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From: Commander, Western Division, Naval Facilities Engineering Command
To: Distribution

Subj: PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION, NAVAL
STATION, TREASURE ISLAND, HUNTERS POINT ANNEX

- Encl: (1) Identification of Exposure Pathways, Baseline Public Health and Environmental Evaluation for Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California, May 29, 1991 (revised version of May 9, 1991 submittal)
- (2) Identification of Exposure Pathways for Operable Unit II, Baseline Public Health and Environmental Evaluation for Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California, May 29, 1991
- (3) Identification of Intake Assumptions for Operable Unit II, Baseline Public Health and Environmental Evaluation for Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California, May 29, 1991

1. In accordance with the Federal Facility Agreement for Naval Station, Treasure Island, Hunters Point Annex, enclosures (1) through (3) are forwarded.
2. These working materials address the identification of exposure pathways and intake assumptions for the Hunters Point Annex Baseline Public and Environmental Health Evaluation. We look forward to discussing these working materials with the agencies during the technical meeting scheduled on 13 June 1991.
3. By copy of this letter, these documents are also being provided to other concerned regulatory agencies.
4. Should you have any questions regarding this matter, the point of contact is Commander, Western Division, Naval Facilities Engineering Command (Attn: Louise Lew, Code 1811, (415) 244-2551.)

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ENCLOSURE 1

IDENTIFICATION OF EXPOSURE PATHWAYS, BASELINE
PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION

DATED 29 MAY 1991

THIS ENCLOSURE WAS NOT SUBMITTED TO THE
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ENCLOSURE 1

IDENTIFICATION OF EXPOSURE PATHWAYS
BASELINE PUBLIC HEALTH AND
ENVIRONMENTAL EVALUATION

DATED 09 MAY 1991

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**IDENTIFICATION OF EXPOSURE PATHWAYS FOR OPERABLE UNIT II
BASELINE PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION FOR
NAVAL STATION, TREASURE ISLAND
HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA
May 29, 1991**

The following describes the exposure pathways being considered for evaluation for the Operable Unit (OU)-II Baseline Public Health and Environmental Evaluation (BPHEE) at Hunters Point Annex (HPA).

The OU-II exposure pathways to be considered for evaluation are limited to human exposure pathways. A separate ecological risk assessment for the facility is being planned at this time. Information from implementation of the Environmental Sampling and Analysis Plan (ESAP) may be included in the OU-II BPHEE if the data are available early enough to be incorporated.

The comprehensive list of potential pathways submitted for all of HPA (Table A-1 and A-2; *HLA, 1991a*) was reviewed to evaluate whether particular pathways exist, are likely to occur, or are important at OU-II, and whether they should be quantified for the BPHEE. Tables B-1 and B-2 summarize the pathways being considered for evaluation. Exposure scenarios and numerical intake assumptions specific to OU-II are being developed as separate working materials for the human exposure pathways to be quantified for the OU-II BPHEE.

The following assumptions were made in identifying potential human exposure at HPA and are applicable to the OU-II BPHEE:

- o Future civilian residential lease holders are expected to be considered under the future hypothetical onsite residential scenario. Currently no residential civilian lease holders are known to occupy the HPA site.

- o Current and future civilian commercial lease holders are expected to be considered under the current and future onsite worker scenarios.
- o Wastes spilled on building floors and outdoor pads that are not subject to interim remedial actions are expected to be evaluated during remedial investigations being conducted at the OU. The risk assessment will be conducted based on the condition of the spill area and available analytical results for any sampling completed.
- o Groundwater is not considered a potential source of drinking water (EPA Class III) if it contains total dissolved solids (TDS) greater than 10,000 milligrams per liter (mg/l). Due to the mixed hydrogeochemistry of the groundwater below HPA, the TDS content of the groundwater is expected to be variable. Potential groundwater uses will be evaluated on an Installation Restoration (IR) site-specific basis, hereafter referred to as site-specific basis, depending on the TDS content of the groundwater at each site. The following table summarizes groundwater that may potentially serve as future sources of drinking water based on its TDS levels (HLA, 1991b):

<u>IR</u>	<u>TDS</u> <u>(mg/l)</u>
IR-6	5920
IR-9	6640
IR-10	4030

Based on the TDS value of 20,100 mg/l for IR-8, the groundwater is not considered to be of drinking water quality.

The above information may change once current and future groundwater flow directions and chemical plumes are characterized. No current uses of groundwater have been identified at HPA.

- o Use of bay waters in the vicinity of HPA for current and future recreational purposes such as swimming will be considered in the BPHEE under the onsite recreational user scenario.
- o Bay waters were assumed not to be used currently or in the future for domestic or municipal water supplies, based on EPA TDS criteria.
- o It is assumed that there are not currently and will not be any surface water bodies onsite.
- o HPA is not considered to be used for growing fruits and vegetables currently. A future hypothetical residential population will be evaluated based on the potential ingestion of homegrown fruits and vegetables from HPA sites.

- o The primary media of concern with regard to homegrown fruits and vegetables are soil and groundwater.
- o Off-facility residents are defined as residential populations living outside the HPA boundary line. Any hypothetical residential populations within HPA facility boundaries will be referred to as "onsite". For example, for IR-6 risks be assessed for a hypothetical onsite residential population living directly on IR-6, and for a hypothetical HPA residential population living beyond the IR-6 site boundary line; both populations will be considered as onsite.
- o Onsite occasional users are defined as having occasional access to HPA for the purpose of conducting business or making personal visits. Unauthorized visitors (trespassers) are also included in this receptor population. The exposure scenarios and assumptions for an onsite occasional user will be different from an onsite recreational user.
- o A current onsite recreational user is defined only as a receptor population using the bay waters in the immediate vicinity of HPA for water-recreational sports and activities such as fishing, boating and swimming. A separate evaluation for current off-facility recreational users is not being considered for the OU-II BPHEE. Future onsite recreational users include a receptor population using HPA areas for non-water recreation sports and activities as well as those using the bay water for recreational purposes.
- o The primary media of concern with regard to fish and shellfish are groundwater, bay sediments, and bay waters.
- o The primary media of concern with regard to inhalation are soil, groundwater, and bay waters.

The following outlines the main differences between the potential pathways previously identified for all of HPA (*HLA, 1991a*), and those that are expected to be quantified for OU-II:

- o Ingestion of fish and shellfish from bay waters by off-facility residents will be evaluated under a future scenario only, because it is not expected that chemicals from OU-II have reached the bay;
- o Pathways related to onsite occasional users already evaluated in the current scenario will not be reevaluated in the future scenario. In the future scenarios the pathway would be equivalent to the current scenario based on baseline conditions and by assuming a source of chemical release no longer exists at the sites, therefore the current scenario would be worst case;

- o Pathways related to onsite workers already evaluated in the current scenario will not be reevaluated in the future scenario. In the future scenarios the pathway would be equivalent to the current scenario based on baseline conditions and by assuming a source of chemical release no longer exists at the sites, therefore the current scenario would be worst case.

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Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Current Land Use Onsite Workers (Adults)	1) Inhalation of volatile chemicals in outdoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater
	2) Inhalation of chemicals adsorbed onto dust particulates in outdoor air	Yes	Assumes airborne emissions of chemicals adsorbed onto soil particulates
	3) Inhalation of volatile chemicals in indoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater and migration into a building
	4) Inhalation of chemicals adsorbed onto dust particulates in indoor air	No	Assumes exposures from exposure pathway #2 will be representative, therefore separate evaluation may not be necessary
	5) Ingestion of soil	Yes	Assumes direct contact with chemicals in soil
	6) Dermal contact with soil	Yes	Assumes direct contact with chemicals in soil
	7) Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	No	Unlikely; groundwater not currently a domestic or municipal water source
	8) Ingestion of groundwater as a drinking water source	No	Unlikely; groundwater not currently a domestic or municipal water source

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Current Land Use Onsite Workers (Adults) (continued)	9) Dermal contact with groundwater during domestic use (i.e., showering)	No	Unlikely; groundwater not currently a domestic or municipal water source
Onsite Occasional Users (Adults and Children)	10) Inhalation of volatile chemicals in outdoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater
	11) Inhalation of chemicals adsorbed onto dust particulates in outdoor air	Yes	Assumes airborne emissions of chemicals adsorbed onto soil particulates
	12) Inhalation of volatile chemicals in indoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater and migration into a building
	13) Inhalation of chemicals adsorbed onto dust particulates in indoor air	No	Assumes exposures from exposure pathway #11 will be representative, therefore separate evaluation may not be necessary
	14) Ingestion of soil	Yes	Assumes direct contact with chemicals in soil
Onsite Recreational Users (Adults and Children)	15) Dermal contact with soil	Yes	Assumes direct contact with chemicals in soil
	16) Inhalation of volatile chemicals in bay water during swimming	No	Pathway to be evaluated as future scenario

