Letter Health Consultation

WOODS WOOLEN MILL SITE

HILLSBOROUGH, NEW HAMPSHIRE

EPA FACILITY ID: NHD986467777

Prepared by
New Hampshire Department of Environmental Services

MARCH 23, 2011

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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New Hampshire Department of Environmental Services
Environmental Health Program
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The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

February 24, 2011

Gary Lipson, On-Scene Coordinator
Environmental Protection Agency, Region I
Emergency Response Branch
5 Post Office Square- Suite 100
Boston, MA 02109-3912

Dear Mr. Lipson,

This letter is in response to your request to evaluate the public health significance of polycyclic aromatic hydrocarbons (PAHs) in soils at the Woods Woolen Mill Site in Hillsborough, NH. The Town of Hillsborough, which owns the property, is interested in developing the site in the future as a recreational area for the general public [EPA 2010]. The New Hampshire Department of Environmental Services, Environmental Health Program (EHP) evaluated PAH soil sample results for this site in order to make recommendations for further actions to the U.S. EPA On-Scene Coordinator.

Background and Statement of Issues

The Woods Woolen Mill Site is a former industrial site located on 2.4-acres of land on the Contoocook River, adjacent to West Mill Street in Hillsborough NH. The site is bounded to the north and west by the Contoocook River. There is an undeveloped wooded area to the south and a residential area to the east of the site beyond West Mill Street. The mill, which was constructed in 1880, produced cloth for various clothing and overcoat products. During its period of operation, the mill complex consisted of the original mill building, a boiler house, warehouse building and office/residential building. The Woods family purchased the mill in 1945 and used it for the production of yarn. The property was sold in 1977 and the mill buildings closed in the mid-1980s. The site has been abandoned since that time. Two of the buildings, the original mill building and warehouse building, were demolished and subsequently removed [Figure]. There have been several subsequent changes of ownership; the property has been owned by the Town of Hillsborough since 2004 [Weston 2010].

A full history of the site is included in the report, “Preliminary Assessment /Site Investigation Report for the Woods Woolen Mill Site, Hillsborough, Hillsborough County, New Hampshire” by Weston Solutions, Inc., dated November 2010. Briefly, in 2000, at the request of NH DES, the EPA conducted a removal action at the site to dispose of a number of drums and containers containing hazardous substances from the site. In December, 2006 a Phase I Environmental Site Assessment was completed that concluded that potential sources for the release of hazardous materials to soil, and surface water were present at the site. During 2009, the Town of Hillsborough, which had assumed ownership of the

property, conducted building materials sampling, conducted demolition of the former mill building foundation and warehouse building, and transported and disposed of the demolition debris.

Beginning in August, 2010 EPA conducted extensive soil sampling at the site. A total of 27 surface soil and 14 subsurface soil samples were collected from different locations throughout the Woods Woolen Mill Site including where the excavated mill buildings once existed and an adjacent Right-of Way that is controlled by the NH Department of Transportation. Surface soil samples were collected from depths of 0 to 0.5 ft; subsurface samples were collected at varying depths from 1 to 3.5 ft. The results of the soil sampling are discussed at length in the Preliminary Assessment /Site Investigation Report [Weston 2010].

Public Health Implications

EHP has chosen to evaluate the theoretical health risk for a local resident who may periodically access the site in the future for recreational purposes. These individuals would potentially be exposed to site-related contaminants through the incidental ingestion of contaminated surface soil, the inhalation of fugitive dust, and ingestion and dermal contact with surface water from the Contoocook River. EPA collected soil samples at the site in August, 2010. There are no ambient air or surface water sampling data currently available in order to evaluate these potential exposure pathways. EHP has therefore limited its analysis of exposure pathways to the evaluation of incidental ingestion of surface soil at the site.

In order to evaluate the health risk associated with the incidental ingestion of surface soil by a future recreator at the site, EHP has compared surface soil data to the S-2 Soil Standards that are presented in the NH Risk Characterization and Management Policy or NH RCMP (NH DES 1998). The S-2 Soil Standards are direct-contact risk-based numbers that DES has identified as being protective of human health for a recreational exposure scenario. In addition, EHP has used the exposure factors and assumptions on which the S-2 values were developed to evaluate the theoretical health risk for an individual recreating on this site. The NH RCMP identifies an adult receptor as the reasonably maximally exposed receptor for a recreational scenario. The adult recreator is expected to be exposed to outdoor soils with a frequency of 146 days per year for a period of 25 years [NH DES 1998].

