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Transmittal

Date: 5 October 2005

From: Lynn Marie Hornecker

To: **Frank Cheng**
State of California Environmental Protection Agency
Department of Toxic Substances Control (DTSC), Region 4
Site Mitigation Branch, Base Closure Unit
5796 Corporate Avenue
Cypress, CA 90630

Subj: Response to DTSC Comments
Former Temporary Accumulation Area (TAA) 769
Former Marine Corps Air Station, El Toro

Transmitted as the attachment is a set of corrected pages for the documentation for Former TAA 769 at the Former Marine Corps Air Station, El Toro. The text of Sections 5 and 6 and Table 7 were revised in response to the DTSC comments dated 15 August 2005.

Please review the attached information and provide comments within 60 days of receipt, if possible. If additional time is required for the review, please contact Mr. Darren Newton (E-mail: Darren.Newton@navy.mil) to establish a schedule for the completion of the review.

Please do not hesitate to contact me at (619) 532-0783 if you have questions pertaining to Former TAA 769.

Thank you very much.

Attachment
Corrected pages for Former TAA 769 documentation

Copy to:
Darren Newton
BRAC Environmental Coordinator
Base Realignment and Closure
Marine Corps Air Station, El Toro
7040 Trabuco Road
Irvine, California 92618

CSO El Toro

Project File (MCAS El Toro)

ADDENDUM TO SUMMARY REPORT TEMPORARY ACCUMULATION AREA 769

DATED 04 JUNE 2003

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

RECORD NO. M60050_003417

5.0 Risk Characterization and Hazard Index Calculation

This section briefly describes the approach used to estimate risk and summarizes the baseline screening level risk assessment results for former TAA 769. A screening level risk assessment for human health based on a residential land use was conducted following the guidance provided in the EPA Region 9 PRGs Memorandum dated November 1, 2002 (EPA, 2002). In accordance with DTSC comments letter dated 14 December 2004, the risk evaluation has been expanded to include a screening level assessment of health effects on construction workers and an assessment of potential exposure to lead using DTSC's Lead Spread Model (version 7.0); this assessment was based on the guidance for this scenario in the EPA *Supplemental Guidance to Developing Soil Screening Guidance for Superfund Sites* (EPA, 2002). The analytical results of Shaw Environmental, Inc. confirmation soil borings (TAA769-SB-A through TAA769-SB-C) and the RCRA Facility Assessment (RFA) angle boring (222A1) conducted at former TAA 769 were used to calculate risks.

5.1 Physical Characteristics

Based on the review of the RFA boring log (222A1), the subsurface lithology at former TAA 769 consists of primarily of silts and sands. These units appear typical of the channel and overbank deposits in comprising the Holocene deposits on the Tustin Plain. The groundwater is present at a depth of approximately 111 feet below ground surface (CDM, 2003).

5.1.1 Exposure Assessment

Former TAA 769 was used as a temporary hazardous waste storage area. Areas surrounding former TAA 769 are unpaved.

The Station officially closed on July 2, 1999 in accordance with the Base Closure and Realignment Act of 1993 (BRAC III). Former TAA 769 is located within a parcel designated for future use as Open Space: Exposition Center according to the Great Park Land Use Plan that was issued by the City of Irvine in June 2002.

For screening purposes, the ingestion, dermal contact, and inhalation exposure pathways are assumed to be complete for former TAA 769, as if the area were unpaved. Should the screening fail, further evaluation of the exposure pathways would be required. A site conceptual model for former TAA 769 is shown on Figure 3.

Under a residential land use scenario at former TAA 769, workers or humans could be potentially exposed to surrounding soil by ingestion, dermal contact, or inhalation of dust or

volatilized contaminants. These are the same exposure pathways evaluated by the EPA PRGs (EPA, 2002). Figure 4 presents the potential migration pathways at TAA 769.

For the purposes of this risk screening evaluation, the residential scenario is used as the worst-case scenario. The PRGs based on this exposure scenario are provided in Table 3.

The assessment of lead is based on predicting blood lead levels rather than a comparison of the dose to a toxicity criterion. For this risk assessment, DTSC's Lead Spread Model (version 7.0) has been used to estimate the potential adverse health effects of lead. For this assessment, all default exposure assumptions have been used except for the soil concentration of lead (Table 4).

