Figure 1 — Intro Map

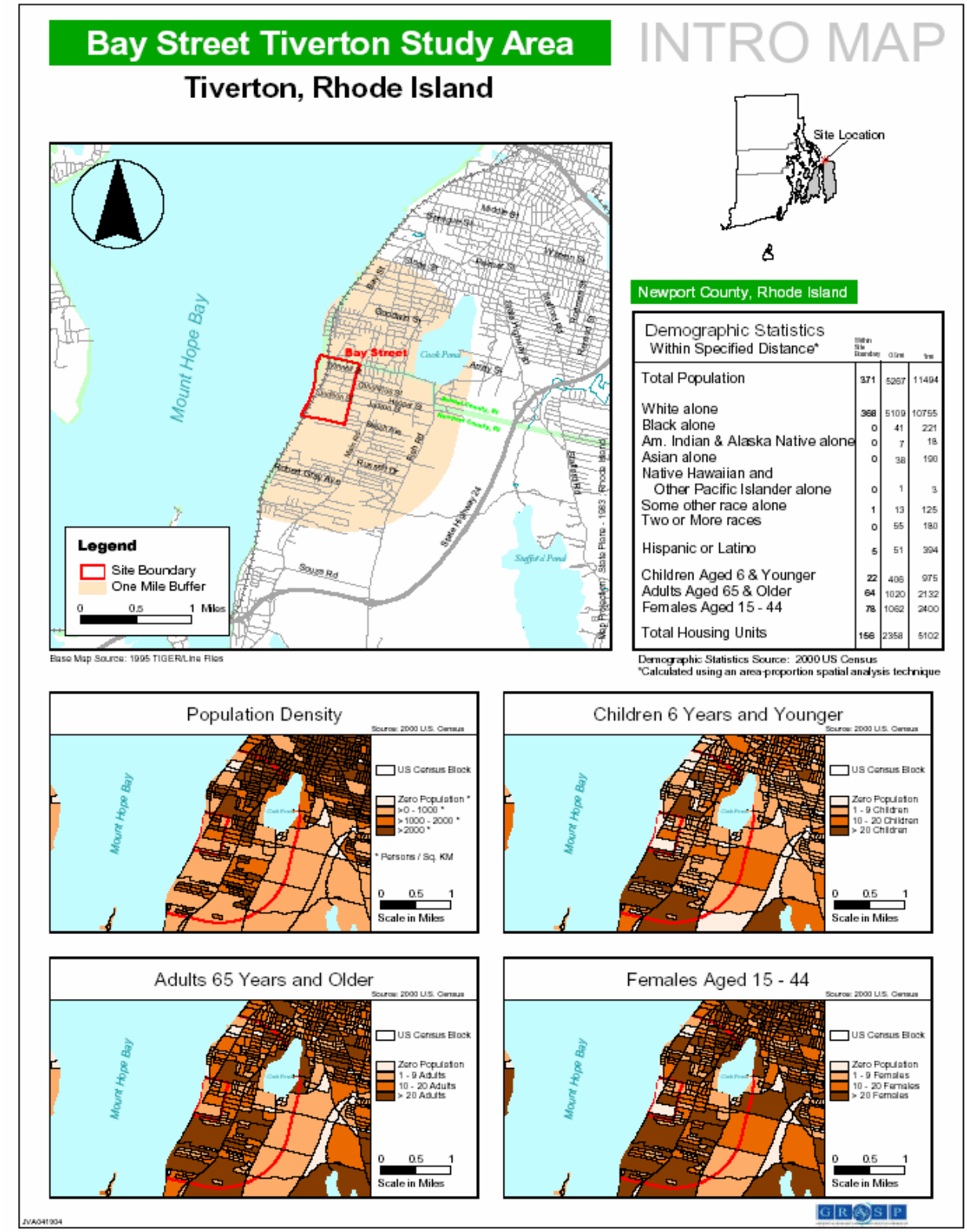

Table 1 — Summary of Surface and Subsurface Soil samples

Sampling Date	*Collecting agency*	*# of surface soil*	*# of subsurface soil*	*Locations*
10/07/2002	EA	5	0	Soil stockpile
10/23/2002	EA	3	0	Soil stockpile
10/29-11/01/2002	EA	0	7	Roadways
11/14/2002	EA	0	4	Roadways
12/18/2002	EA	0	2	Roadways
04/29/2003	EA	7	3	BVRC
04/28-29/2003	EA	0	25	Roadways
06-08/2003	VHB	440	142	Residential
11/26/2003	EA	11	0	BVRC
11/21-24/2003	EA	0	23	Roadways
Total	NA	465	216	NA

Note:

EA: EA Engineering, Science, and Technology, Inc.