Based on the location of the site near a residential area and the possible future use of the site as a recreational area, the adult recreator scenario is considered to be protective of individuals who will use the site for recreation. This scenario is applied to recreational site assessments throughout the state of New Hampshire.

Benzo(a)pyrene [B(a)P] was used to assess the relative toxicity of the seven carcinogenic PAHs (cPAHs) classified by EPA as probable human carcinogens. To determine the toxicity of the mixture of PAHs, the concentration of each cPAH was multiplied by a Toxic Equivalency Factor (TEF) which relates its toxicity to that of B(a)P (Table1). The sum of the weighted concentrations was used to evaluate the overall toxicity of the PAH mixture [Schoeny and Poirier 1993].

For the Woods Woolen Mill Site, EHP identified exposure point concentrations (EPC) for the various cPAHs utilizing ProUCL v.4.00.04 [EPA 2009, Singh and Nocerino 2007]. This program computes the 95th % upper confidence limit of the mean for each of the soil contaminant concentrations. The product of each EPC and its TEF were then added together to calculate the total cPAH toxicity equivalence (TEQ) [Schoeny and Poirier 1993]. EHP used the TEQ in calculating a daily ingestion dose for the adult recreator. Finally, EHP calculated a theoretical lifetime cancer risk for exposure to the cPAH by multiplying the recreator daily ingestion dose by the cancer slope factor for B(a)P.

EHP computed the theoretical lifetime cancer risk for an adult recreator, assuming an average number of 64 days per year exposed (central tendency), and 146 days per year (high end frequency). EHP determined a range of risk for cPAH based on these different frequencies of exposure. Using the TEQ for the combined cPAH identified for this analysis, EHP considers there to be a significantly increased lifetime cancer risk (approximately 1 to 2 cases of excess cancer per 100,000 people exposed over a lifetime) associated with the incidental ingestion of PAH-contaminated surface soil for an adult recreating at this site (Table 2). EHP typically considers a theoretical lifetime cancer risk of $1.0x10^{-5}$ or greater to be significant [NH DES 1998]..

Polycyclic aromatic hydrocarbons. Polycyclic aromatic hydrocarbons (PAHs) comprise a group of over 100 different chemicals that are formed during the incomplete combustion of coal, oil, gas and wood. PAHs are usually found as a mixture of at least two or more of these compounds. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but they are also found in a number of personal care and cosmetic products and in the manufacture of dyes, plastics, and pesticides. They are commonly found in the environment at low levels in ambient air, water, and soil. Diesel exhaust contains significant amounts of PAHs. Urban soils contain measurable amounts of PAHs, primarily from airborne fallout from motor vehicle exhaust, residential wood burning, and industrial sources. Levels in surface soil samples collected near urban areas and industrial sites typically range between 1 to 2 ppm [ATSDR 1995].

PAHs generally have a low degree of acute toxicity to humans. PAH levels in the environment are generally very low and usually do not present a concern for non-cancer effects. The carcinogenicity of certain PAHs has been well established in laboratory animals. Researchers have reported increased incidences of skin, lung, bladder, liver, and stomach cancers, in exposed laboratory animals. In humans, increased incidences of lung, skin, and bladder cancer are associated with occupational exposure. Due to the complexity of PAH mixtures, the most toxic compound, benzo(a)pyrene [B(a)P], is used as the indicator compound in evaluating toxicity . While not all PAHs are considered carcinogenic (e.g., pyrene), the EPA has determined that benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene are probable human carcinogens [ATSDR 1995]. Recently, the International Agency for Research on Cancer (IARC) has upgraded its overall evaluation of benzo(a)pyrene from 2B to Group 1 (carcinogenic to humans) [IARC 2010].

Conclusions

Levels of PAHs identified in surface soil, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, are elevated and exceed their respective NH RCMP S-2 Soil Standards. After analysis of soil data collected at the site, EHP concludes that non-cancer adverse health effects are not expected for a future adult recreator from exposure to PAHs in surface soil. There is, however, a low to moderate increased lifetime cancer risk associated with long term exposure (incidental ingestion of surface soil for an adult recreating at the site at a frequency of 146 days for 25 years). This theoretical increased cancer risk of 1.9×10^{-5} is equivalent to approximately 2 additional cases of cancer, assuming that one-hundred thousand persons are exposed over a lifetime. The NH RCMP considers a theoretical increased cancer risk in excess of 1.0×10^{-5} to be significant. EHP would consider a risk level in excess of 1.0×10^{-5} to be a *public health hazard.* For a theoretical increased lifetime cancer risk greater than 1.0×10^{-5} EHP typically recommends actions to protect the health of the public. It should be noted that the health risk that EHP has calculated for the Woods Woolen Mill Site is a theoretical risk; the actual health risk may, in fact, be lower than the calculated risk. To protect public health, exposures to surface soil should be prevented.