The redevelopment of the TAA 769 site will likely involves construction activities that will disturb soil. In accordance with DTSC comments letter dated 14 December 2004, a screening level risk assessment was also conducted for this receptor. The exposure pathways assumed to be complete for construction workers are inhalation of soil particulates, soil ingestion, and soil dermal contact. This is a small site (approximately 17 foot by 12 foot area) at which any construction is not likely to take more than 1 to 2 days for either total excavation or utility maintenance. However, a health conservative assessment was taken to this assessment, particularly regarding the length of time workers will be exposed to soil, for this assessment it was assumed that construction workers would be on-site and involved in activities that will create high levels of dust for one month (21 work days) over a single year (that is an exposure averaging time of 365 days).

The potential air concentration of soil is difficult to predict since it is a function of the activities and the climate. Based on occupational regulations, unprotected workers should not be exposed to soil suspended in the air at a concentration that exceeds the Occupational Safety and Health Administration Permissible Exposure Limit (PEL) of 10 mg/m^3. For the purposes of this risk assessment, it was assumed that average concentration over the construction period would be a concentration equal to $1/10^{th}$ of the PEL. This is likely to be a conservative measure since earthmoving and heavy equipment travel (i.e., those actions which would create the highest dust emissions) would not expect to last for more than a few minutes during any given work days. During other activities, wind erosion of a bare soil surface is likely to create the dust and the emission rates for wind-erosion are generally substantially lower than during the earthmoving activities. Other exposure factors are shown on Table 6.

5.2 *Toxicity Assessment*

The PRGs incorporate the toxicity values from the Integrated Risk Information System (IRIS), the Health Effects Assessment Summary Tables, and the National Center for

Environmental Assessment. Cancer PRGs incorporate cancer toxicity values and the noncancer PRGs incorporates the toxicity values for chronic health affects other than cancer (EPA, 2002). Both cancer risk and noncancer hazards were evaluated in this screening risk assessment. For the construction worker scenario, toxicity factors were obtained, in order of priority, from the Office of Environmental Health Hazard Assessment (OEHHA) toxicity criteria database and EPA's IRIS and comparable databases, as evaluated and published in the 2004 PRG tables. The values used are provided in Table 6.

5.3 Risk Characterization

Risk Characterization for Residential Receptor

The PRGs are concentrations calculated using standard exposure factors that are protective of humans, including sensitive groups, over a lifetime. These PRG concentrations pose acceptable cancer risk or non-cancer hazard under the exposure scenarios evaluated. Generally, a cancer risk of 10^{-6} or less and a non-cancer hazard index (HI) of 1.0 or less are considered acceptable levels of exposure. Therefore, the PRG concentrations are calculated to the lower end of the acceptable cancer risk range of 10^{-6} and to a non-cancer hazard index of 1.0.

Cancer risk is calculated by dividing the site concentration by the PRG for each chemical. The ratios are added and the sum is then multiplied by 10^{-6}. The hazard index is calculated by dividing the site concentration by the PRG for each chemical and adding the resultant ratios.

Maximum concentrations for chemicals detected at the site are used for this risk screening, for this screening no comparisons of site concentrations to background concentrations have been made for selection of chemicals of potential concern. For the purposes of risk management this assessment has also included a risk screening of the background concentrations of the chemicals at the site. The objective of this screening was to put the site results into perspective with the local, ambient risk for chemicals in the soil. To maintain a conservative estimate of background risk, the 95th quantile background concentrations calculated for the Station (BNI, 1996b) are used to calculate background contributions to cancer risk.