VHB: Vanasse Hangen Brustlin, Inc.

NA: not applicable

BVRC: Bay View Recreation Area

Table 2 — Summary of Residential Surface Soil Samples (PPM)

Substance	*Maximum*	*Mean*	*Median*	*# of Samples*	*# of detects*	*CV*	*cv_type*
1,2,4-trichlorobenzene				411	0	20	RMEG
1,2-dichlorobenzene				411	0	200	RMEG
1,3-dichlorobenzene				411	0	2,300	RBC
1,4-dichlorobenzene				411	0	27	RBC
1-bromo-4-phenoxy benzene				411	0	NA	NA
2,4,5-trichlorophenol				411	0	200	RMEG
2,4,6-trichlorophenol				411	0	60	CREG
2,4-dichlorophenol				411	0	6	RMEG
2,4-dimethylphenol				411	0	40	RMEG
2,4-dinitrophenol				411	0	4	RMEG
2,4-dinitrotoluene				411	0	160	RBC
2,6-dinitrotoluene	0.469	0.31	0.31	411	2	78	RBC
2-chloronaphthalene				411	0	200	RMEG
2-chlorophenol				411	0	10	RMEG
2-methylnaphthalene	1.86	0.328	0.163	411	21	100	CEMEG
2-methylphenol	0.0529	0.0529	0.0529	411	1	3,900	RBC
2-nitroaniline				411	0	230	RBC
2-nitrophenol				411	0	58	SSL
3,3'-dichlorobenzidine				411	0	2	CREG
3-methylphenol, 4-methylphenol	0.158	0.0652	0.0371	411	4	390	RBC
3-nitroaniline				411	0	24	RBC
4,6-dinitro-o-cresol				411	0	7.8	RBC
4-chloroaniline				411	0	310	RBC
4-chlorophenyl phenyl ether				411	0	NA	NA
4-nitroaniline				411	0	32	RBC
4-nitrophenol	0.366	0.366	0.366	411	1	NA	NA
acenaphthene	5.74	0.479	0.0786	411	54	100	RMEG
acenaphthylene	2.82	0.287	0.0807	411	41	NA	NA
anthracene	16.5	0.847	0.152	411	105	600	RMEG
antimony				411	0	0.8	RMEG
arsenic	131	6.06	4.24	440	440	30	DHAC
azobenzene				411	0	6	CREG
benzene				410	0	10	CREG
benzo(a)anthracene	24.8	1.31	0.398	411	175	0.88	RBC

Substance	*Maximum*	*Mean*	*Median*	*# of Samples*	*# of detects*	*CV*	*cv_type*
benzo(a)pyrene	15.9	1.04	0.365	411	183	0.1	CREG
benzo(b)fluoranthene	16	1.1	0.424	411	189	0.88	RBC
benzo(ghi)perylene	10.7	1.06	0.497	411	85	0.8	RIDEM
benzo(k)fluoranthene	16	1.2	0.439	411	153	8.8	RBC
benzoic acid	2.16	1.02	0.75	411	4	8,000	RMEG
benzyl alcohol	0.437	0.437	0.437	411	1	23,000	RBC
beryllium	0.853	0.244	0.23	411	411	160	RBC
biphenyl	0.839	0.141	0.0522	411	12	100	RMEG
bis(2-chloroethoxy)methane				411	0	NA	NA
bis(2-chloroethyl) ether				411	0	0.6	CREG
bis(2-chloroisopropyl) ether				411	0	80	RMEG
butyl benzyl phthalate	7.14	0.444	0.0734	411	37	16,000	RBC
cadmium	9.62	1.72	1.18	411	19	39	RBC
carbazole	6.35	0.454	0.0741	411	76	32	SSL
chromium	29	7	6.55	411	411	NA	NA
chrysene	21.4	1.31	0.426	411	187	88	RBC
copper	457	19.9	11.1	411	410	3,100	RBC
cyanide	160	16.1	7.4	412	117	1,000	RMEG
di(2-ethylhexyl)phthalate	2.66	0.586	0.32	411	21	50	CREG
di-n-butyl phthalate	1.58	0.294	0.0473	411	13	200	RMEG
di-n-octyl phthalate	0.29	0.272	0.272	411	2	1,600	SSL
dibenzo(a,h)anthracene	3.78	0.388	0.104	411	45	0.088	RBC
dibenzofuran	5.75	0.527	0.0562	411	42	160	RBC
diethyl phthalate				411	0	2,000	RMEG
dimethyl phthalate	0.425	0.416	0.416	411	2	780,000	SSL
ethyl benzene	0.36	0.191	0.138	410	3	7,800	RBC
fluoranthene	46.8	2.01	0.538	411	226	80	RMEG
fluorine	6.6	0.598	0.0839	411	62	80	RMEG
hexachlorobenzene				411	0	0.1	CEMEG
hexachlorobutadiene				411	0	9	CREG
hexachlorocyclopentadiene				411	0	10	RMEG
hexachloroethane				411	0	50	CREG
indeno(1,2,3-cd)pyrene	9.63	1.02	0.511	411	79	0.88	RBC
isophorone				411	0	400	CEMEG
lead	5600	103	52.9	440	432	400	SSL