It should be noted from the preceding discussion that EHP's choice of an adult recreator to evaluate exposure is based on assumptions and factors presented in the NH RCMP. The potential health risk for a child recreating at the site could be greater. In general, children are smaller than adults, resulting in higher doses of chemical exposure per body weight. Children, because of their developing body systems, tend to be more susceptible to the effects of chemical exposures. Finally, children depend completely on adults for the identification of hazards and risk management in their lives.

It should also be noted that the above conclusion is based on the evaluation of PAHs in surface soil at the site. EPA was concerned about the elevated levels of PAHs in soil; this group of contaminants, therefore, was the focus of this evaluation. EHP would be able to evaluate other site-related chemical contaminants in soil if requested.

Recommendations

Exposure to contaminated surface soils at the Woods Woolen Mill Site needs to be prevented.

Sampling of other environmental media (surface water, sediments, outdoor air) should be conducted to determine if exposure involving other exposure pathways presents a potential concern.

Public Health Action Plan

Actions Taken
EPA conducted a removal action in 2000 to remove a number of drums containing hazardous substances from the site and had them transported to an off-site licensed facility for proper disposal. An unregistered 12,000 gal. underground fuel storage tank was also removed from the site.

In 2008, the Town of Hillsborough, under the Brownfields Program, contracted for the demolition of structurally unsound buildings and the disposal of demolition debris at the site.

In 2010, EPA conducted environmental sampling to identify the nature and extent of chemical contamination remaining at the site.

Actions Planned
EPA will consider actions to mitigate exposure to contaminated soils at the site.

EHP will be able to evaluate any new environmental sampling data that becomes available for the site.

Sincerely,

Dennis Pinski, Section Supervisor
Environmental Health Program
NH Department of Environmental Services

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TABLES

Table 1 Woods Woolen Mill Site Hillsborough, NH
On-site Surface Soil PAH-TEF Calculations for Carcinogenic PAHs

Contaminants Of Concern (PAHs)	Frequency of Detects	Maximum Detect (ug/kg)	EPC (95% UCL) (ug/kg)	PAH-TEF *	PAH conc. Relative to B(a)P (ug/kg)
benzo(a)anthracene	26/27	19000	5137	0.1	513.7
benzo(a)pyrene	26/27	18000	11444	1	11444
benzo(b)fluoranthene	26/27	18000	4656	0.1	465.6
benzo(k)fluoranthene	26/27	14000	3932	0.01	39.32
chrysene	26/27	21000	5445	0.001	5.45
dibenz(a,h)anthracene	0/27	0		1.00	
indeno(1,2,3-cd) pyrene	16/27	9300	3030	0.1	303
Total PAH-TEQ (carcinogenic)					12771

PAHs – Polycyclic Aromatic Hydrocarbons
EPC- Exposure Point Concentration
95% UCL- 95th percent Upper Confidence Limit (EPA Model ProUCLv. 4.00)
Although the data were neither normally or log normally distributed, EHP used the 95 UCL of the Log transformed data as a conservative estimation of the exposure point concentration.
PAH-TEF- Polycyclic Aromatic Hydrocarbons- Toxicity Equivalency Factor
* Schoeny and Poirier 1993
ug/kg- microgram/kilogram

Table 2 Woods Woolen Mill Site Hillsborough, NH
Cancer Risk (Ingestion)

Contaminants Of Concern	EPC (mg/kg)	Comparison Values * (mg/kg)	Dose (mg/kg/day)	CSF (mg/kg/day) $^{-1}$	ELCR (Adult receptor 146 days/yr.)
BaP-TEQ	12.77	0.7	2.61×10^{-6}	7.3	1.9×10^{-5}

BaP-TEQ- Benzo(a)pyrene Toxicity Equivalence
EPC- Exposure Point Concentration
* - NH Risk Characterization and Management Policy, S-2 Soil Standards
CSF- Cancer Slope Factor
mg/kg- milligram/kilogram
mg/kg/day- milligram/kilogram/day
ELCR- Elevated Lifetime Cancer Risk