At former TAA 769, the detected carcinogens in soil were benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, ideno(1,2,3-cd)pyrene, 4,4'-DDD, 4,4'DDE, dieldrin, heptachlor epoxide, arsenic, beryllium, chromium, and cobalt. The summed cancer risk for soil under the potential future residential scenario is 2×10^{-5}. This risk is primarily associated with potential exposures to arsenic (the risk is 1×10^{-5}), dieldrin (3×10^{-6}) and benzo(a)pyrene (risks are 2×10^{-6}). The arsenic at the site soil may be

naturally occurring, the concentration in site soil is less than the reported background concentrations (Table 3) and the risk associated with the background concentration is 2 x 10^{-5}. The risks from benzo(a)pyrene and dieldrin are just above the *de minimus* criterion of 1 x 10^{-6}. These chemicals do not occur naturally in soil, but there are sources of the dieldrin and benzo(a)pyrene to the environment that are not related to site activities at TAA769 (such as grass fires, auto exhausts, and pesticide spraying at the community level). Both chemicals have been detected in the background soils at TAA769 and the cancer risks associated with these background levels are 0.4 x 10^{-6} for benzo(a)pyrene and 3 x 10^{-6} for dieldrin. Consequently, the site risks are consistent with ambient environmental risks and are close to the *de minimus* level.

Compounds that were detected at former TAA 769 that contribute to the non-cancer HI include acetone, 2-butanone, toluene, fluoranthene, pyrene, endrin, aluminum, antimony, arsenic, barium, beryllium, cobalt, copper, iron, lead, manganese, nickel, thallium, vanadium and zinc. The summed non-cancer hazard index for soil under the potential future residential scenario is 2.93 (Table 3). This suggests that there is a level of concern for noncarcinogenic health effects but it should also be noted that this is a conservative HI because it assumes that maximum detected concentrations are representative of the entire site and is summed across all toxicological endpoints. This noncarcinogenic hazard is evaluated further in the next section.

As indicated earlier, the exposures to lead in the soil at the TAA 769 site have been evaluated using the DTSC's Lead Spread model (Table 4). This model predicts the blood lead concentrations for children and adults based on site conditions as well as baseline lead exposures that are obtained from food, air, and drinking water. For the site, the model predicts 99% of all exposed children would have a blood lead level of 7.0 µg/dL or less. For pica children, the model predicts the blood lead levels of 99% of all exposed individuals would be 8.4 µg/dL or less. Generally, the critical blood lead level is 10 µg/dL, at this concentration intervention to reduce lead exposures are implemented. Based on this comparison, no potential health threat for the lead soil levels at the TAA 769 site have been identified.

Target Organ Evaluation for Residential Receptor

Because initial screening for residential scenario resulted in an HI greater than 1.0, a target organ evaluation was conducted for the potential contributors. The only significant contributors are those chemicals with maximum concentrations that could affect the HI or those that contribute 0.1 or greater to the HI are aluminum, antimony, arsenic, iron, lead, manganese, thallium, and vanadium as shown in Table 5.

Using maximum concentrations, the iron overload resulted in an HI of 1.29 (Klaasen et. al., 1999). The target organ hazard index using maximum values for cardio-vascular system, skin, endocrine system, longevity, central nervous system (1.16), kidney, blood, and reproductive system were each less than 1.0. The contributor to iron overload was iron.

The target organ evaluation using average concentrations for aluminum, antimony, arsenic, iron, lead, manganese, thallium, and vanadium resulted in a HI for each of the target organs of less than 1.0.

Results of the target organ evaluation using maximum concentrations and then for average concentrations are shown in Table 5.

Risk Characterization for Construction Worker

Table 7 presents the risk characterization for the construction workers. Based on the maximum measured concentration of each COPC in the soil, the predicted cancer risk is 3×10^{-7}. That is below the *de minimus* risk level and this predicted risk is in the range generally considered acceptable for occupational risks. The primary risk drivers in this assessment are arsenic, the risk via the soil ingestion and skin contact routes is 2×10^{-7}. The site concentrations of arsenic (2.7 to 5.6 mg/kg) are consistent with background, naturally occurring concentrations of arsenic at MCAS El Toro is 6.86 mg/kg. This risk is also associated with the assumed concentration of soil suspended in the air of 1 mg/m^3, which is a conservative estimate for long term exposures.

Table 7 also presents the non-carcinogenic health hazard assessment. A hazard index of 0.7 has been predicted. All chemicals had hazard quotients equal to or less than 1.

Summary

The site-related incremental cancer risk and non-cancer hazard index at former TAA 769 are acceptable for the following reasons:

- Although the cancer risk for hypothetical on-site residents is above the *de minimus* level of 1×10^{-6}, the major sources of the risk (arsenic, dieldrin, and benzo(a)pyrene) in site soil occur at or close to background soil levels. Thus, the risk associated with exposure to site soils is consistent with risks associated with ambient environmental exposures.