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Current Land Use Onsite Recreational Users (Adults and Children) (continued)	17) Ingestion of bay water during swimming	No	Pathway to be evaluated as future scenario
	18) Dermal contact with bay water during swimming	No	Pathway to be evaluated as future scenario
	19) Ingestion of fish and shellfish from bay waters	No	Pathway to be evaluated as future scenario
Off-Facility Residents (Adults and Children)	20) Inhalation of site-related volatile chemicals in off-facility outdoor air from soil and/or groundwater	Yes	Assumes volatilization and off-facility migration of airborne (vapor phase) chemicals from soil and/or groundwater
	21) Inhalation of site-related chemicals adsorbed onto dust particulates in off-facility outdoor air	Yes	Assumes airborne emissions of chemicals adsorbed onto airborne soil particulates migrating off-facility
	22) Inhalation of volatile chemicals in indoor and/or outdoor air from off-facility groundwater plume	Yes	Groundwater flow direction needs to be identified prior to exclusion of this pathway; more than likely plume does not exist in off-facility (beyond HPA boundary) locations
	23) Inhalation of chemicals adsorbed onto dust particulates in indoor air	No	Assumes exposures from exposure pathway #21 will be representative, therefore separate evaluation may not be necessary

**Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE;
Hunters Point Annex**

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Current Land Use Off-Facility Residents (Adults and Children) (continued)	24) Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	No	Unlikely, groundwater not currently a domestic or municipal water source
	25) Ingestion of soil	Yes	Assumes off-facility migration of dust emissions and deposition in off-facility areas
	26) Dermal contact with soil	Yes	Assumes off-facility migration of dust emissions and deposition in off-facility areas
	27) Ingestion of groundwater as a drinking water source	No	Unlikely; groundwater not currently a domestic or municipal water source; spring unlikely to be impacted by site based on hydrogeologic conditions
	28) Dermal contact with groundwater during household use	No	Unlikely; groundwater not currently a domestic or municipal water source
	29) Ingestion of fish and shellfish from bay waters	No	Pathway to be evaluated as future scenario
Future Land Use Onsite Workers (Adults)	30) Pathways assumed to be equivalent to Current Onsite Workers (Adult); therefore, separate evaluation may not be necessary except for the following:	--	--

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Future Land Use Onsite Workers (Adults) (continued)	31) Ingestion of groundwater as a drinking water source	Yes	Assumes facilities will be available and groundwater will be of drinking water quality
	32) Dermal contact with groundwater during household use (i.e., showering)	Yes	Assumes facilities will be available and groundwater will be used
	33) Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	Yes	Assumes facilities will be available and groundwater will be used
Onsite Occasional Users (Adults and Children)	34) Pathways assumed to be equivalent to current onsite occasional users (adults and children); therefore, separate evaluation may not be necessary	--	--
Onsite Recreational Users (Adults and Children)	35) Inhalation of volatile chemicals in outdoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater
	36) Inhalation of chemicals adsorbed onto dust particulates in outdoor air	Yes	Assumes airborne emissions of chemicals adsorbed onto soil particulates

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Future Land Use Onsite Recreational Users (Adults and Children) (continued)	37) Inhalation of volatile chemicals in indoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater and migration into an onsite building used for recreational purposes
	38) Inhalation of chemicals adsorbed onto dust particulates in indoor air	No	Assumes exposures from exposure pathway #36 will be representative, therefore separate evaluation may not be necessary
	39) Inhalation of volatile chemicals in bay water during swimming	Yes	Assumes chemicals may potentially migrate to bay waters
	40) Ingestion of soil	Yes	Assumes direct contact with chemicals in soil
	41) Dermal contact with soil	Yes	Assumes direct contact with chemicals in soil
	42) Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	Yes	Assumes recreational facilities will be available and groundwater will be used
	43) Ingestion of groundwater as a drinking water source	Yes	Assumes recreational facilities will be available and groundwater will be of drinking water quality

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Future Land Use Onsite Recreational Users (Adults and Children) (continued)	44) Dermal contact with groundwater during domestic use (i.e., showering)	Yes	Assumes recreational facilities will be available and groundwater will be used
	45) Ingestion of bay water during swimming	Yes	Assumes chemicals may potentially migrate to bay waters
	46) Dermal contact with bay water during swimming	Yes	Assumes chemicals may potentially migrate to bay waters
	47) Ingestion of fish and shellfish from bay waters	Yes	Assumes chemicals may potentially migrate to bay waters
Onsite Residents (Adults and Children)	48) Inhalation of volatile chemicals in outdoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater
	49) Inhalation of chemicals adsorbed onto dust particulates in outdoor air	Yes	Assumes airborne emissions of chemicals adsorbed onto soil particulates
	50) Inhalation of volatile chemicals in indoor air from soil and/or groundwater	Yes	Assumes volatilization of chemicals from soil and/or groundwater and migration into a building

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Future Land Use Onsite Residents (Adults and Children) (continued)	51) Inhalation of chemicals adsorbed onto dust particulates in indoor air	No	Assumes exposures from exposure pathway #49 will be representative, therefore separate evaluation may not be necessary
	52) Ingestion of soil	Yes	Assumes direct contact with chemicals in soil
	53) Dermal contact with soil	Yes	Assumes direct contact with chemicals in soil
	54) Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	Yes	Assumes groundwater to be used for domestic use
	55) Ingestion of groundwater as a drinking water source	Yes	Assumes facilities will be available and groundwater will be of drinking water quality
	56) Dermal contact with groundwater during domestic use (i.e., showering)	Yes	Assumes groundwater to be used for domestic use
	57) Ingestion of homegrown fruits and vegetables	Yes	Assumes gardens to be used for homegrown fruits and vegetables
	58) Ingestion of fish and shellfish from bay waters	Yes	Assumes chemicals may potentially migrate to bay waters

Table B-1. Potential Exposure Pathways To be Considered for Operable Unit II BPHEE; Hunters Point Annex

Potentially Exposed Population	Exposure Pathway	Considered for Evaluation	Comments
Future Land Use Off-Facility Residents (Adults and Children)	59) All pathways assumed to be equivalent to Current Off-Facility Residents (Adults and Children); therefore, separate evaluation may not be necessary except the following:	--	--
	60) Ingestion of groundwater as a drinking water source	Yes	Assumes facilities will be available and groundwater will be of drinking water quality
	61) Dermal contact with groundwater during household use (i.e., showering)	Yes	Assumes groundwater to be used for domestic use
	62) Ingestion of fish and shellfish from bay waters	Yes	Assumes chemicals may potentially migrate to bay waters
	63) Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	Yes	Assumes groundwater to be used for domestic use
64) Inhalation of volatile chemicals in indoor and/or outdoor air from off-facility groundwater plume	Yes	Direction of groundwater flow needs to be identified prior to exclusion of this pathway; more than likely plume will not exist in off-facility (beyond HPA boundary) locations	

LITERATURE CITED

Harding Lawson Associates, 1991a. *Identification of Exposure Pathways for Baseline Public Health and Environmental Evaluation, Naval Station, Hunters Point Annex, Treasure Island, San Francisco, California.* May 24 (revised version to May 9).

Harding Lawson Associates, 1991b. *Summary of Findings Memorandum, Operable Unit II Sites, Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California. Volumes I and II.* April 18.

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Table B-2. Potential Exposure Pathways to be Considered for Hunters Point Annex OU-II BPHEE

Pathway of Exposure	Current				Future				
	Onsite Worker (Adults)	Onsite Occasional Users (Adults & Children)	Onsite Recreational Users (Adults & Children) /a/	Offsite Residents (Adults & Children) /c/	Onsite Worker (Adults)	Onsite Occasional Users (Adults & Children)	Onsite Recreational Users (Adults & Children) /f/	Onsite Residents (Adults & Children)	Offsite Residents (Adults & Children)
<u>INHALATION PATHWAYS</u>									
Inhalation of volatile chemicals in outdoor air from soil and/or groundwater	Y	Y	--	--	N /e/	N /e/	Y	Y	--
Inhalation of chemicals adsorbed onto dust particulates in outdoor air	Y	Y	--	--	N /e/	N /e/	Y	Y	--
Inhalation of volatile chemicals in indoor air from soil and/or groundwater	Y	Y	--	--	N /e/	N /e/	Y	Y	--
Inhalation of chemicals adsorbed onto dust particulates in indoor air	N	N	--	N	N /e/	N /e/	N	N	N
Inhalation of volatile chemicals in bay water during swimming	N/A	N	N /b/	--	N/A	--	Y	--	--
Inhalation of site-related volatile chemicals in offsite outdoor air	N/A	N/A	N/A	Y	N/A	N/A	N/A	N/A	N /e/
Inhalation of site-related chemicals adsorbed onto dust particulates in offsite outdoor air	N/A	N/A	N/A	Y	N/A	N/A	N/A	N/A	N /e/
Inhalation of volatile chemicals in indoor and/or outdoor air from offsite groundwater plume	N/A	N/A	N/A	Y /d/	N/A	N/A	N/A	N/A	Y /d/
Inhalation of volatile chemicals in groundwater during domestic use (i.e., showering)	N	--	--	N	Y	--	Y	Y	Y
<u>INGESTION PATHWAYS</u>									
Ingestion of soil	Y	Y	--	Y	N /e/	N /e/	Y	Y	N /e/
Ingestion of groundwater as a drinking water source	N	--	--	N	Y	--	Y	Y	Y
Ingestion of bay water during swimming	N/A	--	N /b/	--	N/A	--	Y	--	--
Ingestion of fish and shellfish from bay waters	N/A	--	N /b/	N /b/	N/A	--	Y	Y	Y
Ingestion of homegrown fruits and vegetables	N/A	--	--	--	N/A	--	--	Y	--
<u>DERMAL PATHWAYS</u>									
Dermal contact with soil	Y	Y	--	Y	N /e/	N /e/	Y	Y	N /e/
Dermal contact with bay water during swimming	N/A	--	N /b/	--	N/A	--	Y	--	--
Dermal contact with groundwater during household use (i.e., showering)	N	--	--	N	Y	--	Y	Y	Y

