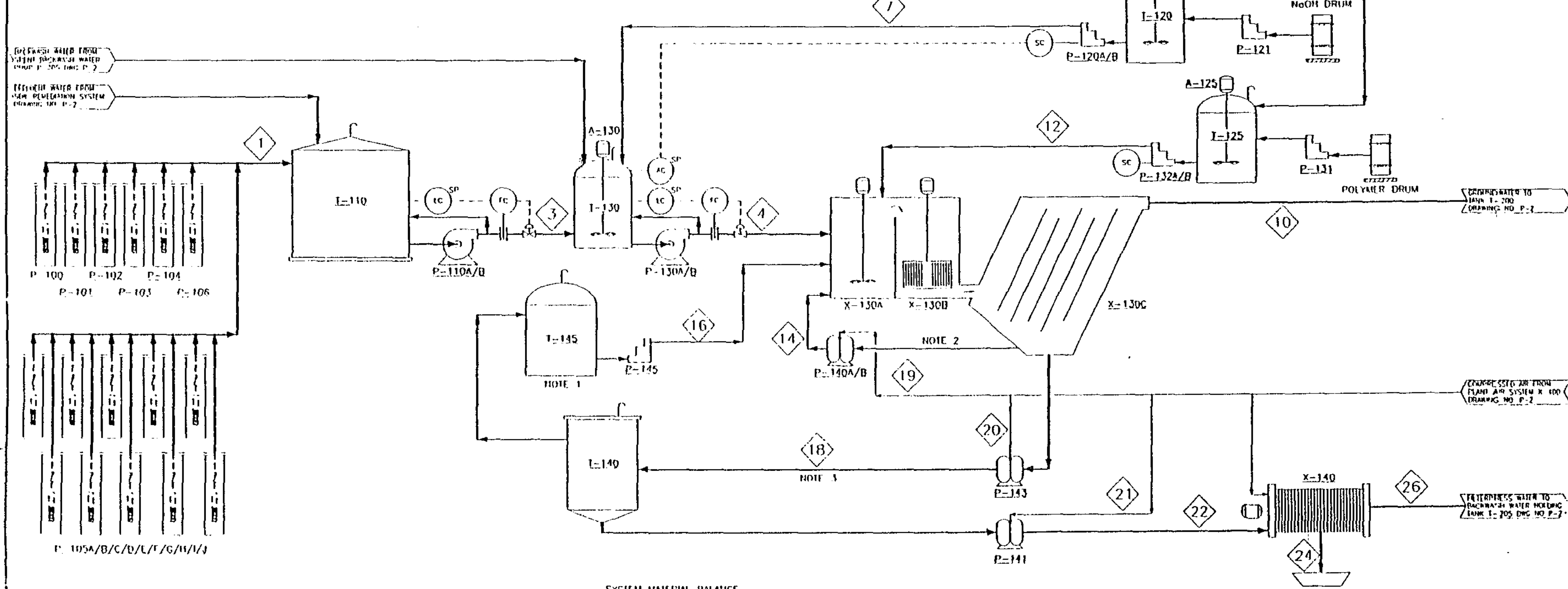
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND — NORFOLK, VIRGINIA
ATLANTIC DIVISION
NAVAL STATION — NAVAL BASE NORFOLK, VA
CAMP ALLEN LANDFILL
SOIL AND GROUNDWATER REMEDIATION

Baker — BAKER ENVIRONMENTAL, INC.

SCALE N.T.S.
CONSTR. CONTR. NO. N62470-93-B
NAVFAC DRAWING NO. 4284875
SHEET P-2

P-100/1/2/3/4/6	P-105A/B/C/D/E/F/G/H/I/J	P-110A/B	T-110	A-120	P-120A/B	T-120	P-121	T-125	A-130	P-130A/B	T-130	X-130A	X-130B	X-130C	P-131	P-132A/B	P-140A/B	T-140
AREA AT GROUNDWATER EXTRACTION PUMPS	AREA B GROUNDWATER EXTRACTION PUMPS	GROUNDWATER FEED PUMPS	GROUNDWATER FEED TANK	NaOH MIX TANK AGITATOR	NaOH FEED PUMPS	NaOH MIX TANK	50% NaOH FEED PUMP	POLYMER MIX TANK	INITIAL pH ADJUST TANK AGITATOR	SOLIDS REMOVAL FEED PUMPS	INITIAL pH ADJUST TANK	FLASH MIX TANK	FLOCCULATION TANK	INCLINE PLATE CLARIFIER	POLYMER DRUM PUMP	POLYMER FEED PUMPS	SLUDGE RECYCLE PUMPS	SLUDGE THICKENING TANK