- For the residential scenario, the target organ evaluation using average concentrations for aluminum, antimony, arsenic, iron, lead, manganese, thallium, and vanadium resulted in a HI for each of the target organs of less than 1.0.

- DTSC's Lead Spread model for the TAA 769 site, predicts 99% of all exposed children would have a blood lead level of 7.0 µg/dL or less. For pica children, the model predicts

the blood lead levels of 99% of all exposed individuals would be 8.4 μg/dL or less. Generally, the critical blood lead level is 10 μg/dL, at this concentration intervention to reduce lead exposures are implemented. Based on this comparison, no potential health threat for the lead soil levels at the TAA 769 site has been identified.

- For the construction worker scenario, the hazard index is less than 1.

6.0 Conclusions and Recommendations

The following conclusions are based upon existing background information, previous field investigations, and Shaw Environmental Inc.'s confirmation soil sampling analytical results and screening level risk assessment calculations:

- Former TAA 769 consists of an approximately 17-foot by 12-foot concrete pad with berm, roof, and chain-linked fence. No cracks or stains were observed on the surface of the TAA.
- TAA 769 was investigated as SWMU 222 during the RFA.
- During a field RFA visit in 1991, JEG identified SWMU 222 (also known as TAA 769) as a temporary hazardous waste storage area. Because the TAA was used as a HWSA in the past, SWMU 222 (TAA 769) was recommended for a sampling visit (JEG, 1993).
- JEG advanced one angle boring (222A1) on the northwest side of SWMU 222 (TAA 769). Soil boring 186A1 was drilled using a hollow-stem auger rig to a depth of 62 feet below ground surface (bgs). Because the concentrations of detected compounds were below RFA established cleanup goals for the site and/or below the contract required detection limit (CRDL), JEG recommended "No Further Action (NFA)" for SWMU 222 (TAA 769).
- In 1994, as part of the RFA, BNI visited former TAA 769, and observed a 10-foot by 10-foot, concrete pad with berm and roof. There were twenty 5-gallon containers stored at TAA 769, and the concrete pad appeared clean. Based on observations during their site visit, BNI did not recommend sampling at the TAA.
- In October 2002, a *Summary Report, Temporary Accumulation Area (TAA) 769, Marine Corps Air Station, El Toro, California* was submitted to the California Department of Toxic Substances Control (DTSC) Region 4.
- After reviewing the Summary Report the DTSC, in a letter dated October 29, 2002, requested further investigation.
- Based on the October 2002 letter from the DTSC, Shaw Environmental, Inc. collected a total of 6 confirmation soil samples from three hand auger boring locations (TAA769-SB-A through TAA769-SB-C), in close proximity to TAA 769 in April 2003.
- The detected carcinogens in soil were benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, ideno(1,2,3-cd)pyrene, 4,4'-DDD, 4,4'DDE, dieldrin, heptachlor epoxide, arsenic, beryllium, chromium, and cobalt, which were evaluated to determine the risk associated with their presence for present or anticipated future land uses.
- Compounds that were detected at former TAA 769 that contribute to the residential scenario non-cancer HI include acetone, 2-butanone, toluene, fluoranthene, pyrene, endrin, aluminum, antimony, arsenic, barium, beryllium, cobalt, copper, iron, lead,

manganese, nickel, thallium, vanadium and zinc. For the construction scenario, the noncarcinogenic chemical of concern is aluminum.

- The residential risk calculations for former TAA 769 resulted in a site-related net cancer risk less background risk of less than 10^{-6}. The predicted risk level for construction workers is 3×10^{-7}.

- DTSC's Lead Spread model for the TAA 769 site, predicts 99% of all exposed children would have a blood lead level of 7.0 µg/dL or less. For pica children, the model predicts the blood lead levels of 99% of all exposed individuals would be 8.4 µg/dL or less. Generally, the critical blood lead level is 10 µg/dL, at this concentration intervention to reduce lead exposures are implemented. Based on this comparison, no potential health threat for the lead soil levels at the TAA 769 site has been identified.