Substance	*Maximum*	*Mean*	*Median*	*# of Samples*	*# of detects*	*CV*	*cv_type*
m,p- xylene or total xylenes				410	0	400	RMEG
mercury	42.2	0.947	0.324	411	401	23	SSL
n-nitrosodi-n-propylamine				411	0	0.1	CREG
n-nitrosodimethylamine				411	0	0.01	CREG
n-nitrosodiphenylamine				411	0	100	CREG
naphthalene	3.57	0.399	0.0598	411	42	1,600	RBC
nickel	37	5.29	4.85	411	408	1,600	RBC
nitrobenzene				411	0	39	RBC
p-chloro-m-cresol	0.0379	0.0379	0.0379	411	1	NA	NA
pentachlorophenol				411	0	2	CEMEG
phenanthrene	62.5	2.03	0.377	411	204	7,800	SSL
phenol				411	0	600	RMEG
pyrene	64.1	2.54	0.558	411	249	2,000	CEMEG
pyridine				411	0	2	RMEG
selenium				411	0	10	CEMEG
silver	1.48	1.48	1.48	411	1	10	RMEG
thallium				411	0	5.5	RBC
toluene	0.34	0.228	0.296	410	3	40	IEMEG
total petroleum hydrocarbons	1,440	132	68.3	411	88	500	RIDEM
zinc	1,140	67	37.8	411	411	20,000	CEMEG

Note:
Bold text: contaminant of concern
Maximum: maximum concentration
Mean: mean concentration
Median: median concentration
NA: not applicable
CEMEG: chronic environmental media evaluation guide
IEMEG: intermediate environmental media evaluation guide
RMEG: reference dose media evaluation guide
CREG: cancer risk evaluation guide for 1×10^{-6} excess cancer risk
DHAC: ATSDR Division of Health Assessment and Consultation guidance
RIDEM: Rhode Island Department of Environmental Management Residential Direct Exposure Criteria
RBC: EPA Region 3 risk based concentrations
SSL: EPA soil screening level

Table 3 — Summary of Bay Street Recreation Area Surface Soil Samples (PPM)

Substance	*Maximum*	*Mean*	*Median*	*#of samples*	*# of detects*	*CV*	*cv type*
2-butanone	0.273	0.214	0.215	8	6	1000	RMEG
2-methylnaphthalene	0.069	0.069	0.069	7	1	100	CEMEG
acenaphthene	0.025	0.025	0.025	7	1	100	RMEG
acenaphthylene	0.146	0.0693	0.04	15	3	NA	NA
anthracene	0.069	0.069	0.069	7	1	600	RMEG
arsenic	**10.3**	**5.19**	**4.91**	**15**	**15**	**0.5**	**CREG**
benzo(a)anthracene	0.255	0.114	0.102	15	8	0.88	RBC
benzo(a)pyrene	**0.279**	**0.138**	**0.131**	**15**	**7**	**0.1**	**CREG**
benzo(b)fluoranthene	0.273	0.123	0.112	15	7	0.88	RBC
benzo(ghi)perylene	0.199	0.117	0.105	15	6	0.8	RIDEM
benzo(k)fluoranthene	0.269	0.175	0.156	15	4	8.8	RBC
beryllium	0.46	0.323	0.311	15	15	160	RBC
chromium	10.5	8.03	8.14	15	15	NA	NA
chrysene	0.305	0.16	0.136	15	7	88	RBC
copper	17.8	9	9.91	15	15	3100	RBC
cyanide	9.2	9.2	9.2	7	1	1000	RMEG
dibenzo(a,h)anthracene	0.056	0.0435	0.0435	15	2	0.088	RBC
fluoranthene	0.38	0.218	0.223	15	8	80	RMEG
fluorine				7	0	80	RMEG
indeno(1,2,3-cd)pyrene	0.155	0.0964	0.089	15	5	0.88	RBC
lead	99	37.9	28.8	15	13	400	SSL
mercury	1.97	0.586	0.219	15	13	23	SSL
naphthalene	0.186	0.115	0.115	7	2	1600	RBC
nickel	11.5	6.77	6.09	15	15	1600	RBC
phenanthrene	0.228	0.132	0.113	15	6	7800	SSL
pyrene	0.427	0.228	0.2	15	8	2000	CEMEG