X-140	P-141	P-143	P-145	T-145
PLATE & FRAME FILTER PRESS	FILTER PRESS FEED PUMP	SLUDGE BLOWDOWN PUMP	SUPERNATANT PUMP	SUPERNATANT SURGE TANK



SYSTEM MATERIAL BALANCE

Design Basis / Stream	Units	1	3	4	7	10	12	14	16	** 18	* 19	* 20	* 21	* 22	* 24	* 26	*50			
Mass Flow	lb/hr	150,142.8	150,142.8	150,160.4	17.660	150,612.7	452.3	12,049.0	10,010.7	207.0	91.7	9.2	91.7	13,897.1	1,985.3	11,911.8	1,085.4			
Volume Flow	gpm (acfm)	300.0	300.0	300.0	0.0283	300.9	0.88	22.8	20.0	2.3	(8.5)	(0.8)	(2.6)	25.0	3.1	23.8	130.1			
Temperature	F	55.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0			
Pressure	psig (*W.C.)	20.0	50.0	30.0	10.0	0.0	20.0	20.0	20.0	20.0	20.0	20.0	100.0	80.0	0.0	0.0	50.0			
Density	lb/ft3 (SG)	62.4	62.4	62.4	77.8	62.4	64.2	66.0	62.4	66.0	0.18	0.18	0.60	69.3	81.1	62.4	62.4			
Molecular Weight		NA	NA	NA	NA	NA	NA	NA	NA	NA	29	29	29	NA	NA	NA	NA			
Viscosity	cp	1.0	1.0	1.0	1.2	1.0	1.0	7.0	5.0	7.0	NA	NA	NA	7.0	NA	1.0	1.0			
pH		5.0	5.0	9.5	14.4	9.5	7.0	9.5	9.5	9.5	NA	NA	NA	9.5	NA	9.5	7.0			
Composition																				
H2O	wt%	> 99	> 99	> 99	80	> 99	> 99	>97	>98	>97	0	0	0	>97	64	> 99	> 99			
Acetone	ug/l	262	262	262	0	262	236	262	262	262.3	0	0	0	262	262	262	236			
Benzene	ug/l	47	47	47	0	47	5	47	47	47.4	0	0	0	47	47	47	5			
Chlorobenzene	ug/l	3	3	3	0	3	0	3	3	2.8	0	0	0	3	3	3	0			
Chloroethane	ug/l	19	19	19	0	19	1	19	19	19.3	0	0	0	19	19	19	1			
Chloroform	ug/l	1	1	1	0	1	0	1	1	1.2	0	0	0	1	1	1	0			
Dichlorofluoromethane	ug/l	1	1	1	0	1	0	1	1	1	0	0	0	1	1	1	0			
1,2 Dichloroethane	ug/l	37	37	37	0	37	5	37	37	37	0	0	0	37	37	37	5			
1,2 Dichloroethene	ug/l	895	895	895	0	895	7	895	895	895	0	0	0	895	895	895	7			
Tetrachloroethane	ug/l	1	1	1	0	1	0	0.8	1	0.8	0	0	0	1	1	1	0			
Toluene	ug/l	0.45	0.45	0.45	0	0.45	0.02	0.45	0.45	0.45	0	0	0	0.45	0.45	0.45	0.02			
1,1,1 Trichloroethane	ug/l	0.30	0.30	0.30	0	0.30	0.02	0.30	0.30	0.30	0	0	0	0.30	0.30	0.30	0.02			
Trichloroethene	ug/l	76	76	76	0	76	4	76	76	76	0	0	0	76	76	76	4			
Trichlorofluoromethane	ug/l	157	157	157	0	157	100	157	157	157	0	0	0	157	157	157	100			
Vinyl Chloride	ug/l	556	556	556	0	556	2	556	556	556	0	0	0	556	556	556	2			
Xylenes	ug/l	12	12	12	0	12	1	12	12	12	0	0	0	12	12	12	1			
Iron	ppm	16	16	0	0	0.3	0	0	0	0	0	0	0	0	0	0	1			
Solids	ppm (%)	15	15	22	0	5	<1	515	100	30,000	0	0	0	50,000	(35)	5	<1			
Polymer	wt%	0	0	0	0	0	0.10	0	0	0	0	0	0	0	0	0	0			
HCl	wt%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NaOH	wt%	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0			
Air	wt%	0	0	0	0	0	0	0	0	0	100	100	100	0	0	0	0			