- The target organ evaluation using average concentrations for aluminum, antimony, arsenic, iron, lead, manganese, thallium, and vanadium resulted in a HI for each of the target organs of less than 1.0.

The objectives of this project are considered to be achieved, since former TAA 769 is no longer used for storage of hazardous waste. Confirmation soil sampling was conducted at former TAA 769 to verify that concentrations of contaminants were at or below acceptable background or health-risk based concentrations.

Based upon the absence of evidence of a significant release at former TAA 769, the screening risk calculations, it is recommended that former TAA 769 (SWMU 222) should be identified as "closed" in the next Base Realignment Closure Business Plan update.

Table 7
Construction Worker Scenario Risk Characterization
Former TAA 769

Inhalation Risk =	Inhalation LADD * CSFi	Inhalation HQ =	Inhalation ADD / RfDi
Oral Risk =	(Soil Ingestion LADD + Soil Dermal Contact LADD) * CSFo	Oral HQ =	(Soil Ingestion ADD + Soil Dermal Contact ADD) / RfDo

where

Variable	rameter Definition	units	value
Inhalation LADD	Lifetime Average Daily Dose - Inhalation Pathway	mg/kg-day	Table 6
Soil Ingestion LADD	Lifetime Average Daily Dose - Soil Ingestion Pathway	mg/kg-day	Table 6
Soil Dermal Contact LADD	Lifetime Average Daily Dose - Soil Dermal Contact Pathway	mg/kg-day	Table 6
Inhalation ADD	Lifetime Average Daily Dose - Inhalation Pathway	mg/kg-day	Table 6
Soil Ingestion ADD	Lifetime Average Daily Dose - Soil Ingestion Pathway	mg/kg-day	Table 6
Soil Dermal Contact ADD	Lifetime Average Daily Dose - Soil Dermal Contact Pathway	mg/kg-day	Table 6
CSFi	Cancer Slope Factor - Inhalation	$(mg/kg\text{-}day)^{-1}$	OEHHA Toxicity Database, EPA (2004)
CSFo	Cancer Slope Factor - Oral	$(mg/kg\text{-}day)^{-1}$	OEHHA Toxicity Database, EPA (2004)
RfDi	Reference Dose - Inhalation	mg/kg-day	OEHHA Toxicity Database, EPA (2004)
RfDo	Reference Dose - Oral	mg/kg-day	OEHHA Toxicity Database, EPA (2004)

Chemical	CSFi	CSFo	Source	Inhalation Risk	Oral Risk	Total Risk	RFDi	RFDo	Source	Inhalation HQ*	Oral HQ*	Hazard Index*
Volatiles												
Acetone	Not Applicable						9.00E-01	9.00E-01	IRIS/IRIS	0.0000	0.0000	0.0000
2-Butanone	Not Applicable						1.40E+00	6.00E-01	IRIS/IRIS	0.0000	0.0000	0.0000
Toluene	Not Applicable						8.57E-01	2.00E-01	OEHHA/IRIS	0.0000	0.0000	0.0000
Semi-Volatiles												
Benzo(a)Pyrene	3.9	12	OEHHA	1.E-10	9.E-09	1.E-08	NA	NA	IRIS/IRIS			0.0000
Benzo(b)Fluoranthene	0.39	1.2	OEHHA	2.E-11	2.E-09	2.E-09	NA	NA	-/-			0.0000
Bis(2-Ethylhexyl)Phthalate	0.84	0.3	OEHHA	4.E-10	3.E-09	3.E-09	8.00E-01	8.00E-01	IRIS/IRIS	0.0000	0.0000	0.0000
Fluoranthene	Not Applicable						4.00E-02	4.00E-02	IRIS/IRIS	0.0000	0.0000	0.0000
Indeno(1,2,3-cd)Pyrene	0.39	1.2	OEHHA	1.E-11	9.E-10	1.E-09	NA	NA	-/-			0.0000
Pyrene	Not Applicable						3.00E-02	3.00E-02	IRIS/IRIS	0.0000	0.0000	0.0000
Pesticides												
4,4'-DDD	0.34	0.34	OEHHA	1.E-11	4.E-10	4.E-10	NA	NA	-/-			0.0000
4,4'-DDE	0.24	0.24	OEHHA	5.E-12	2.E-10	2.E-10	NA	NA	-/-			0.0000
Alpha-Chlordane	1.2	1.3	OEHHA	2.E-12	8.E-11	8.E-11	2.00E-04	5.00E-04	IRIS/IRIS	0.0000	0.0000	0.0000
Dieldrin	16	16	OEHHA	3.E-10	1.E-08	1.E-08	5.00E-05	5.00E-05	IRIS/IRIS	0.0000	0.00	0.001
Endosulfan Sulfate	Not Applicable						6.00E-03	6.00E-03	IRIS/IRIS	0.0000	0.0000	0.0000
Endrin	Not Applicable						3.00E-04	3.00E-04	IRIS/IRIS	0.0000	0.0000	0.0000
Gamma-Chlordane	1.2	1.3	OEHHA	3.E-12	1.E-10	1.E-10	2.00E-04	5.00E-04	IRIS/IRIS	0.0000	0.0000	0.0000
Heptachlor Epoxide	5.5	5.5	OEHHA	2.E-11	7.E-10	7.E-10	1.30E-04	1.30E-05	IRIS/IRIS	0.0000	0.001	0.001
Metals												
Aluminum	Not Applicable						1.40E-03	1.00E+00	-/IRIS	0	0.0	0.4
Antimony	Not Applicable						NA	4.00E-04	-/IRIS		0.01	0.01