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**Table B-2. Potential Exposure Pathways to be Considered for
Hunters Point Annex OU-II BPHEE**

FOOTNOTES:

N = Excluded from further evaluation

Y = Included for further evaluation

-- = Pathway does not exist or is not likely to occur; pathway may be considered under other receptor population; see text for further explanation

N/A = Pathway not applicable to receptor

/a/ Current onsite recreational user defined as a receptor population using the bay water in the immediate vicinity of HPA for water-recreational sports such as fishing, boating and swimming.

/b/ Pathway to be evaluated under future scenario.

**/c/ Offsite resident defined as receptor population located beyond HPA boundary line.
Any hypothetical onsite residential population to be referred to as onsite in all cases.
See text for explanation.**

/d/ Direction of groundwater flow needs to be evaluated prior to excluding this pathway.

/e/ Pathway assumed to be equivalent to current scenario based on baseline conditions and by assuming a source of chemical release no longer exists.

// Future onsite recreational users include a receptor population using HPA areas for non-water recreation sports and activities.

**IDENTIFICATION OF INTAKE ASSUMPTIONS FOR OPERABLE UNIT II
BASELINE PUBLIC HEALTH AND ENVIRONMENTAL EVALUATION FOR
NAVAL STATION, TREASURE ISLAND
HUNTERS POINT ANNEX
SAN FRANCISCO, CALIFORNIA
May 29, 1991**

The following describes the procedures and methods expected to be followed in developing the exposure scenarios and intake assumptions for the Baseline Public Health and Environmental Evaluation (BPHEE) for Operable Unit (OU) II at Hunters Point Annex. The actual values for the intake assumptions will be added to this document after the technical meetings scheduled June 13, 1991 with the regulatory agencies. This document is to be used in conjunction with the working materials (text and Tables A-1 and A-2, *HLA, 1991a*) prepared for identification of exposure pathways as well as the attached Table B-1, B-2 and Worksheets 1 through 17.

Attachment 1 lists guidance and other documents to be used for developing intake assumptions; this list may expand during the process of developing intake assumptions if other references are found to have additional information. As stated in the Addendum to the Work Plan (*HLA, 1991b*), guidance or other documents issued after June 13, 1991 will be incorporated if information in these documents would be expected to significantly change the results of the BPHEE. The *Supplemental Guidance: "Standard Default Exposure Factors"* issued on March 25, 1991 by EPA will be reviewed during development of actual intake values. Default values may be recommended if they are applicable and appropriate for HPA and the individual Installation Restoration (IR) sites. If other guidance documents such as the Risk Assessment Guidance for Superfund (RAGS, *EPA, 1989a*) or Exposure Factors Handbook (EFH, *EPA, 1990b*) have more complete information to support the proposed intake values, they may be used

instead of the default values stated in the EPA Supplemental Guidance document (EPA, 1991). EPA guidance will take precedence over other agency documents.

Seventeen exposure scenarios are recommended for quantification in the OU-II BPHEE. Actual values which are not exposure-scenario specific are presented in Worksheets 1 through 17. Once the recommendations outlined below have been discussed and approved, the values for exposure-scenario-specific intake assumptions will be summarized in future submittals to the agencies.

Both the average and the reasonable maximum exposure (RME) scenarios will be evaluated in the OU-II BPHEE. Development of intake assumptions for both average and RME are recommended for each exposure scenario. Generally, the average scenario represents approximately the 50th-percentile intake values and the RME scenario represents the 95th-percentile intake values. If intake values are not available based on these percentile distributions, other methods such as means and maximums or 90th-percentile intake values will be used for average and RME scenarios, respectively.

The following factors and descriptions are recommended to be used in all exposure scenarios. For the majority of the receptor populations (i.e., worker and residential populations), an exposure duration of 9 years and 30 years will be assumed for the average and RME scenarios, respectively (EPA, 1989a). Exposure durations for other receptor populations will be recommended in future submittals to the agencies. To consider changes in dose over time as a child or adult based on these exposure durations, splitting of populations into several age groups is recommended to evaluate a 9-year and 30-year exposure duration. As shown in Attachment 2, for the average scenario, children are split into two age groups of 0-5 and 5-9 years; adults are considered for

ages 18-27 years. For the RME scenario, children are split into ages 0-5, 5-11, 11-18 and as adults into 18-30 years; adults are considered for ages 18-48 years.

The procedures and methods for developing intake assumptions depend on the availability of information. Consistent rules such as the use of both male and female data, the use of all age-specific data based on the age group descriptions selected, and the use of 50th- and 95th-percentile intake values for average and RME scenarios, respectively, are adopted when the information is presented as such in the guidance or other source documents. The availability of this information, especially age-specific data, allows calculation of weighted averages of the male and female 50th and/or 95th percentile data for each age group selected, as shown in the example below:

Example 1

Based on literature summarized in the Exposure Factors Handbook (EFH, EPA, 1990, Table 4B-3 and 4B-4), age-specific male and female total body surface areas for children are used to estimate age-specific average total body surface areas that may come into contact with water from showering. For the average scenario, the age-specific average of the 50th-percentile total body surface area values reported for males and females are used to estimate a weighted average for each age group being evaluated. Weighted averages of 6553 cm² for children ages 0-5 and 8,918 cm² for children ages 5-9 are estimated based on the following information; age specific information was not presented in EFH for children ages less than 2 years as shown below:

<u>Age Group</u>	<u>Duration (year)</u>	<u>Age</u>	<u>Value (cm²)</u>
0-5	1	2<3 ^a	5,910
	1	3<4	6,565
	1	4<5	7,185
5-9	1	5<6	7,860
	1	6<7	8,545
	1	7<8	9,265
	1	8<9	10,000

^a 2<3 = 2 year old up to third birthday

Adult residents are assumed to have an average surface area of 18,150 cm² based on the average of the 50th-percentile total body surface areas given for adult males (19,400 cm²) and females (16,900 cm²; EPA 1990, Table 4B-1).

When age-specific values are not available, other methods can be adopted as shown in the example below:

Example 2

Based on the data presented in EFH (EPA, 1990), the average rate for inhalation of indoor air can be estimated from an EPA study of activity patterns by activity level (EPA, 1985) to include 48 percent resting, 48 percent light activity, 3 percent moderate activity and 1 percent heavy activity. Based on these percentages, and the literature information summarized in Table 3-1 (EFH, 1990) for each of the activity levels for 6 and 10 year olds, the inhalation rates for the average scenario are estimated to be 0.66 m³/hour for children ages 0-5, and 0.81 m³/hour for children ages 5-9. Adult residents are assumed to have an average inhalation rate of 0.63 m³/hour (EPA, 1990; Table 3-1).

The inhalation rate for the RME indoor inhalation scenario are estimated from the same EPA study of activity patterns by activity level (EPA, 1985) to include

25 percent resting activity, 60 percent light activity, 10 percent moderate activity, and 5 percent heavy activity. Based on these percentages and the literature information summarized in Table 3-1 for each of the activity levels for 6 and 10 year olds, the inhalation rates for the RME scenario are estimated to be 0.90 m³/hour for children ages 0-5, 1.23 m³/hour for children ages 5-11, and 1.24 m³/hour for children ages 11-18. Adult residents are assumed to have an RME inhalation rate of 0.89 m³/hour (EFH, 1990).

The weighted average method is recommended for the OU II BPHEE. Based on weighted averages of the age-specific male and female data presented in EFH (EPA, 1990) the following body weights for each of the age groups (children and adults) are recommended:

<u>Age Group</u>	<u>Body Weight (kg)</u>
0-5	13
5-9	24
5-11	27
11-18	54
18-27	70
18-30	70
18-48	70

These body weights will be used in estimating intakes for all seventeen scenarios as shown in worksheets I through 17. Standard averaging times based on RAGS (1989a) are also used for chemicals classified as potential carcinogens (365 days per year for 70 years) and noncarcinogens (365 days per year for the defined exposure duration). These will be used for all seventeen scenarios also. EFH (EPA, 1990) recommends an "appropriate average value" for 75 years as life expectancy for humans. No guidance is provided for evaluating carcinogens based on 75 years; therefore, 70 years is recommended for HPA unless other information becomes available.