Substance	*Maximum*	*Mean*	*Median*	*#of samples*	*# of detects*	*CV*	*cv type*
tetrahydrofuran	0.053	0.046	0.046	8	2	84	RBC
zinc	190	42.3	30.1	15	15	20,000	CEMEG

Note:
Bold text: contaminant of concern
Maximum: maximum concentration
Mean: mean concentration
Median: median concentration
NA: not applicable
CEMEG: chronic environmental media evaluation guide
RMEG: reference dose media evaluation guide
CREG: cancer risk evaluation guide for 1×10^{-6} excess cancer risk
RIDEM: Rhode Island Department of Environmental Management Residential Direct Exposure Criteria
RBC: EPA Region 3 risk based concentrations
SSL: EPA soil screening level

Table 4 — Summary of Subsurface Soil Samples (PPM), Tiverton, RI

Substance	*Maximum*	*Mean*	*Median*	*# of Sample*	*# of detect*	*CV*	*cv_type*
1,2,4-trichlorobenzene				136	0	20	RMEG
1,2,4-trimethylbenzene	0.06	0.06	0.06	3	1	3900	RBC
1,2-dichlorobenzene				136	0	200	RMEG
1,3-dichlorobenzene				136	0	2300	RBC
1,4-dichlorobenzene				136	0	27	RBC
1-bromo-4-phenoxy benzene				136	0	NA	NA
2,4,5-trichlorophenol				136	0	200	RMEG
2,4,6-trichlorophenol	0.816	0.816	0.816	136	1	60	CREG
2,4-dichlorophenol				136	0	6	RMEG
2,4-dimethylphenol				136	0	40	RMEG
2,4-dinitrophenol				136	0	4	RMEG
2,4-dinitrotoluene				136	0	160	RBC
2,6-dinitrotoluene				136	0	78	RBC
2-butanone	0.154	0.151	0.151	3	2	1000	RMEG
2-chloronaphthalene				136	0	200	RMEG
2-chlorophenol				136	0	10	RMEG
2-methylnaphthalene	428	31.4	0.29	165	14	100	CEMEG
2-methylphenol	0.026	0.026	0.026	155	1	3900	RBC
2-nitroaniline				136	0	230	RBC
2-nitrophenol				136	0	58	SSL
3,3'-dichlorobenzidine				136	0	2	CREG
3-methylphenol/4-methylphenol	0.038	0.038	0.038	155	1	390	RBC
3-nitroaniline				136	0	24	RBC
4,6-dinitro-o-cresol				136	0	7.8	RBC
4-chloroaniline				136	0	310	RBC
4-chlorophenyl phenyl ether				136	0		
4-nitroaniline				136	0	32	RBC
4-nitrophenol				136	0	NA	NA
acenaphthene	4.14	0.762	0.122	158	15	100	RMEG
acenaphthylene	12.5	0.966	0.187	164	18	NA	NA
anthracene	78	5.17	0.292	168	23	600	RMEG
antimony				136	0	0.8	RMEG
arsenic	37.9	3.06	2.42	163	146	30	DHAC
azobenzene				136	0	6	CREG
benzene				136	0	10	CREG
benzo(a)anthracene	73.5	4.15	0.352	165	28	0.88	RBC
benzo(a)pyrene	451	20.3	0.41	162	24	0.1	CREG
benzo(b)fluoranthene	452	18.2	0.577	165	27	0.88	RBC
benzo(ghi)perylene	6.61	1.45	0.866	162	8	0.8	RIDEM
benzo(k)fluoranthene	56.4	3.76	0.688	165	24	8.8	RBC
benzoic acid				136	0	8000	RMEG
benzyl alcohol				136	0	23000	RBC
beryllium	0.827	0.2	0.18	144	139	160	RBC
biphenyl	1.18	0.654	0.754	155	3	100	RMEG
bis(2-chloroethoxy)methane				136	0	NA	NA
bis(2-chloroethyl) ether				136	0	0.6	CREG