NOTES:

1. PUMP OUT OF T-145 IS INTERMITTENT WITH A FLOW RATE AS SHOWN IN 16.
2. NORMAL FLOW IS CONTINUOUS SLUDGE RECYCLE.
3. THE "**" INDICATES THAT THE FLOW SHOWN IS THE BLOWDOWN RATE OF SLUDGE TO TANK T-140. THE BLOWDOWN FLOW RATE WILL OCCUR ONCE EVERY HOUR FOR TEN (10) MINUTES.
4. THE "*" INDICATES THAT THE FLOW IS INTERMITTANT.

THIS DRAWING IS DIAGRAMMATIC AND REQUIRES FURTHER DEVELOPMENT IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION NORFOLK, VIRGINIA
NAVAL STATION NORFOLK, VIRGINIA
CAMP ALLEN LANDFILL
SOIL AND GROUNDWATER REMEDIATION
PROCESS FLOW DIAGRAM

Baker ENVIRONMENTAL

SCALE: NTS
62470-93-B-38
4284874
P-1

MANUAL VALVES

- ANGLE VALVE
- BALL VALVE
- CLOSED BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- DIAPHRAGM VALVE
- GATE VALVE
- GLOBE VALVE
- NEEDLE VALVE
- PLUG VALVE
- ROTARY VALVE
- 3-WAY VALVE
- 4-WAY VALVE

NOTE:
VALVES SHOWN SOLID ARE CLOSED (EXCEPT BALL

CONTROL VALVES

- DIAPHRAGM ACTUATOR
- DIAPHRAGM ACTUATOR WITH POSITIONER
- ELECTRIC MOTOR ACTUATOR
- HYDRAULIC ACTUATOR
- PNEUMATIC ACTUATOR
- PNEUMATIC CYLINDER ACTUATOR
- REGULATOR WITH EXTERNAL TAP
- SELF CONTAINED REGULATOR
- 2-WAY SOLENOID
- 3-WAY SOLENOID
- 4-WAY SOLENOID

FC INDICATES "FAIL CLOSED"
FL INDICATES "FAIL LAST"
FO INDICATES "FAIL OPEN"

SAFETY RELIEFS

- PRESSURE SAFETY VALVE (PSV)
- RUPTURE DISK (PRESSURE)
- VACUUM SAFETY VALVE (PSV)
- VACUUM AND PRESSURE SAFETY VALVE

PIPING

- UTILITY PIPING
- SECONDARY PROCESS PIPING
- MAIN PROCESS PIPING
- LINE BREAK, PIPING OR INSTRUMENTATION
- CC — INSULATED PIPING (COLD CONSERVATION)
- HC — INSULATED PIPING (HEAT CONSERVATION)
- PP — INSULATED PIPING (PERSONNEL PROTECTION)
- ET — INSULATED AND ELECTRICAL TRACED PIPING
- ST — INSULATED AND SOLVENT TRACED PIPING
- ST — INSULATED AND STEAM TRACED PIPING
- INSULATED AND JACKETED PIPING
- FLANGED NOZZLE CONNECTION
- THREADED CAP OR CONNECTION
- IA — INSTRUMENT AIR SUPPLY AND FILTER/REGULATOR
- D — SIGHT GLASS
- T — TRAP
- AE — AIR ELIMINATOR
- D — POP DRAIN
- SP — SAMPLE PORT
- VB — VACUUM BREAKER
- BLIND FLANGE/FLANGES
- THREADED CAP
- DIAPHRAGM SEAL
- DRAIN
- EDUCTOR
- EXPANSION JOINT
- FLEXIBLE CONNECTION
- HOSE CONNECTION
- REDUCER
- SLIP BLIND
- TIE-IN
- VENT TO ATMOSPHERE
- "Y" STRAINER
- INLINE STRAINER