The equations presented in Worksheets 1 through 17 will be used to quantify each exposure scenario. These equations are consistent with RAGS (EPA, 1989a).

The following outlines methods for developing specific intake values for the selected age groups proposed in the previous section. These recommendations are based on a thorough review of the available guidance documents on intake assumptions. Once approved, these specific intake values for each exposure scenario will be developed and submitted to the agencies.

Dermal Body Surface Areas

- o For showering scenarios, skin surface areas will be based on 100% skin surface area contact with water.
- o For average swimming scenarios, skin surface areas will be based on only parts of the body coming into contact with water. Generally described as a wading scenario, the body parts will consist of the hands, forearms, legs and feet. The RME scenario will be based on 100% skin surface area contact with water.

Ingestion of Groundwater

- o For the average and RME scenarios, ingestion rates will be based on tapwater consumption rates presented in EFH (EPA, 1990) rather than total fluid consumption rates.

Ingestion of Soil

- o For the average and RME scenarios, EPA (1989, 1990) ingestion rates for soil will be used over Sedman's (1989) ingestion rates.

Ingestion of Homegrown Fruits and Vegetables

- o Fruit and vegetable ingestion rates will be developed from survey information that is summarized in the Agency for Toxic Substances Disease Registry Health Effects Assessment Document (ATSDR, 1990) which provides age-specific values for total vegetable consumption by

males and females developed from a U.S. Department of Agriculture (USDA) survey performed on individuals in 48 states from 1977 to 1978 (ATSDR, 1990; Pao et al, 1982; Pao, 1985). HLA has reviewed this information and found the ATSDR ingestion rates more complete. The ingestion rates are similar to those described in EFH (EPA, 1990).

- o A seasonal factor will be used in the equation to adjust the annualized ingestion rates mentioned above, to account for seasonal variations precluding growth and harvest of fruits and vegetables. As stated in EFH (EPA, 1990) homegrown vegetables are eaten primarily in the late summer and fall months when they are harvested, or about 20 percent of the year. This is applicable to HPA. EFH (EPA, 1990) also states that household members may ingest preserved or canned homegrown vegetables; therefore, for the RME scenario, the seasonal factor will be increased to 50 percent. These seasonal factors may be adjusted based on the climatic conditions at HPA to derive a more site-specific intake value.

Ingestion of Shellfish and Fish

- o Fish ingestion rates will be developed from survey information that is summarized in Agency for Toxic Substances Disease Registry (ATSDR, 1990), which provides age-specific values for total shellfish and fish consumption by males and females developed from a U.S. Department of Agriculture (USDA) survey performed on individuals in 48 states during 1977 to 1978 (ATSDR, 1990; Pao et al, 1982; Pao, 1985). HLA has reviewed this information and found the ATSDR ingestion rates more complete. The ingestion rates are similar to those described in EFH (EPA, 1990).
- o As described in EFH (EPA, 1990) a fraction will be used in the equation to adjust the annualized ingestion rates mentioned above, to account for the average per capita ingestion of contaminated fish and shellfish.

Inhalation Rates

- o Inhalation rates will be based on the percent activity levels appropriate to each of the exposure scenarios as recommended by EFH (EPA, 1990) as shown below:

Showering: 100 percent light activity for average and RME scenarios

Indoor Air: 48 percent resting, 48 percent light, 3 percent moderate, 1 percent heavy activity for average scenarios and 25 percent resting, 60 percent light, 10 percent moderate, 5 percent heavy for RME scenarios.

Outdoor Air: 28 percent resting, 28 percent light, 37 percent moderate, 7 percent heavy activity for average scenarios and 50 percent moderate, 50 percent heavy activity for RME scenarios

Exposure Time

- o The recommended exposure time in hours/day for inhalation of outdoor air in EFH (EPA, 1990) is 0.44 hour/day based on the mean hours per week for adult males and females for several categories of outdoor activities at home. Because this value is considered to underestimate the time spent outdoors by children, a different value will be developed. Survey information on the mean hours/week spent outdoors by children during school months is contained in EFH (EPA, 1990).
- o Several assumptions need to be made for the non-school year months: 1) assume the school year is 9.5 months (80 percent of the year) and the non-school year is 2.5 months (20 percent of the year); 2) include hours for the categories presented in EFH (EPA, 1990) of "sports" and "outdoors", and one-half of the hours for "playing and games" in estimating outdoor time during the school year; and 3) include one-half the hours for the category of "school" in estimating outdoor time during the non-school year. Based on these assumptions, the average of male and female 3-11 year old values presented in EFH (EPA, 1990) equals 1.4 hours/day, for the school year and 0.68 for the non-school year, for a total of 2.1 hours/day/year. This value would therefore be applicable to children in the age groups 0-5, 5-9 and 5-11.

Absorbed Versus Adsorbed Doses

- o The equation used to estimate the chronic daily intake of a chemical incorporates an absorption factor. The following discussion summarizes the methods described in RAGS (EPA, 1989a) for using absorption factors. Toxicity values (RfDs and SFs) are based on either administered (applied) or absorbed doses. Most toxicity values are based on administered doses that already incorporate any influence due to absorption fractions. Therefore, no adjustment to a dose estimate due to incomplete absorption is appropriate for chemicals with toxicity values based on administered doses. This is consistent with EPA Region IX guidance (EPA, 1989b) and RAGS (EPA, 1989a). EPA Region IX recommends the use of absorption factors in the following three instances:
 - Assessment of exposure via a different route from what was utilized in the studies used to establish the toxicity values (e.g., oral versus dermal exposure);
 - Interaction with the matrix (e.g., bioavailability decreased due to chemical binding to soil);
 - Toxicity value is based on an absorbed dose.
- o Based on these considerations, it is suggested that absorption factors be used when toxicity values are based on absorbed doses and when an oral toxicity value is used for dermal exposure. As stated in the Addendum to

the Work Plan (HLA, 1991b) all recommended chemical-specific absorption factors for the chemicals of concern will be submitted for agency approval.

Exposure Point Concentrations

- o Exposure point concentrations will be estimated according to the schedule for the OU-II BPHEE. The methods and approaches for estimating exposure point concentrations will be discussed at a future technical meeting. Several models are currently being reviewed for groundwater; surface water; air; bioaccumulation in fruits, vegetables and fish. The models will be designed to estimate IR-specific chemical concentrations; that is, the source of contamination from each IR will be identified and modeled separately to derive chemical-specific concentrations in each media of concern for each IR. Any potential for comingling plumes will be discussed qualitatively and/or shown on plates. Comingling plumes will not be quantitatively assessed in the models or the risk characterization section of the OU-II BPHEE. It is expected that the basewide BPHEE will contain evaluations of inter- and intramedia interactions.

Receptor Locations

- o The actual location of each receptor population described in the worksheets will be mapped on plates outlining each of the IRs and the areas surrounding HPA. These receptor locations will be recommended during the discussions on exposure point concentrations since approaches and methods selected for the models will be affected by the receptor locations.

REFERENCES

- Agency for Toxic Substances and Diseases Registry (ATDSR), 1990. *Health Assessment Guidance Manual (HAGM) Draft*, United States Department of Health and Human Services, Atlanta, GA.
- Harding Lawson Associates, 1991a. *Identification of Exposure Pathways for Operable Unit II, Baseline Public Health and Environmental Evaluation, Hunters Point Annex, Naval Station, Treasure Island, San Francisco, California*. May 9.
- Harding Lawson Associates, 1991b. *Addendum to Work Plan, Volume 6, for Baseline Public Health and Environmental Evaluation, Remedial Investigation/Feasibility Study for Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California*, May 3.
- Pao, E. M., K. H., Guenther, P.M., Mickle S.J., 1982. *Foods Commonly Eaten by Individuals: Amount Per Day and Per Eating Occasion*. United States Department of Agriculture. Human Nutrition Information Service, Home Economics Research Report No. 44. 431pp. Also referenced as USDA.
- Pao, E. M., 1985. *Nationwide Food Consumption Survey, Continuing Survey of Food Intakes by Individuals*. Human Nutrition Information Service, Home Economics Research Report No. 44. 431pp. Also referenced as USDA.
- Sedman, R. M., 1989. *The Development of Applied Action Levels for Soil Contact: A Scenario for the Exposure of Humans to Soil in a Residential Setting*. Environmental Health Perspectives 79: 291-313.
- U.S. EPA, 1985. *Development of Statistical Distribution on Ranges of Standard Factors Used in Exposure Assessments*. EPA No. 60018-85-010.
- U.S. EPA, 1989a. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (RAGS-Part A), Interim Final*. Office of Emergency and Remedial Response, Washington, D.C. 20460, EPA/540/1-89/002, December.
- U.S. EPA, 1989b. *Risk Assessment Guidance for Superfund, Human Health Risk Assessment; U.S. EPA Region IX Recommendations, Interim Final*, December 15.
- U.S. EPA, 1990. *Exposure Factors Handbook (EFH)*, Office of Health and Environmental Assessment, Washington, D.C. 20460, EPA/600/8-89/043, March.
- U.S. EPA, 1991. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"*, OSWER Directive 9285.6-03, March 25.