Substance	*Maximum*	*Mean*	*Median*	*# of Sample*	*# of detect*	*CV*	*cv_type*
bis(2-chloroisopropyl) ether				136	0	80	RMEG
butyl benzyl phthalate				136	0	16000	RBC
cadmium	1.65	1.65	1.65	136	1	39	RBC
carbazole	5.56	0.8	0.114	146	8	32	SSL
chromium	48.2	6.41	4.79	144	142	NA	NA
chrysene	62.9	3.69	0.551	165	29	88	RBC
copper	127	11.1	5.71	144	140	3100	RBC
cyanide	1130	88.3	10.1	168	28	1000	RMEG
di(2-ethylhexyl)phthalate				136	0	50	CREG
di-n-butyl phthalate				136	0	200	RMEG
di-n-octyl phthalate				136	0	1600	SSL
dibenzo(a,h)anthracene	82.4	7.94	0.261	168	11	0.088	RBC
dibenzofuran	9.68	1.52	0.129	155	10	160	RBC
diethyl phthalate				136	0	2000	RMEG
dimethyl phthalate				136	0	780000	SSL
ethyl benzene	1.67	0.644	0.151	139	3	7800	RBC
fluoranthene	201	10.9	0.861	174	34	80	RMEG
fluorine	89.9	6.95	0.187	165	16	80	RMEG
hexachlorobenzene				136	0	0.1	CEMEG
hexachlorobutadiene				136	0	9	CREG
hexachlorocyclopentadiene				136	0	10	RMEG
hexachloroethane				136	0	50	CREG
indeno(1,2,3-cd)pyrene	14.1	3.15	0.885	171	15	0.88	RBC
isophorone				136	0	400	CEMEG
isopropylbenzene	0.122	0.122	0.122	3	1	200	RMEG
lead	692	63.6	12.5	163	70	400	SSL
m,p- xylene or total xylenes				136	0	400	RMEG
mercury	73.4	2.41	0.21	144	41	23	SSL
methyl-4-(1-methylethyl)benzene	0.054	0.054	0.054	3	1	NA	NA
n-nitrosodi-n-propylamine				136	0	0.1	CREG
n-nitrosodimethylamine	0.0342	0.0342	0.0342	136	1	0.01	CREG
n-nitrosodiphenylamine				136	0	100	CREG
naphthalene	1570	88.3	0.426	164	18	1600	RBC
nickel	27.2	5.03	4.14	144	140	1600	RBC
nitrobenzene				136	0	39	RBC
p-chloro-m-cresol				136	0	NA	NA
pentachlorophenol				136	0	2	CEMEG
phenanthrene	305	14	0.458	171	34	7800	SSL
phenol				136	0	600	RMEG
pyrene	131	8.26	0.943	174	40	60	RMEG
pyridine				136	0	2	RMEG
selenium				136	0	10	CEMEG
silver	0.906	0.906	0.906	136	1	10	RMEG
tetrahydrofuran	0.091	0.079	0.079	6	2	84	RBC
thallium				136	0	5.5	RBC
toluene	0.039	0.039	0.039	139	1	40	IEMEG

Substance	*Maximum*	*Mean*	*Median*	*# of Sample*	*# of detect*	*CV*	*cv_type*
totalpetroleum hydrocarbons	1410	224	96.5	136	10	500	RIDEM
zinc	2520	43.4	17.2	144	144	20,000	CEMEG

Notes:
Bold text: contaminant of concern
Maximum: maximum concentration
Mean: mean concentration
Median: median concentration
NA: not applicable
CEMEG: chronic environmental media evaluation guide
IEMEG: intermediate environmental media evaluation guide
RMEG: reference dose media evaluation guide
CREG: cancer risk evaluation guide for 1×10^{-6} excess cancer risk
DHAC: ATSDR Division of Health Assessment and Consultation guidance
RIDEM: Rhode Island Department of Environmental Management Residential Direct Exposure Criteria
RBC: EPA Region 3 risk based concentrations
SSL: EPA soil screening level5mimiaihuhu’

Appendix A — ATSDR's Comparison Values and Definitions

ATSDR comparison values (CVs) are media-specific concentrations considered safe under default exposure scenario. ATSDR uses them as screening values to identify contaminants (site-specific substances) that require further evaluation to determine the potential for adverse health effects.