FIGURE

Woods Woolen Mill Site Hillsborough NH
On-site Surface Soil Sampling Locations

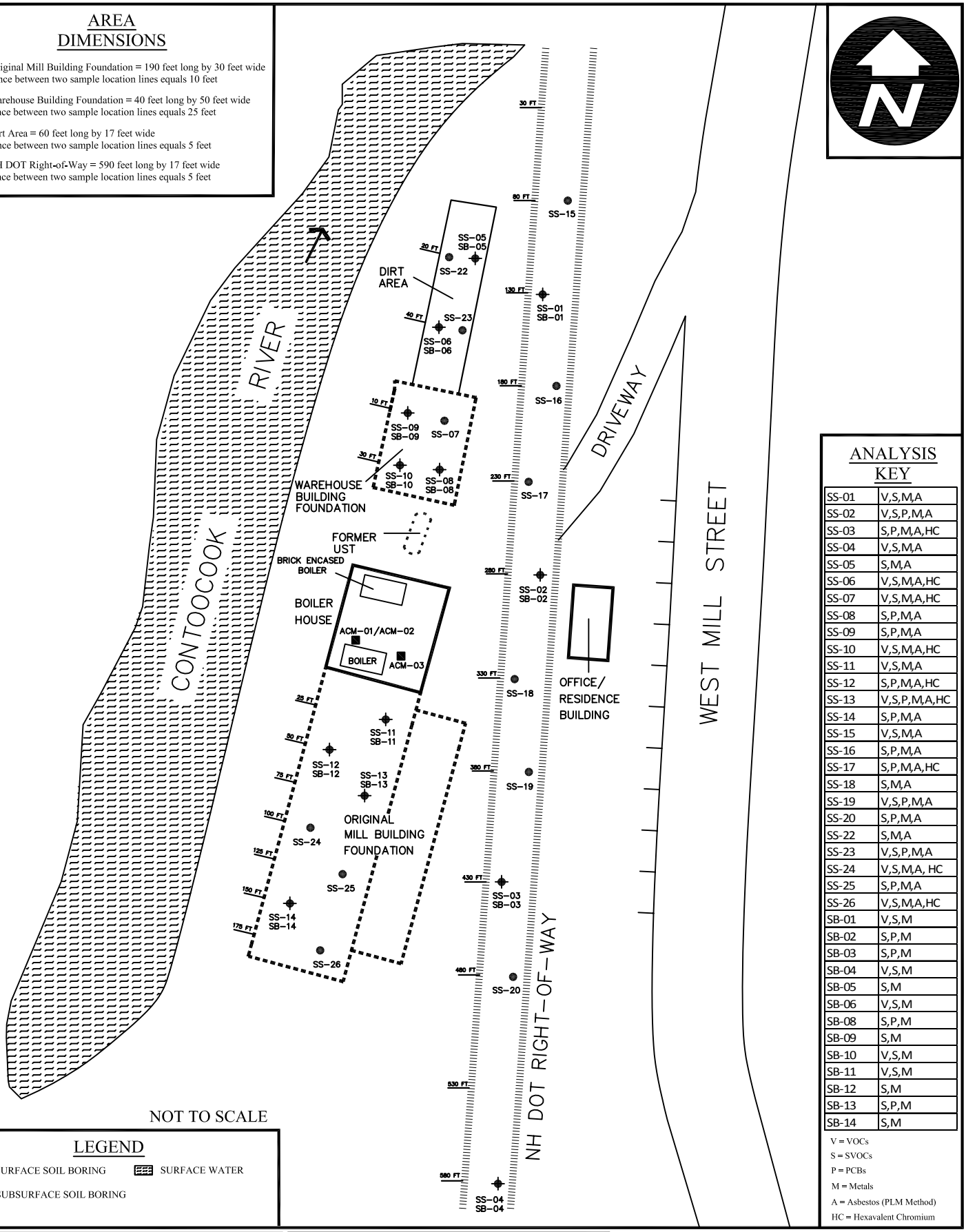
AREA DIMENSIONS

1.) Original Mill Building Foundation = 190 feet long by 30 feet wide
Distance between two sample location lines equals 10 feet

2.) Warehouse Building Foundation = 40 feet long by 50 feet wide
Distance between two sample location lines equals 25 feet