ATTACHMENT 1 REFERENCES

The following EPA guidance documents will provide the basic framework for preparing the BPHEE:

- U.S. EPA, 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (RAGS, Part A), Interim Final*. Office of Emergency and Remedial Response, Washington, D.C. 20460, EPA/540/1-89/002, December.
- U.S. EPA, 1988. *Superfund Exposure Assessment Manual*, Office of Emergency and Remedial Response, Washington, D.C. 20460, EPA/540/1-88/001, April.
- U.S. EPA, 1990. *Exposure Factors Handbook (EFH)*, Office of Health and Environmental Assessment, Washington, D.C. 20460, EPA/600/8-89/043, March.
- U.S. EPA. *Exposure Assessment Methods Handbook*, Draft, Office of Health and Environmental Assessment, Athens, GA, when document becomes available.
- U.S. EPA, 1990. *Guidance for Data Usability in Risk Assessment*, Office of Solid Waste and Emergency Response, EPA/540/G-90/008, October.
- U.S. EPA, 1990/91. *Health Effects Assessment Summary Tables*, Most Current Quarter, FY.
- U.S. EPA, 1990/91. *Integrated Risk Information System Data Base*, Current Printout.
- U.S. EPA, 1989. *Risk Assessment Guidance for Superfund; Volume II, Environmental Evaluation Manual, Interim Final*, Office of Emergency and Remedial Response, Washington, D.C. 20460, EPA/540/1-89/001A, March.
- U.S. EPA, 1989. *Risk Assessment Guidance for Superfund, Human Health Risk Assessment*; U.S. EPA Region IX Recommendations, Interim Final, December 15.

Other guidance and source documents that may be consulted in the preparation of the BPHEE include:

- o Agency for Toxic Substances and Diseases Registry (ATDSR), 1990. *Health Assessment Guidance Manual (HAGM) Draft*, United States Department of Health and Human Services, Atlanta, GA.
- o CAPCOA, 1989. *Toxic Air Pollutant Source Assessment Manual*, revised December.
- o McKone T.E., 1989. *Dermal Uptake of Chemicals from a Soil Matrix*. Risk Anal. 10:47-419.
- o State of California, Department of Health Services, 1986. *The California Site Mitigation Decision Tree Manual*, May.
- o State of California, Department of Health Services, 1990. *Scientific and Technical Standards for Hazardous Waste Sites, Draft Book II*, August.
- o U.S. EPA, 1985. *Development of Statistical Distribution on Ranges of Standard Factors Used in Exposure Assessments*. EPA No. 60018-85-010.
- o U.S. EPA, 1986. *Guidelines for Carcinogen Risk Assessment*, 51 Federal Register 33992, September 24.
- o U.S. EPA, 1986. *Guidelines for Exposure Assessment*, 51 Federal Register 34042, September 24.
- o U.S. EPA, 1986. *Guidelines for Health Risk Assessment of Chemical Mixtures*, 51 Federal Register 34014, September 24.
- o U.S. EPA, 1986. *Guidelines for Health Assessment of Suspect Developmental Toxicants*, 51 Federal Register 34028, September 24.
- o U.S. EPA, 1986. *Guidelines for Mutagenicity Risk Assessment*, 51 Federal Register 34006, September 24.
- o U.S. EPA, 1989. *Proposed Amendments to the Guidelines for Health Assessment of Suspect Developmental Toxicants*, 54 Federal Register 9386, March.
- o U.S. EPA, 1990. *Draft Guidance on Standard Exposure Assumptions*. June 29.
- o U.S. EPA, 1991. *Review Draft Interim Guidance for Dermal Exposure Assessment*, OHEA-E-367, March.

- o U.S. EPA, 1991. *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"*, OSWER Directive 9285.6-03, March 25.

The BPHEE is being prepared in response to the following requirements:

- o Federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA);
- o National Oil and Hazardous Substances Pollution Contingency Plan (NCP), revised and amended March, 1990;
- o California Department of Health Services (DHS), Remedial Action Order (RAO), Docket No. HSA87/88-034RA, dated January 7, 1988;
- o Federal Facility Agreement, September, 1990

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**ATTACHMENT 2. METHODS USED TO DETERMINE AGE GROUPS AND EXPOSURE DURATIONS
BPHEE - HUNTER'S POINT ANNEX**

Years	Duration	Description	Explanation
<u>AVERAGE SCENARIO</u>			
>1 1 - 2 2 - 3 3 - 4 4 - 5	5 years	Indicated as 0 - 5 years	0-5 includes ages 0-1, 1-2, 2-3, 3-4 and 4-5th birthday
5 - 6 6 - 7 7 - 8 8 - 9	4 years	Indicated as 5 - 9 years	
18 - 19 19 - 20 20 - 21 21 - 22 22 - 23 23 - 24 24 - 25 25 - 26 26 - 27	9 years	Indicated as 18-27 years	
<u>REASONABLE MAXIMUM SCENARIO</u>			
>1 1 - 2 2 - 3 3 - 4 4 - 5	5 years	Indicated as 0 - 5 years	
5 - 6 6 - 7 7 - 8 8 - 9 9 - 10 10 - 11	6 years	Indicated as 5 - 11 years	
11 - 12 12 - 13 13 - 14 14 - 15 15 - 16 16 - 17 17 - 18	7 years	Indicated as 11 - 18 years	

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**ATTACHMENT 2. METHODS USED TO DETERMINE AGE GROUPS AND EXPOSURE DURATIONS
BPHEE - HUNTER'S POINT ANNEX**

Years	Duration	Description	Explanation
18 - 19	12 years	Indicated as 18 - 30 years	T
19 - 20			
20 - 21			
21 - 22			
22 - 23			
23 - 24			
24 - 25			
25 - 26			
26 - 27			
27 - 28			
28 - 29			
29 - 30			
18 - 19	30 years	Indicated as 18 - 48 years	E A R D
19 - 20			
20 - 21			
21 - 22			
22 - 23			
23 - 24			
24 - 25			
25 - 26			
26 - 27			
27 - 28			
28 - 29			
29 - 30			
30 - 31			
31 - 32			
32 - 33			
33 - 34			
34 - 35			
35 - 36			
36 - 37			
37 - 38			
38 - 39			
39 - 40			
40 - 41			
41 - 42			
42 - 43			
43 - 44			
44 - 45			
45 - 46			
46 - 47			
47 - 48			

Worksheet 1. Intake Assumptions for Inhalation of Volatile Chemicals from Soil and/or Groundwater to Outdoor Air - Current Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	* IR Inhalation Rate (m ³ /hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

AVERAGE SCENARIO	Onsite	Adult Worker	18 - 27									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 9					24	365	70	365	ED
	Offsite	Adult Resident	18 - 27					70	365	70	365	ED
	Onsite	Child Occasional User	0 - 5					13	365	70	365	ED
	Onsite	Child Occasional User	5 - 9					24	365	70	365	ED
	Onsite	Adult Occasional User	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	* IR Inhalation Rate (m ³ /hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

REASONABLE MAXIMUM SCENARIO	Onsite	Adult Worker	18 - 48									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 11					27	365	70	365	ED
	Offsite	Child Resident	11 - 18					54	365	70	365	ED
	Offsite	Adult Resident	18 - 30					70	365	70	365	ED
	Offsite	Adult Resident	18 - 48					70	365	70	365	ED
	Onsite	Child Occasional User	0 - 5					13	365	70	365	ED
	Onsite	Child Occasional User	5 - 11					27	365	70	365	ED
	Onsite	Child Occasional User	11 - 18					54	365	70	365	ED
	Onsite	Adult Occasional User	18 - 30					70	365	70	365	ED
	Onsite	Adult Occasional User	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table for outdoor air concentration)
PAF - Pulmonary Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available.