INSTRUMENTS

- PANEL MOUNTED INSTRUMENT
- REAR PANEL MOUNTED INSTRUMENT
- LOCALLY MOUNTED INSTRUMENT
- INSTRUMENT FURNISHED WITH EQUIPMENT
- DISTRIBUTED CONTROL DISPLAYED ON CRT
- DISTRIBUTED CONTROL NON DISPLAY FUNCTION
- DISTRIBUTED CONTROL BLIND FUNCTION
- DISTRIBUTED CONTROL MANUAL BACKUP
- DISTRIBUTED CONTROL H: HIGH ALARM L: LOW ALARM
- LC — LEVEL GAUGE BOARD (WITH SEAL)
- LC — LEVEL GAUGE BOARD (WITHOUT SEAL)
- FE — ORIFICE PLATE
- RO — RESTRICTING ORIFICE
- FT — VORTEX SHEDDING FLOW TRANSMITTER
- FI — ROTAMETER/PURGE METER
- FT — TARGET FLOW METER
- FE — PITOT TUBE (OR ANNUBAR)
- FE — TURBINE OR PROPELLER FLOW SENSOR
- FE — MAGNETIC FLOW METER (SENSOR ELEMENT)

INSTRUMENTS

- FE — WEIR
- FQ — POSITIVE DISPLACEMENT FLOW TOTALIZING INDICATOR
- FT — SONIC FLOW TRANSMITTER (DOPPLER OR TRANSIT TIME)
- FX — FLOW STRAIGHTENING VANE
- TE — TEMPERATURE ELEMENT
- TE — TEMPERATURE ELEMENT FILLED SYSTEM
- FE — VENTURI FLOW ELEMENT
- OUTPUT FROM INTERLOCK LOGIC IN PLC
- INPUT TO INTERLOCK LOGIC IN PLC
- OUTPUT FROM INTERLOCK LOGIC IN FIELD OR BY RELAY
- INPUT TO INTERLOCK LOGIC IN FIELD OR BY RELAY
- LOGIC FUNCTION S - SUM
- TRANSDUCER FUNCTION
  - R - RESISTANCE
  - I - CURRENT
  - P - PNEUMATIC
  - MV - MILLIVOLTS
- AI — ANALOG INPUT
- DI — DIGITAL INPUT
- AO — ANALOG OUTPUT
- DO — DIGITAL OUTPUT
- • — ENERGIZED
- de — DE-ENERGIZED
- S/S — START/STOP
- E/S — ENABLE/STOP
- HOA — HAND OFF AUTOMATIC
- PB — PUSH BUTTON EMERGENCY STOP
- CSO — CAR SEAL OPEN
- CSC — CAR SEAL CLOSED

INSTRUMENT SIGNALS

- CAPILLARY TUBING
- ELECTRICAL SIGNAL
- HYDRAULIC
- PNEUMATIC TUBING
- SOFTWARE

MISCELLANEOUS

- CONSERVATION/BREATHING VENT
- CONTAINMENT PALLET
- EXTRACTION WELL
- VERTICAL CENTRIFUGAL PUMP
- RECIPROCATING AIR COMPRESSOR