Table 7
Construction Worker Scenario Risk Characterization
Former TAA 769

Chemical	CSFi	CSFo	Source	Inhalation Risk	Oral Risk	Total Risk	RFDi	RFDo	Source	Inhalation HQ*	Oral HQ*	Hazard Index*
Arsenic	12	9.5	OEHHA	2.E-08	2.E-07	2.E-07	8.57E-06	3.00E-04	OEHHA/IRIS	0.0	0.01	0.02
Barium	Not Applicable						1.40E-04	7.00E-02	IRIS/IRIS		0.00	0.001
Beryllium	8.4	NA	OEHHA	2.E-09		2.E-09	2.00E-06	2.00E-03	OEHHA/IRIS	0.0	0.000	0.01
Chromium	Not Applicable						5.71E-05	1.50E+00	OEHHA/IRIS	0.0	0.0000	0.01
Cobalt	9.8	NA	IRIS	2.E-08		2.E-08	5.70E-06	2.00E-02	IRIS/IRIS	0.0	0.000	0.03
Copper	Not Applicable						NA	4.00E-02	-/IRIS		0.000	0.0001
Iron	Not Applicable						NA	3.00E-01	-/IRIS		0.0	0.03
Lead	A cancinogen but evaluated for non-carcinogenic health effects using leadspread						NA	NA	-/-	See LeadSpread - Table 5		
Manganese	Not Applicable						5.71E-05	2.40E-02	OEHHA/IRIS	0	0.00	0.1
Nickel	0.91	NA	OEHHA	4.E-09		4.E-09	1.43E-05	2.00E-02	OEHHA/IRIS	0.0	0.000	0.02
Thallium	Not Applicable						NA	6.60E-05	-/IRIS		0.01	0.01
Vanadium	Not Applicable						NA	1.00E-03	-/IRIS		0.0	0.02
Zinc	Not Applicable						NA	3.00E-01	-/IRIS		0.000	0.0001
			Pathway Risk	5.E-08	3.E-07				Pathway Hazard Index	0.6	0.1	
			Total Risk			3.E-07			Scenario Total Hazard Index			0.7

Sources:

OEHHA = California Office of Environmental Health Hazard Assessment Toxicity Criteria Database, searched January 2005

IRS = U.S. Environmental Protection Agency Integrated Risk Information System or Equivalent, as presented in the 2004 Preliminary Remediation Goal Tables from US EPA Region 9

- = not source since there is no value

NA = not applicable since the chemical is not a carcinogen or no noncarcinogenic health criteria have been published

*: Any value presented as "0.0000" is less than 0.0001 (<0.0001)

TABLE 7
Estimated Risks due to Potential Soil Exposures
Construction Worker Scenario