Worksheet 2. Intake Assumptions for Inhalation of Volatile Chemicals from Soil and/or Groundwater to Outdoor Air - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/ day)	* EF Exposure Frequency (days/ year)	* ED Exposure Duration (years/ lifetime)	* IR Inhalation Rate (m ³ /hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5					13	365	70	365	ED
	Onsite	Child Recreational User	5 - 9					24	365	70	365	ED
	Onsite	Adult Recreational User	18 - 27					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 9					24	365	70	365	ED
	Onsite	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/ day)	* EF Exposure Frequency (days/ year)	* ED Exposure Duration (years/ lifetime)	* IR Inhalation Rate (m ³ /hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5					13	365	70	365	ED
	Onsite	Child Recreational User	5 - 11					27	365	70	365	ED
	Onsite	Child Recreational User	11 - 18					54	365	70	365	ED
	Onsite	Adult Recreational User	18 - 30					70	365	70	365	ED
	Onsite	Adult Recreational User	18 - 48					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 11					27	365	70	365	ED
	Onsite	Child Resident	11 - 18					54	365	70	365	ED
	Onsite	Adult Resident	18 - 30					70	365	70	365	ED
	Onsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table for outdoor air concentration)

PAF - Pulmonary Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 3. Intake Assumptions for Inhalation of Volatile Chemicals from Soil and/or Groundwater to Indoor Air - Current Scenario
 OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* ET	* EF	* ED	* IR	BW Body Weight (kg)	ATc		ATn /b/	
				Exposure Time (hours/ day)	Exposure Frequency (days/ year)	Exposure Duration (years/ lifetime)	Inhalation Rate (m ³ /hr)		Carcinogenic AVERAGING TIME (days) (years)		Noncarcinogenic AVERAGING TIME (days) (years)	

AVERAGE SCENARIO	Onsite	Adult Worker	18 - 27									
	Onsite	Child Occasional User	0 - 5					13	365	70	365	ED
	Onsite	Child Occasional User	5 - 9					24	365	70	365	ED
	Onsite	Adult Occasional User	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* ET	* EF	* ED	* IR	BW Body Weight (kg)	ATc		ATn /b/	
				Exposure Time (hours/ day)	Exposure Frequency (days/ year)	Exposure Duration (years/ lifetime)	Inhalation Rate (m ³ /hr)		Carcinogenic AVERAGING TIME (days) (years)		Noncarcinogenic AVERAGING TIME (days) (years)	

REASONABLE MAXIMUM SCENARIO	Onsite	Adult Worker	18 - 48									
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 11					27	365	70	365	ED
	Onsite	Child Resident	11 - 18					54	365	70	365	ED
	Onsite	Adult Resident	18 - 30					70	365	70	365	ED
	Onsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table for indoor air concentration)
 PAF - Pulmonary Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 4. Intake Assumptions for Inhalation of Volatile Chemicals from Soil and/or Groundwater to Indoor Air - Future Scenario
OU 11 BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* ET	* EF	* ED	* IR	BW Body Weight (kg)	ATc		ATn /b/	
				Exposure Time (hours/ day)	Exposure Frequency (days/ year)	Exposure Duration (years/ lifetime)	Inhalation Rate (m ³ /hr)		Carcinogenic AVERAGING TIME (days) (years)		Noncarcinogenic AVERAGING TIME (days) (years)	
AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5					13	365	70	365	ED
	Onsite	Child Recreational User	5 - 9					24	365	70	365	ED
	Onsite	Adult Recreational User	18 - 27					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 9					24	365	70	365	ED
	Onsite	Child Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* ET	* EF	* ED	* IR	BW Body Weight (kg)	ATc		ATn /b/	
				Exposure Time (hours/ day)	Exposure Frequency (days/ year)	Exposure Duration (years/ lifetime)	Inhalation Rate (m ³ /hr)		Carcinogenic AVERAGING TIME (days) (years)		Noncarcinogenic AVERAGING TIME (days) (years)	
REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5					13	365	70	365	ED
	Onsite	Child Recreational User	5 - 11					27	365	70	365	ED
	Onsite	Child Recreational User	11 - 18					54	365	70	365	ED
	Onsite	Adult Recreational User	18 - 30					70	365	70	365	ED
	Onsite	Adult Recreational User	18 - 48					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 11					27	365	70	365	ED
	Onsite	Child Resident	11 - 18					54	365	70	365	ED
	Onsite	Adult Resident	18 - 30					70	365	70	365	ED
	Onsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table for indoor air concentration)
PAF - Pulmonary Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 5. Intake Assumptions for Inhalation of Dust Emissions in Outdoor Air - Current Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	* IR Inhalation Rate (m ³ /hr)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

AVERAGE SCENARIO	Onsite	Adult Worker	18 - 27									
	Onsite	Child Occasional User	0 - 5					13	365	70	365	ED
	Onsite	Child Occasional User	5 - 9					24	365	70	365	ED
	Onsite	Adult Occasional User	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	* IR Inhalation Rate (m ³ /hr)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

REASONABLE MAXIMUM SCENARIO	Onsite	Adult Worker	18 - 48									
	Onsite	Child Occasional User	0 - 5					13	365	70	365	ED
	Onsite	Child Occasional User	5 - 11					27	365	70	365	ED
	Onsite	Child Occasional User	11 - 18					54	365	70	365	ED
	Onsite	Adult Occasional User	18 - 30					70	365	70	365	ED
	Onsite	Adult Occasional User	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table)
PAF - Pulmonary Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

/c/ May be an overestimate; need to consider other inclement weather conditions that may preclude swimming activities.

* = Alternate value for this exposure pathway may be available .

Worksheet 6. Intake Assumptions for Inhalation of Dust Emissions in Outdoor Air - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/ day)	* EF Exposure Frequency (days/ year)	* ED Exposure Duration (years/ lifetime)	* IR Inhalation Rate (m ³ /hr)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5					13	365	70	365	ED
	Onsite	Child Recreational User	5 - 9					24	365	70	365	ED
	Onsite	Adult Recreational User	18 - 27					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 9					24	365	70	365	ED
	Onsite	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* ET Exposure Time (hours/ day)	* EF Exposure Frequency (days/ year)	* ED Exposure Duration (years/ lifetime)	* IR Inhalation Rate (m ³ /hr)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5					13	365	70	365	ED
	Onsite	Child Recreational User	5 - 11					27	365	70	365	ED
	Onsite	Child Recreational User	11 - 18					54	365	70	365	ED
	Onsite	Adult Recreational User	18 - 30					70	365	70	365	ED
	Onsite	Adult Recreational User	18 - 48					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 11					27	365	70	365	ED
	Onsite	Child Resident	11 - 18					54	365	70	365	ED
	Onsite	Adult Resident	18 - 30					70	365	70	365	ED
	Onsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table)

PAF - Pulmonary Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

/c/ May be an overestimate; need to consider other inclement weather conditions that may preclude swimming activities.

* = Alternate value for this exposure pathway may be available .

Worksheet 7. Intake Assumptions for Ingestion of Soil - Current Scenario
OU 11 BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/year)	ED Exposure Duration (years/lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
								(days)	(years)	(days)	(years)
AVERAGE SCENARIO	Onsite	Worker	18 - 27				70	365	70	365	ED
	Onsite	Child Occasional User	0 - 5								
	Onsite	Child Occasional User	5 - 9								
	Onsite	Adult Occasional User	18 - 27								
	Offsite	Child Resident	0 - 5				13	365	70	365	ED
	Offsite	Child Resident	5 - 9				24	365	70	365	ED
	Offsite	Adult Resident	18 - 27				70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/year)	ED Exposure Duration (years/lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
								(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	On-Site	Worker	18 - 48				70	365	70	365	ED
	Off-Site	Worker	18 - 48				70	365	70	365	ED
	On-Site	Child Resident	0 - 5				13	365	70	365	ED
	On-Site	Child Resident	5 - 11				27	365	70	365	ED
	On-Site	Child Resident	11 - 18				54	365	70	365	ED
	On-Site	Adult Resident	18 - 30				70	365	70	365	ED
	On-Site	Adult Resident	18 - 48				70	365	70	365	ED
	Off-Site	Child Resident	0 - 5				13	365	70	365	ED
	Off-Site	Child Resident	5 - 11				27	365	70	365	ED
	Off-Site	Child Resident	11 - 18				54	365	70	365	ED
	Off-Site	Adult Resident	18 - 30				70	365	70	365	ED
	Off-Site	Adult Resident	18 - 48				70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CS - Chemical Concentration in Soil (mg/kg; Table)

OAF - Oral Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CS} \times \text{OAF} \times \text{EF} \times \text{ED} \times \text{IR} \times 10^{-6} \text{ kg/mg}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 8. Intake Assumptions for Ingestion of Soil - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/year)	ED Exposure Duration (years/lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
								(days)	(years)	(days)	(years)

AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5								
	Onsite	Child Recreational User	5 - 9								
	Onsite	Adult Recreational User	18 - 27								
	Onsite	Child Resident	0 - 5								
	Onsite	Child Resident	5 - 9								
	Onsite	Adult Resident	18 - 27								
	Offsite	Child Resident	0 - 5				13	365	70	365	ED
	Offsite	Child Resident	5 - 9				24	365	70	365	ED
	Offsite	Adult Resident	18 - 27				70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/year)	ED Exposure Duration (years/lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
								(days)	(years)	(days)	(years)

REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5								
	Onsite	Child Recreational User	5 - 11								
	Onsite	Child Recreational User	11 - 18								
	Onsite	Adult Recreational User	18 - 30								
	Onsite	Adult Recreational User	18 - 48								
	Onsite	Child Resident	0 - 5								
	Onsite	Child Resident	5 - 11								
	Onsite	Child Resident	11 - 18								
	Onsite	Adult Resident	18 - 30								
	Onsite	Adult Resident	18 - 48								
	Offsite	Child Resident	0 - 5				13	365	70	365	ED
	Offsite	Child Resident	5 - 11				27	365	70	365	ED
	Offsite	Child Resident	11 - 18				54	365	70	365	ED
	Offsite	Adult Resident	18 - 30				70	365	70	365	ED
	Offsite	Adult Resident	18 - 48				70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CS - Chemical Concentration in Soil (mg/kg; Table)
OAF - Oral Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CS} \times \text{OAF} \times \text{EF} \times \text{ED} \times 10^{-6} \text{ kg/mg}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).
/b/ ATn (years) is equivalent to ED value in all cases.
* = Alternate value for this exposure pathway may be available .