Generally, a chemical at a site requires further evaluation when its maximum concentration in air, water, or soil exceeds one of ATSDR's comparison values. Comparison values are *not*, however, thresholds of toxicity. While concentrations at or below the relevant comparison value may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a comparison value would be expected to produce adverse health effects. Indeed, the purpose behind highly conservative, health-based standards and guidelines is to enable health professionals to recognize and resolve potential public health problems *before* they become actual health hazards. The probability that adverse health outcomes will actually occur as a result of exposure to environmental contaminants depends on individual lifestyle and genetic factors and site-specific conditions that affect the route, magnitude, and duration of actual exposure–not on environmental concentrations alone.

ATSDR derives screening values based on non-cancer effects by dividing NOAELs (no-observed-adverse-effect levels) or LOAELs (lowest-observed-adverse-effect levels). These levels stem from animal or human studies and include cumulative safety margins (variously called safety factors, uncertainty factors, and modifying factors) that typically range from 10 to 1,000 or more.

By contrast, cancer-based screening values come from linear extrapolation from animal data obtained at high doses because human cancer incidence data for very low levels of exposure simply do not exist, and probably never will.

Listed below are the comparison values that ATSDR uses to select chemicals for further evaluation, along with the abbreviations for the most common units of measure.

EMEG = Environmental Media Evaluation Guides

RMEG = Reference Dose Media Evaluation Guide

MRLs = Minimal Risk Levels

ppm = Parts Per Million, e.g., mg/L or mg/kg

ppb = Parts Per Billion, e.g., μg/L or μg/kg

kg = Kilogram (1,000 grams)

mg = Milligram (0.001 grams)

μg = Microgram (0.000001 grams) $\mu g/ m^3$

L = Liter

m^3 = Cubic Meter (used in reference to a volume of air equal to 1,000 liters)

Acute Exposure is defined as exposure to a chemical for a duration of 14 days or less.

Cancer Risk Evaluation Guides (CREG): Estimated contaminant concentrations in water, soil, or air that would be expected to cause no more than one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors.

Chronic Exposure: Exposure to a chemical for 365 days or more.

Environmental Media Evaluation Guides (EMEGs): Concentrations of a contaminant in water, soil, or air unlikely to produce any appreciable risk of adverse, non-cancer effects over a specified duration of exposure. EMEGs are derived from ATSDR minimal risk levels by factoring in default body weights and ingestion rates. ATSDR computes separate EMEGs for acute (≤14 days), intermediate (15–364 days), and chronic (≥365 days) exposures.

Intermediate Exposure: Exposure to a chemical for a duration of 15–364 days.

Lowest Observed Adverse Effect Level (LOAELs): The lowest exposure level of a chemical in a study, or group of studies, that produces statistically or biologically significant increase(s) in frequency or severity of adverse health effects between the exposed and control populations.

Minimal Risk Levels (MRL): Estimate of daily human exposure to a hazardous substance that is likely to be without an appreciable risk of adverse noncancer health effects over a specified route and duration of exposure.

No Observed Adverse Effect Level (NOAEL): The dose of a chemical at which there were no statistically or biologically significant increases in frequency or severity of adverse health effects seen between the exposed population and its appropriate control**.** Effects may be produced at this dose, but they are not considered to be adverse.

Uncertainty Factor (UF): A factor used in deriving the MRL or reference dose or reference concentration from exposure data.

The following comparison values were used for this health consultation:

Environmental Media Evaluation Guide (EMEGs)

Reference Dose Media Evaluation Guide (RMEGs)

Cancer Risk Evaluation Guides (CREGs)

Minimal Risk Levels (MRLs)

EPA Reference Doses (RfDs) and

EPA Risk-Based Concentrations (RBCs) or Preliminary Remediation Goals (PRGs)

EPA soil screening levels (SSL)

RIDEM Residential Direct Exposure Criteria

Appendix B — Dose Calculation for Estimating Arsenic Exposure Doses

The major exposure pathway by which residents can be exposed to arsenic at the site is incidental ingestion of contaminated soil. Children and children with soil-pica behavior are a special concern for acute exposures because ingesting high amounts of soil could lead to significant arsenic exposure.