LINE CODE

102-XXXXX-2"-GW

- LINE NUMBER
- PIPING SPECIFICATION
- LINE CONTENTS
- PIPING SIZE

SYMBOL	SERVICE
AA	AMBIENT AIR
AC	HYDROCHLORIC ACID SOLUTION
BD	BLOWDOWN
BW	BACKWASH
CAR	ACTIVATED CARBON
GW	GROUNDWATER
IA	INSTRUMENT AIR
NAH	SODIUM HYDROXIDE SOLUTION
A	PLANT AIR
PMR	POLYMER
PW	PROCESS WATER
SL	SLUDGE
TGW	TREATED EFFLUENT
V	VENT
BW	SPENT BACKWASH WATER

THIS DRAWING IS DIAGRAMMATIC AND REQUIRES FURTHER DEVELOPMENT IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

INSTRUMENT FUNCTION IDENTIFICATION SYMBOLS

	1st LETTER	2nd LETTER	3rd LETTER	4th LETTER	LAST LETTER
A	ANALYZER	ALARM	ALARM	ALARM	ALARM
B	BURNER (FLAME)				
C	CONTROL (LOOP)	CONTROLLER	CONTROLLER	CONTROLLER	CONTROLLER
D	DENSITY	DIFFERENTIAL			DRIVE OPERATOR
E	VOLTAGE	ELEMENT			
F	FLOW	RATIO	FLOW	FLOW	
G	GAUGE	GAUGE			GLASS
H	HAND (MANUAL)		HIGH	HIGH	HIGH
I	AMPERES	INDICATOR			INDICATOR
J	POWER				MIR FB & LCT
K	TIME (COUNT)				
L	LEVEL	LEVEL	LOW	LOW	LOW
M	MOISTURE				METER
N	USER'S CHOICE				
O	OPERATIONAL	ORIFICE			
P	PRESSURE	PRESSURE	PRESSURE		PNEUMATIC
Q	SPECIAL	INTEGRATE	INTEGRATE	INTEGRATE	INTEGRATE
R	RESTRICTING	RECORDER	RECORDER	RECORDER	RECORDER
S	SPEED SOLENOID	SAFETY/SWITCH	SWITCH	SWITCH	SWITCH
T	TEMPERATURE	TEMPERATURE	TEMPERATURE		TRANSMITTER
U	MULTIVARIABLE	MULTIVARIABLE			MULTIVARIABLE
V	VIBRATION	VALVE	VALVE	VALVE	VALVE
W	WEIGHT				WELL
X	UNCLASSIFIED				
Y	USER'S CHOICE				
Z	POSITION				COMPUTER
pH	pH				

Baker
BAKER ENVIRONMENTAL, INC
CORAOPOLIS, PENNSYLVANIA

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA
NAVAL STATION
NAVAL BASE, NORFOLK, VA
CAMP ALLEN LANDFILL
SOIL AND GROUNDWATER REMEDIATION
P&ID SYMBOLS AND LEGENDS

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Table 1
Groundwater Characteristics by Area and Aquifer
Volatile Organics Analysis
Camp Allen Landfill, Norfolk Naval Base, Norfolk, Virginia