Worksheet 9. Intake Assumptions for Dermal Contact with Soil - Current Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* SA Surface Area (cm ²)	* AF Adherence Factor (mg/cm ²)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
AVERAGE SCENARIO	On-Site	Worker	18 - 27					70	365	70	365	ED
	Onsite	Child Occasional User	0 - 5									
	Onsite	Child Occasional User	5 - 9									
	Onsite	Adult Occasional User	18 - 27									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 9					24	365	70	365	ED
	Offsite	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* SA Surface Area (cm ²)	* AF Adherence Factor (mg/cm ²)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	Onsite	Worker	18 - 48					70	365	70	365	ED
	Onsite	Child Occasional User	0 - 5									
	Onsite	Child Occasional User	5 - 11									
	Onsite	Child Occasional User	11 - 18									
	Onsite	Adult Occasional User	18 - 30									
	Onsite	Adult Occasional User	18 - 48									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 11					27	365	70	365	ED
	Offsite	Child Resident	11 - 18					54	365	70	365	ED
	Offsite	Adult Resident	18 - 30					70	365	70	365	ED
	Offsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CS - Chemical Concentration in Soil (mg/kg; Table)

DAF - Dermal Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CS} \times \text{DAF} \times \text{EF} \times \text{ED} \times \text{SA} \times \text{AF} \times 10^{-6} \text{ kg/mg}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 10. Intake Assumptions for Dermal Contact with Soil - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* SA Surface Area (cm ²)	* AF Adherence Factor (mg/cm ²)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5									
	Onsite	Child Recreational User	5 - 9									
	Onsite	Adult Recreational User	18 - 27									
	Onsite	Child Resident	0 - 5									
	Onsite	Child Resident	5 - 9									
	Onsite	Adult Resident	18 - 27									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 9					24	365	70	365	ED
	Offsite	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* SA Surface Area (cm ²)	* AF Adherence Factor (mg/cm ²)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5									
	Onsite	Child Recreational User	5 - 11									
	Onsite	Child Recreational User	11 - 18									
	Onsite	Adult Recreational User	18 - 30									
	Onsite	Adult Recreational User	18 - 48									
	Onsite	Child Resident	0 - 5									
	Onsite	Child Resident	5 - 11									
	Onsite	Child Resident	11 - 18									
	Onsite	Adult Resident	18 - 30									
	Onsite	Adult Resident	18 - 48									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 11					27	365	70	365	ED
	Offsite	Child Resident	11 - 18					54	365	70	365	ED
	Offsite	Adult Resident	18 - 30					70	365	70	365	ED
	Offsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CS - Chemical Concentration in Soil (mg/kg; Table)
DAF - Dermal Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CS} \times \text{DAF} \times \text{EF} \times \text{ED} \times \text{SA} \times \text{AF} \times 10^{-6} \text{ kg/mg}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).
/b/ ATn (years) is equivalent to ED value in all cases.
* = Alternate value for this exposure pathway may be available .

Worksheet 11. Intake Assumptions for Ingestion of Groundwater As Drinking Water Source - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* FI Fraction of Intake (unitless)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
AVERAGE SCENARIO	On-Site	Worker	18 - 27					70	365	70	365	ED
	On-Site	Child Recreational User	0 - 5									
	On-Site	Child Recreational User	5 - 9									
	On-Site	Adult Recreational User	18 - 27									
	On-Site	Child Resident	0 - 5					13	365	70	365	ED
	On-Site	Child Resident	5 - 9					24	365	70	365	ED
	On-Site	Adult Resident	18 - 27					70	365	70	365	ED
	Off-Site	Child Resident	0 - 5					13	365	70	365	ED
	Off-Site	Child Resident	5 - 9					24	365	70	365	ED
	Off-Site	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* FI Fraction of Intake (unitless)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	On-Site	Worker	18 - 48					70	365	70	365	ED
	On-Site	Child Recreational User	0 - 5									
	On-Site	Child Recreational User	5 - 11									
	On-Site	Child Recreational User	11 - 18									
	On-Site	Adult Recreational User	18 - 30									
	On-Site	Adult Recreational User	18 - 48									
	On-Site	Child Resident	0 - 5					13	365	70	365	ED
	On-Site	Child Resident	5 - 11					27	365	70	365	ED
	On-Site	Child Resident	11 - 18					54	365	70	365	ED
	On-Site	Adult Resident	18 - 30					70	365	70	365	ED
	On-Site	Adult Resident	18 - 48					70	365	70	365	ED
	Off-Site	Child Resident	0 - 5					13	365	70	365	ED
	Off-Site	Child Resident	5 - 11					27	365	70	365	ED
	Off-Site	Child Resident	11 - 18					54	365	70	365	ED
	Off-Site	Adult Resident	18 - 30					70	365	70	365	ED
	Off-Site	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CW - Chemical Concentration in Water (mg/l; Table)

OAF - Oral Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CW} \times \text{OAF} \times \text{FI} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 12. Intake Assumptions for Ingestion of Bay Water During Swimming - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
								(days)	(years)	(days)	(years)
AVERAGE SCENARIO	On-Site	Child Recreational User	0 - 5				13	365	70	365	ED
	On-Site	Child Recreational User	5 - 9				24	365	70	365	ED
	On-Site	Adult Recreational User	18 - 27				70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* EF Exposure Frequency (days/ year)	ED Exposure Duration (years/ lifetime)	* IR Ingestion Rate (l/day)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn /b/ Noncarcinogenic AVERAGING TIME	
								(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	On-Site	Child Recreational User	0 - 5				13	365	70	365	ED
	On-Site	Child Recreational User	5 - 11				27	365	70	365	ED
	On-Site	Child Recreational User	11 - 18				54	365	70	365	ED
	On-Site	Adult Recreational User	18 - 30				70	365	70	365	ED
	On-Site	Adult Recreational User	18 - 48				70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CW - Chemical Concentration in Water (mg/l; Table)

OAF - Oral Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CW} \times \text{OAF} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 13. Intake Assumptions for Ingestion of Fish and Shellfish from Bay Waters - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* FT	* EF	ED	* IR	BW	ATc		ATn /b/	
				Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years/lifetime)	Ingestion Rate (kg/day)	Body Weight (kg)	Carcinogenic AVERAGING TIME (days) (years)	Noncarcinogenic AVERAGING TIME (days) (years)		

AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5									
	Onsite	Child Recreational User	5 - 9									
	Onsite	Adult Recreational User	18 - 27									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 9					24	365	70	365	ED
	Offsite	Adult Resident	18 - 27					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 9					24	365	70	365	ED
	Onsite	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* FT	* EF	ED	* IR	BW	ATc		ATn /b/	
				Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years/lifetime)	Ingestion Rate (kg/day)	Body Weight (kg)	Carcinogenic AVERAGING TIME (days) (years)	Noncarcinogenic AVERAGING TIME (days) (years)		

REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5									
	Onsite	Child Recreational User	5 - 11									
	Onsite	Child Recreational User	11 - 18									
	Onsite	Adult Recreational User	18 - 30									
	Onsite	Adult Recreational User	18 - 48									
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 11					27	365	70	365	ED
	Offsite	Child Resident	11 - 18					54	365	70	365	ED
	Offsite	Adult Resident	18 - 30					70	365	70	365	ED
	Offsite	Adult Resident	18 - 48					70	365	70	365	ED
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 11					27	365	70	365	ED
	Onsite	Child Resident	11 - 18					54	365	70	365	ED
	Onsite	Adult Resident	18 - 30					70	365	70	365	ED
	Onsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CF - Chemical Concentration in fish (mg/kg; Table)

OAF - Oral Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CF} \times \text{OAF} \times \text{FT} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 14. Intake Assumptions for Ingestion of Homegrown Fruits and Vegetables - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age /a/ (years)	* FI	* EF	* SF	ED	* IR	BW	ATc		ATn /b/	
				Fraction Ingested (unitless)	Exposure Frequency (days/year)	Seasonal Factor (unitless)	Exposure Duration (years/lifetime)	Ingestion Rate (kg/day)	Body Weight (kg)	Carcinogenic AVERAGING TIME (days) (years)	Noncarcinogenic AVERAGING TIME (days) (years)		
AVERAGE SCENARIO	On-Site	Child Resident	0 - 5						13	365	70	365	ED
	On-Site	Child Resident	5 - 9						24	365	70	365	ED
	On-Site	Adult Resident	18 - 27						70	365	70	365	ED

Scenario	Location	Receptor Population	Age /a/ (years)	* FI	* EF	* SF	ED	* IR	BW	ATc		ATn /b/	
				Fraction Ingested (unitless)	Exposure Frequency (days/year)	Seasonal Factor (unitless)	Exposure Duration (years/lifetime)	Ingestion Rate (kg/day)	Body Weight (kg)	Carcinogenic AVERAGING TIME (days) (years)	Noncarcinogenic AVERAGING TIME (days) (years)		
REASONABLE MAXIMUM SCENARIO	On-Site	Child Resident	0 - 5						13	365	70	365	ED
	On-Site	Child Resident	5 - 11						27	365	70	365	ED
	On-Site	Child Resident	11 - 18						54	365	70	365	ED
	On-Site	Adult Resident	18 - 30						70	365	70	365	ED
	On-Site	Adult Resident	18 - 48						70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CF - Chemical Concentration in Vegetable and Fruits (mg/kg; Table)
OAF - Oral Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CF} \times \text{OAF} \times \text{FI} \times \text{EF} \times \text{SF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).