The following assumptions were made to estimate ingestion exposure dose for arsenic:

(1) a adult resident's body weight is 70 kg,

(2) a adult resident soil ingestion rate is 100 mg/day

(3) a child's body weight is 10 kg,

(4) a child's soil ingestion rate is 200 mg/day,

(5) a soil-pica child's maximum soil ingestion rates are 600, 1,000, 3,000, and 5,000 mg/day,

The following mathematical formula was used to estimate the daily intake of arsenic:

$ID = C \times IR \times BA \times EF \times 10^{-6}/BW$

Where,

ID=ingestion exposure dose (mg/kg/day)

C=contaminant concentration (mg/kg, the maximum arsenic concentration of 131 mg/kg are used to represent the worst case scenario)

IR=ingestion rate (mg/day)

BA=bioavailability factor (unitless, conservatively assumed to be 60 %)

EF=exposure factor (unitless, conservatively assumed to be 1.0)

BW= body weight (kg)

The following table shows the estimated doses for different groups at acute and chronic exposure durations:

Population	***Soil Intake (mg)***	***Estimated Arsenic Doses (mg/kg/day)***	***Acute MRL (mg/kg/day)***	***Chronic MRL (mg/kg/day)***
Adult	100	0.00011	0.005	0.0003
Child	200	0.0016	0.005	0.0003
Soil-pica child	600	0.0047	0.005	not applicable
Soil-pica child	1,000	0.0079	0.005	not applicable
Soil-pica child	3,000	0.024	0.005	not applicable
Soil-pica child	5,000	0.039	0.005	not applicable

It is unlikely that adults and children at any of the properties at the Bay Street Study Area sampled from October 2002 to November 2003 will experience non-cancerous harmful effects from arsenic in soil. However, children who eat soil excessively (more than 1,000 mg a day), and plays in and ingests soil from part of the yard with the highest arsenic level (131 mg/kg) might

have a dose exceed the acute MRL but below the dose in a human study that caused temporary harmful effects.

Cancer Risk Evaluations for surface soil arsenic levels:

IDs for arsenic = C* x IR x EF x10¯6/BW=6.88x100 x10¯6/70=0.0000098 mg/kg/day

- The 95% upper confidence interval (UCL) on the mean for arsenic was used; the value (6.88 mg/kg) was calculated using the following formula

$$95\%\ Conf = \overline{X} \pm 1.96 \frac{SD}{\sqrt{n}}$$

Cancer risk from ingestion exposures = Average daily dose x CSFo x EF = 0.0000098 mg/kg/day x 1.5 mg/ kg/day¯1x1= 0.000015 =1.5E-05

ATSDR's categories describing any increased cancer risk are defined in the following table:

Category	***Fraction***	***Decimal***	***Exponential***
No Increased Risk	< 1/100,000	<0.00001	<1E-05
No Apparent Increased Risk	1/100,000	0.00001	1E-05
Low Increased Risk	1/10,000	0.0001	1E-04
Moderate Increased Risk	1/1,000	0.001	1E-03
High Increased Risk	<1/100	0.01	1E-02
Very High Increased Risk	> 1/100	>0.01	>1E-02

Using a conservative risk evaluation, residents who have a continuous lifetime exposure to those chemicals via ingestion have no apparent increased risk (1.5E–05) of developing cancer.

Appendix C — Cancer Risk Evaluations

The major exposure pathway by which residents can be exposed to PAHs is incidental ingestion of contaminated soil.

The following assumptions were made to estimate ingestion exposure dose for PAHs:

(1) a resident's body weight is 70 kg,

(2) a resident soil ingestion rate is 100 mg/day

(3) addition of risks for selected PAHs is appropriate

The following mathematical formula was used to estimate the daily intake of PAHs:

ID = C x IR x EF x10¯6/BW

Where,

ID=ingestion exposure dose (mg/kg/day)

C*= contaminant concentration (mg/kg)

IR=ingestion rate (100 mg/day for adults)

EF=exposure factor (unitless, conservatively assumed to be 1.0)

BW= body weight (70 kg for adults)

- The 95% upper confidence interval (UCL) on the mean for individual PAH was used; the values were calculated using the following formula