3.) Dirt Area = 60 feet long by 17 feet wide
Distance between two sample location lines equals 5 feet

4.) NH DOT Right-of-Way = 590 feet long by 17 feet wide
Distance between two sample location lines equals 5 feet



NOT TO SCALE

LEGEND

- SURFACE SOIL BORING
- SURFACE WATER
- SUBSURFACE SOIL BORING

ANALYSIS KEY

SS-01	V,S,M,A
SS-02	V,S,P,M,A
SS-03	S,P,M,A,HC
SS-04	V,S,M,A
SS-05	S,M,A
SS-06	V,S,M,A,HC
SS-07	V,S,M,A,HC
SS-08	S,P,M,A
SS-09	S,P,M,A
SS-10	V,S,M,A,HC
SS-11	V,S,M,A
SS-12	S,P,M,A,HC
SS-13	V,S,P,M,A,HC
SS-14	S,P,M,A
SS-15	V,S,M,A
SS-16	S,P,M,A
SS-17	S,P,M,A,HC
SS-18	S,M,A
SS-19	V,S,P,M,A
SS-20	S,P,M,A
SS-22	S,M,A
SS-23	V,S,P,M,A
SS-24	V,S,M,A, HC
SS-25	S,P,M,A
SS-26	V,S,M,A,HC
SB-01	V,S,M
SB-02	S,P,M
SB-03	S,P,M
SB-04	V,S,M
SB-05	S,M
SB-06	V,S,M
SB-08	S,P,M
SB-09	S,M
SB-10	V,S,M
SB-11	V,S,M
SB-12	S,M
SB-13	S,P,M
SB-14	S,M

V = VOCs
S = SVOCs
P = PCBs
M = Metals
A = Asbestos (PLM Method)
HC = Hexavalent Chromium

FIGURE 3A
SAMPLE ANALYSIS AND LOCATION SKETCH

WOODS WOOLEN MILL SITE
25 WEST MILL STREET
HILLSBOROUGH, NEW HAMPSHIRE

EPA Region I
Superfund Technical Assessment and Response Team (START) III
Contract No. EP-W-05-042

TDD Number:	10-07-0001
Created by:	Timothy Benton
Created on:	8 July 2010
Modified by:	Dean Brammer
Modified on:	30 November 2010

SOURCES: Field Notes

WESTON SOLUTIONS
Restoring Resource Efficiency

R:\10070001\Figures\Figure 3A.dwg

CALCULATIONS

CANCER RISKS

Adult Recreator

1. Adult - Ingestion

Chemical	[Soil](mg/kg)	Conv. (kg/mg)	IR (mg/day)	F(day/yr)	D(yrs)	BW (kg)	AP (days)	LADD ingestion (mg/kg/day)	CSF (mg/kg/day)-1	Ingestion ELCR
BaP TEQ	12.77	1.0E-06	100	146	25	70	25550	2.61E-06	7.3	1.90E-05

Equations:

Ingestion:

Conc. (mg/kg) * Conv. (kg/mg) * IR (mg/d) * F (d/yr) * D (y) * 1/BW (kg) * 1/AP (d) = **LADD (mg/kg-day)**

12.77 mg/kg * 1.0E-06 * 100 mg/day * 146 days/year * 25 years/ 70 kg * 25550 days = 2.61E-06 mg/kg/day

LADD (mg/kg/day)* CSF (mg/kg/day)-1 = ELCR (Ingestion)

2.61E-06 mg/kg/day * 7.3E-01 mg/kg/day = 1.90E-05

Where:

[soil] = contaminant concentration in soil, mg/kg

Conv. = conversion, kg to mg or kg/ug

IR = soil ingestion rate (mg/day)

F = exposure frequency (days per year)

D = exposure duration (years)

BW = body weight (kg)

AP = averaging period; acute: 1 day, chronic: 2555 days, cancer: 25550 days (365*70)

CSF = oral cancer slope factor, risk per mg/kg-day

ELCR = Excess Lifetime Cancer Risk

LADD=lifetime average daily dose

CERTIFICATION

This Letter Health Consultation for the Woods Woolen Mill, Hillsborough, New Hampshire was prepared by the New Hampshire Department of Environmental Services, Environmental Health Program, under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodologies and procedures existing at the time this health consultation was initiated. Editorial review was completed by the cooperative agreement partner.

Technical Project Officer, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Team Lead, CAPEB, DHAC, ATSDR