TAA 769, El Toro, CA

PARAMETERS	UNITS	VALUES
EPCs = Concentration in soil	mg/kg	see table
EF = Exposure Frequency	days/year	21
ED = Exposure Duration	years	1
BW = Body Weight, adult	kg	70
ATnc = Averaging Time - noncarcinogen	days	365
ATc = Averaging Time - carcinogen	days	25550
Kp = Permeability Coefficient	cm/hour	see table
IngRad[a] = Ingestion Rate, adult	mg/day	330
InhRad =Adult Inhalation Rate(EPA, 1996a, p.5-20)	m^3/day	20
SSA a = skin surface area, adult	cm2/day	3300
CF = Conversion Factor	kg/mg	1.00E-06
SFing = Ingestion Cancer Slope Factor	kg-day/mg	see table
SFinh = Inhalation Cancer Slope Factor	kg-day/mg	see table
RfDing = Ingestion Reference Dose	mg/kg-day	see table
RfDinh = Inhalation Reference Dose	mg/kg-day	see table
AF = Adherence factor	mg/cm2	0.3
ABS - absorption factor (inorg)	unitless	see table

CARCINOGENS	**Cs**	**ABS**	**VF**	**EPCa**	**DOSE**			**Toxicity Factors**		**RISK**			
Chemical	(mg/kg)	unitless	m^3/kg	(mg/m^3)	Inhalation	Ingestion	Dermal	SFing	SFinh	Inhalation	Ingestion	Dermal	Total
Arsenic	5.6	0.03		5.60E-06	1.3E-09	2.2E-08	2.0E-09	9.5	12	1.6E-08	2.1E-07	1.9E-08	2.E-07
Be	1.2	0.01		1.23E-06	2.9E-10	4.8E-09	1.4E-10	na	8.4	2.4E-09	--	--	2.E-09
Ni	18.1	0.01		1.81E-05	4.3E-09	7.0E-08	2.1E-09	na	0.91	3.9E-09	--	--	4.E-09
Benzo(a)pyrene	0.14	0.15		1.40E-07	3.3E-11	5.4E-10	2.4E-10	12	3.9	1.3E-10	6.5E-09	2.9E-09	1.E-08
Benzo (b) Fluoranthene	0.2	0.15		2.30E-07	5.4E-11	8.9E-10	4.0E-10	1.2	0.39	2.1E-11	1.1E-09	4.8E-10	2.E-09
BEHP	2.0	0.10		2.00E-06	4.7E-10	7.7E-09	2.3E-09	0.3	0.84	3.9E-10	2.3E-09	7.0E-10	3.E-09
Indeno(1,2,3-c,d)pyrene	0.14	0.15		1.40E-07	3.3E-11	5.4E-10	2.4E-10	1.2	0.39	1.3E-11	6.5E-10	2.9E-10	1.E-09
DDD	1.2E-01	0.50		1.20E-07	2.8E-11	4.6E-10	7.0E-10	0.34	0.34	9.6E-12	1.6E-10	2.4E-10	4.E-10
DDE	8.6E-02	0.50		8.60E-08	2.0E-11	3.3E-10	5.0E-10	0.24	0.24	4.8E-12	8.0E-11	1.2E-10	2.E-10
Alpha chlordane	6.3E-03	0.50		6.30E-09	1.5E-12	2.4E-11	3.7E-11	1.30	1.20	1.8E-12	3.2E-11	4.8E-11	8.E-11
Dieldrin	8.9E-02	0.50		8.90E-08	2.1E-11	3.4E-10	5.2E-10	16.00	16.00	3.3E-10	5.5E-09	8.3E-09	1.E-08
Endosulfan sulfate	4.5E-02	0.50		4.50E-08	1.1E-11	1.7E-10	2.6E-10	na	na	--	--	--	0.E+00
Endrin	1.0E-02	0.50		1.00E-08	2.3E-12	3.9E-11	5.8E-11	na	na	--	--	--	0.E+00
Gamma chlordane	1.1E-02	0.50		1.10E-08	2.6E-12	4.3E-11	6.4E-11	1.30	1.20	3.1E-12	5.5E-11	8.3E-11	1.E-10
Heptachlor epoxide	1.3E-02	0.50		1.30E-08	3.1E-12	5.0E-11	7.6E-11	5.50	5.50	1.7E-11	2.8E-10	4.2E-10	7.E-10
											TOTAL RISK		**3.E-07**