/b/ ATn (years) is equivalent to ED value in all cases.

* = Alternate value for this exposure pathway may be available .

Worksheet 15. Intake Assumptions for Dermal Contact with Bay Water During Swimming - Future Scenario
 OU II BPHEE - Hunter's Point Annex

DRAFT

Scenario	Location	Receptor Population	Age (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	CF Volumetric Conversion Factor (l/cm ³)	* SA Skin Surface Area (cm ²)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn Noncarcinogenic AVERAGING TIME	
										(days)	(years)	(days)	(years)
AVERAGE SCENARIO	Onsite	Child Recreational User	0 - 5						13	365	70	365	ED
	Onsite	Child Recreational User	5 - 9						24	365	70	365	ED
	Onsite	Adult Recreational User	18 - 27						70	365	70	365	ED

Scenario	Location	Receptor Population	Age (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	CF Volumetric Conversion Factor (l/cm ³)	* SA Skin Surface Area (cm ²)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn Noncarcinogenic AVERAGING TIME	
										(days)	(years)	(days)	(years)
REASONABLE MAXIMUM SCENARIO	Onsite	Child Recreational User	0 - 5						13	365	70	365	ED
	Onsite	Child Recreational User	5 - 11						27	365	70	365	ED
	Onsite	Child Recreational User	11 - 18						54	365	70	365	ED
	Onsite	Adult Recreational User	18 - 30						70	365	70	365	ED
	Onsite	Adult Recreational User	18 - 48						70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

- CW - Chemical Concentration in Water (mg/l; Table)
- PC - Permeability Constants (cm/hr; Table)
- DAF - Dermal Absorption Factors (%; Table) - if PC not used

Equation

$$\text{Absorbed Dose /d/} = \frac{\text{CW} \times (\text{PC or DAF}) \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF} \times \text{SA}}{\text{BW} \times \text{AT}}$$

- /a/ The age groups assigned are based on assumed exposure duration (ED).
- /b/ ATn (years) is equivalent to ED value in all cases.
- /c/ May be an overestimate; need to consider other inclement weather conditions precluding swimming activities.
- /d/ PC factor will not be used if DAF factor used.
- * = Alternate value for this exposure pathway may be available .

Worksheet 16. Intake Assumptions for Dermal Contact with Groundwater During Showering - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age (years)	* ET	* EF	* ED	CF Volumetric Conversion Factor (l/cm ³)	* SA	BW Body Weight (kg)	ATc		ATn	
				Exposure Time (hours/ day)	Exposure Frequency (days/ year)	Exposure Duration (years/ lifetime)		Skin Surface Area (cm ²)		Carcinogenic AVERAGING TIME	Noncarcinogenic AVERAGING TIME	(days)	(years)
AVERAGE SCENARIO													
	Onsite	Worker	18 - 27						70	365	70	365	ED
	Onsite	Child Recreational User	0 - 5										
	Onsite	Child Recreational User	5 - 9										
	Onsite	Adult Recreational User	18 - 27										
	Onsite	Child Resident	0 - 5						13	365	70	365	ED
	Onsite	Child Resident	5 - 9						24	365	70	365	ED
	Onsite	Adult Resident	18 - 27						70	365	70	365	ED
	Offsite	Child Resident	0 - 5						13	365	70	365	ED
	Offsite	Child Resident	5 - 9						24	365	70	365	ED
	Offsite	Adult Resident	18 - 27						70	365	70	365	ED

Scenario	Location	Receptor Population	Age (years)	* ET	* EF	* ED	CF Volumetric Conversion Factor (l/cm ³)	* SA	BW Body Weight (kg)	ATc		ATn	
				Exposure Time (hours/ day)	Exposure Frequency (days/ year)	Exposure Duration (years/ lifetime)		Skin Surface Area (cm ²)		Carcinogenic AVERAGING TIME	Noncarcinogenic AVERAGING TIME	(days)	(years)
REASONABLE MAXIMUM SCENARIO													
	Onsite	Worker	18 - 48						70	365	70	365	ED
	Onsite	Child Recreational User	0 - 5										
	Onsite	Child Recreational User	5 - 11										
	Onsite	Child Recreational User	11 - 18										
	Onsite	Adult Recreational User	18 - 30										
	Onsite	Adult Recreational User	18 - 48										
	Onsite	Child Resident	0 - 5						13	365	70	365	ED
	Onsite	Child Resident	5 - 11						27	365	70	365	ED
	Onsite	Child Resident	11 - 18						54	365	70	365	ED
	Onsite	Adult Resident	18 - 30						70	365	70	365	ED
	Onsite	Adult Resident	18 - 48						70	365	70	365	ED
	Offsite	Child Resident	0 - 5						13	365	70	365	ED
	Offsite	Child Resident	5 - 11						27	365	70	365	ED
	Offsite	Child Resident	11 - 18						54	365	70	365	ED
	Offsite	Adult Resident	18 - 30						70	365	70	365	ED
	Offsite	Adult Resident	18 - 48						70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

- CW - Chemical Concentration in Water (mg/L; Table)
- PC - Permeability Constants (cm/hr; Table)
- DAF - Dermal Absorption Factors (%; Table)

Equation

$$\text{Absorbed Dose /c/} = \frac{\text{CW} \times \text{SA} \times \text{PC} \times \text{DAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}}$$

- /a/ The age groups assigned are based on assumed exposure duration (ED).
- /b/ ATn (years) is equivalent to ED value in all cases.
- /c/ PC factor will not be used if DAF factor used.
- * = Alternate value for this exposure pathway may be available.

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Worksheet 17. Intake Assumptions for Inhalation of Chemicals in Groundwater During Showering - Future Scenario
OU II BPHEE - Hunter's Point Annex

Scenario	Location	Receptor Population	Age (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	* IR Inhalation Rate (m ³ /hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

AVERAGE SCENARIO	Onsite	Worker	18 - 27					70	365	70	365	ED
	Onsite	Child Recreational User	0 - 5									
	Onsite	Child Recreational User	5 - 9									
	Onsite	Adult Recreational User	18 - 27									
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 9					24	365	70	365	ED
	Onsite	Adult Resident	18 - 27					70	365	70	365	ED
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 9					24	365	70	365	ED
	Offsite	Adult Resident	18 - 27					70	365	70	365	ED

Scenario	Location	Receptor Population	Age (years)	* ET Exposure Time (hours/day)	* EF Exposure Frequency (days/year)	* ED Exposure Duration (years/lifetime)	* IR Inhalation Rate (m ³ /hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME		ATn Noncarcinogenic AVERAGING TIME	
									(days)	(years)	(days)	(years)

REASONABLE MAXIMUM SCENARIO	Onsite	Worker	18 - 48					70	365	70	365	ED
	Onsite	Child Recreational User	0 - 5									
	Onsite	Child Recreational User	5 - 11									
	Onsite	Child Recreational User	11 - 18									
	Onsite	Adult Recreational User	18 - 30									
	Onsite	Adult Recreational User	18 - 48									
	Onsite	Child Resident	0 - 5					13	365	70	365	ED
	Onsite	Child Resident	5 - 11					27	365	70	365	ED
	Onsite	Child Resident	11 - 18					54	365	70	365	ED
	Onsite	Adult Resident	18 - 30					70	365	70	365	ED
	Onsite	Adult Resident	18 - 48					70	365	70	365	ED
	Offsite	Child Resident	0 - 5					13	365	70	365	ED
	Offsite	Child Resident	5 - 11					27	365	70	365	ED
	Offsite	Child Resident	11 - 18					54	365	70	365	ED
	Offsite	Adult Resident	18 - 30					70	365	70	365	ED
	Offsite	Adult Resident	18 - 48					70	365	70	365	ED

Chemical-Specific Intake Assumptions to Consider

CA - Chemical Concentration in Air (mg/m³; Table)
PAF -Pulmonary Absorption Factor (%; Table)

Equation

$$\text{Absorbed Dose} = \frac{\text{CA} \times \text{PAF} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{IR}}{\text{BW} \times \text{AT}}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).
/b/ ATn (years) is equivalent to ED value in all cases.
* = Alternate value for this exposure pathway may be available .