Parameter	A1-Shallow			A1-Yorktown			A2-Shallow			A2-Yorktown			B-Shallow			B-Yorktown		
	Flow (GPM)	Avg (ug/l)	Max (ug/l)	Flow (GPM)	Avg (ug/l)	Max (ug/l)	Flow (GPM)	Avg (ug/l)	Max (ug/l)	Flow (GPM)	Avg (ug/l)	Max (ug/l)	Flow (GPM)	Avg (ug/l)	Max (ug/l)	Flow (GPM)	Avg (ug/l)	Max (ug/l)
Volatile Organics (ug/l)																		
Acetone	0.1	1.5	12	82	---	---	1	---	---	82	---	---	21	93.3	1400	9	---	---
Benzene	0.1	1.11	5.7	82	---	---	1	---	---	82	0.3	2.1	21	29.4	210	9	16	100
2-Butanone	0.1	0.38	3	82	---	---	1	---	---	82	---	---	21	---	---	9	---	---
Chlorobenzene	0.1	---	---	82	---	---	1	---	---	82	---	---	21	1	15	9	---	---
Chloroethane	0.1	---	---	82	---	---	1	---	---	82	---	---	21	---	---	9	32.7	240
Cloroform	0.1	---	---	82	0.19	1.7	1	---	---	82	---	---	21	---	---	9	---	---
Dichlorodifluoromethane	0.1	---	---	82	---	---	1	---	---	82	---	---	21	0.94	5.4	9	---	---
1,2-Dichloroethane	0.1	---	---	82	---	---	1	0.35	1.4	82	0.89	6.2	21	1.8	26	9	54.7	400
1,2-Dichloroethene (total)	0.1	1.1	8.8	82	87	660	1	16.4	56	82	109	280	21	355	2200	9	0.6	5.4
Ethylbenzene	0.1	0.49	3.9	82	---	---	1	---	---	82	---	---	21	---	---	9	---	---
Tetrachloroethene	0.1	---	---	82	---	---	1	---	---	82	---	---	21	0.29	4.3	9	---	---
Toluene	0.1	1.46	8	82	---	---	1	---	---	82	---	---	21	---	---	9	0.88	5.5
1,1,1-Trichloroethane	0.1	---	---	82	---	---	1	---	---	82	---	---	21	0.31	1.6	9	---	---
Trichloroethene	0.1	---	---	82	1.09	7.2	1	---	---	82	12.1	47	21	53.4	360	9	8	44
Trichlorofluoromethane	0.1	---	---	82	---	---	1	---	---	82	---	---	21	72.7	840	9	---	---
Vinyl Chloride	0.1	---	---	82	38.9	350	1	1.75	7	82	0.19	1.3	21	248	1600	9	---	---
Xylenes (total)	0.1	3.36	22	82	---	---	1	---	---	82	---	---	21	4.1	62	9	0.28	2.5

Table 2
Composite Groundwater Characteristics (1)
Volatile Organics Analysis
Camp Allen Landfill, Norfolk Naval Base, Norfolk, Virginia

Parameter	Areas A1 and B Composite		
	Flow (GPM)	Avg (ug/l)	Max (ug/l)
Volatile Organics			
Acetone	112.1	17.5	262.3
Benzene	112.1	6.8	47.4
2-Butanone	112.1	0.0003	0.003
Chlorobenzene	112.1	0.19	2.8
Chloroethane	112.1	2.6	19.3
Cloroform	112.1	0.14	1.2
Dichlorodifluoromethane	112.1	0.18	1.0
1,2-Dichloroethane	112.1	4.7	37.0
1,2-Dichloroethene (total)	112.1	130	895
Ethylbenzene	112.1	0.0004	0.003
Tetrachloroethene	112.1	0.05	0.81
Toluene	112.1	0.07	0.45
1,1,1-Trichloroethane	112.1	0.06	0.30
Trichloroethene	112.1	11.4	76.2
Trichlorofluoromethane	112.1	13.6	157
Vinyl Chloride	112.1	74.9	556
Xylenes (total)	112.1	0.79	11.8

(1) Composite of: Area A1 - Yorktown Aquifer; Area B - Shallow Aquifer; and Area B - Yorktown Aquifer.