$$95\%\ Conf = \overline{X} \pm 1.96 \frac{SD}{\sqrt{n}}$$

Therefore,

IDs for benzo (a) anthracene = 1.48 x 100 x10¯6/70=0.0000021 mg/kg/day

IDs for benzo (a) pryene = 1.17 x100 x10¯6/70=0.0000016 mg/kg/day

IDs for benzo (b) fluoranthene = 1.29 x100 x10¯6/70=0.0000018 mg/kg/day

IDs for benzo (k) fluoranthene = 1.4 x100 x10¯6/70=0.000002 mg/kg/day

IDs for chrysene = 1.56 x100 x10¯6/70=0.000002 mg/kg/day

IDs for dibenzo (a, h) anthracene = 0.45 x100 x10¯6/70=0.0000006 mg/kg/day

IDs for indeno (1,2,3_CD) pyrene = 1.17 x100 x10¯6/70=0.0000015 mg/kg/day

To evaluate the cancer risk, ATSDR used the EPA region 3 ingestion cancer slope factors (CSFo) for oral exposures. CSFo is based on conservative assumptions such as fixed level of risk (i.e., a 1-in-1 million cancer risk) and a life time exposure (i.e., 365 days per year for 70 years). Together, with the very conservative assumptions used for the above dose calculation, ATSDR overestimates rather than underestimate risk by factors ranging from 10 to 1000.

Cancer risk is calculated as follows:

Cancer risk from ingestion exposures = Average daily dose x CSFo x exposure factor (conservatively assumed to be 1.0)

Cancer risk evaluation results are presented in the table below

Chemical Name	*95%UCI*	*Dose*	*CSFo*	*CV*	*CV Type*	*Risk*
benzo(a)anthracene	1.48	0.0000021	7.3E-001	0.5	CREG	1.5E-06
benzo (a) pryene	1.17	0.0000016	7.3E+000	0.087	RBC	1.2E-05
benzo(b) fluoranthene	1.29	0.0000018	7.3E-001	0.1	CREG	1.3E-06
benzo(k) fluoranthene	1.40	0.0000019	7.3E-001	0.87	RBC	1.4E-06
chrysene	1.56	0.0000022	7.3E-003	88	RBC	1.4E-08
dibenzo(a, h)anthracene	0.45	0.00000059	7.3E+000	0.087	RBC	4.3E-06
indeno (1,2,3_CD)pyrene	1.17	0.0000015	7.3E-001	0.87	RBC	1.6E-06
Total cancer risk	2.2E-05					

95%UCL: the 95% upper confidence interval (UCL) on the mean for individual PAH in mg/kg

Dose: soil ingestion exposure dose (mg/kg/day)

CSFo: EPA region 3 cancer slope factors in mg/ kg/day¯1

CV: comparison values

CREG: ATSDR cancer risk evaluation guide

Cumulative cancer risk assessment indicates that risks from exposures are estimated to have been 2.2E-05 for soil ingestion for the site.

Appendix D — ATSDR's Levels of Public Health Hazard

Category A: Urgent Public Health Hazard

This category is used for sites where short-term exposures (<1 year) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.

This determination represents a professional judgment based on critical data that ATSDR has judged sufficient to support a decision. Such a designation does not necessarily mean that the available data are complete; in some cases, additional data may be required to confirm or further support the decision made.

Criteria:

Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards, such as open mine shafts, poorly stored or maintained flammable/explosive substances, or medical devices, which, if ruptured, could release radioactive materials.

Category B: Public Health Hazard

This category is used for sites that pose a public health hazard because of the existence of long-term exposures (>1 yr) to hazardous substances or conditions that could result in adverse health effects.

This determination represents a professional judgment based on critical data that ATSDR has judged sufficient to support a decision. Such a designation does not necessarily mean that the available data are complete; in some cases, additional data may be required to confirm or further support the decision made.

Criteria:

Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical hazards, such as open mine shafts, poorly stored or maintained flammable/explosive substances, or medical devices which, if ruptured, could release radioactive materials.

Category C: Indeterminate Public Health Hazard

This category indicates that a professional judgment on the level of health hazard cannot be made because information critical to such a decision is lacking.

Criteria:

This category is used for sites for which available *critical* data are insufficient with regard to the extent of exposure and/or toxicological properties at estimated exposure levels. The health assessor must determine, using professional judgment, the "criticality" of such data and the likelihood that the data can and will be obtained in a timely manner. Where some data—even limited data—are available, health assessors should to the extent possible select other hazard categories and support their decision with a clear narrative that explains the limits of the data and the rationale for the decision.

Category D: No Apparent Public Health Hazard

This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.

This determination represents a professional judgment based on critical data that ATSDR has judged sufficient to support a decision. Such a designation does not necessarily mean that the available data are complete; in some cases, additional data may be required to confirm or further support the decision made.

Criteria:

Available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in adverse impact on human health.

Category E: No Public Health Hazard

This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.

Criteria:

Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are occurring, and none are likely to occur in the future.

- *Examples include environmental, demographic, health outcome, exposure, toxicological, medical, or epidemiologic data, as well as community health concerns information.*