CAMP ALLEN LANDFILL

SUMMARY OF PRE DESIGN GROUNDWATER SAMPLING

TABLE 3

Sample Point Designation	Acetone	2-Butanone	Benzene	1,2-Dichloroethene	1,2-Dichlorethane	Ethyl-Benzene	Toluene	Xylene	Trichloroethene	Vinyl Chloride	Chloroform	1,1,1-Trichloro-ethane	Chloro-benzene	Tetrachloro-ethane	Trichirofluro-methane	ichlorodifluor-methane	Chloroethane
A1-MW8A																	
A1-MW9A																	
A1-MW10A																	
A1-MW20																	
A1-MW21			5.7				3.7J	4.9J									
A1-MW22																	
A1-MW25A	12	3															
A1-B20WWS			*3.2	8.8		*3.9	*8	*22									
A1-MW9B				68													
A1-MW9C																	
A1-MW10B				18					1.4								
A1-MW13B																	
A1-MW14B																	
A1-MW24B					18				7.2								
A1-MW25B					660					350							
A1-MW26B				15					1.2		1.7						
A1-MW27B				4.1													
A2-GW1				9.6	1.4					7							
A2-GW2																	
A2-MW11A				48													
A2-MW12																	
A2-MW1B				170													
A2-MW1C																	
A2-MW17B				42	6.2												
A2-MW18B			2.1	6.9						1.3							
A2-MW19B				2.8													
A2-MW23B				260					38								
A2-MW28B				280					34								
B-MW1													15				
B-MW2A					1.1									3.7			
B-MW3A			210	1300					210	990					840		
B-GW4	1400		21	240				62	160	35							
B-MW11A				2200						1600							
B-MW13												1.6				4.5	
B-MW14												1.6				4.2	
B-MW15				170	26				71	120							
B-MW16				1.9						1.1							
B-MW19A																	
B-MW20				340						420							
B-MW21																	
B-MW22A				3.2						3.3							
B-MW23												1.4				5.4	
B-MW24			210	990					360	390					250		
B-MW2B					400												
B-MW2C			1.8		12		2.4	2.5									
B-MW3B					80												
B-MW5B				5.4			5.5		28								
B-MW11B																	
B-MW19B			42						44								54
B-MW25B			100														240
B-MW15B																	
B-MW22B																	

Reference:
"Draft Final Remedial Design Work Plan"; Camp Allen Landfill; Naval Base Norfolk;
Prepared under Contract Task Order 0211
Prepared by Baker Environmental Inc. January 28, 1994

Enclosure (4)
Groundwater Cleanup Levels

Groundwater Cleanup Goals

Yorktown Aquifer

The groundwater cleanup goals for the Yorktown Aquifer are based on the attainment of federal Maximum Contaminant Levels (MCLs) as noted on the attached table of groundwater cleanup goals. These goals will be used in order to protect the Yorktown Aquifer to its potential future use (i.e. potential future drinking water supply.) MCLs may be impossible to achieve since it has been demonstrated that even when using the Best Available Technology, groundwater contaminant levels typically reach asymptotic levels. These levels may exceed MCLs. Since the selected remedy will use the Best Available Technology, when performance curves indicate that asymptotic levels have been reached, the cleanup goals will be revaluated. Remediation completion will likely be when this asymptotic level is reached.

Surficial Aquifer

Unlike the Yorktown Aquifer, the beneficial use of the surfical (or shallow) aquifer is non-potable use. Non-potable groundwater cleanup goals for the shallow aquifer were developed based on a 1×10^{-6} cancer risk level and the exposure pathways of incidental ingestion and dermal absorption of contaminants during outdoor activities, such as car washing and lawn watering. A table of non-potable cleanup goals and the supporting calculations are attached. These non-potable cleanup goals may be impossible to achieve since it has been demonstrated that even when using the Best Available Technology, groundwater contaminant levels typically reach asymptotic levels. These levels may exceed the goals. Since the selected remedy will use the Best Available Technology, when performance curves indicate that asymptotic levels have been reached, the remedy will be considered complete.

GROUNDWATER CLEANUP GOALS (μg/L)
CAMP ALLEN LANDFILL SITE, NORFOLK, VIRGINIA

CONTAMINANTS OF CONCERN	YORKTOWN AQUIFER[1] CLEANUP GOALS (μg/L)	WATER TABLE AQUIFER[2] CLEANUP GOALS (μg/L)
1,2-Dichloroethane	5	190
1,2-Dichloroethene (cis)	70	15,000
1,1,1-Trichloroethane	200	13,500
Benzene	5	600
Ethylbenzene	700	150,000
Tetrachloroethene	5	340
Toluene	1,000	301,000
Trichloroethene	5	1,600
Vinyl Chloride	2	9
Xylenes	10,000	3,000,000

(1) Based on federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs), USEPA, May 1994.

(2) Based on incidental ingestion under a nonpotable use scenario and an incremental cancer risk of 1×10^{-6} and a hazard quotient (HQ) of 1.0 for children.

(3) Action level.

(4) Levels are based on contaminants found in soil and groundwater during the pre-design investigation.