Letter Health Consultation

CHILOQUIN SCHOOLYARD GARDEN

CHILOQUIN, OREGON

Prepared by
Oregon Health Authority

JULY 28, 2014

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
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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Public Health Division
Under a cooperative agreement with the
Agency for Toxic Substances and Disease Registry

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July 28, 2014

Katie Robertson, RG
Project Manager
Oregon Department of Environmental Quality
800 SE Emigrant Ave, Suite 330
Pendleton, OR 97801

RE: Chiloquin Schoolyard Garden, 548 2nd St., Chiloquin, OR 97624

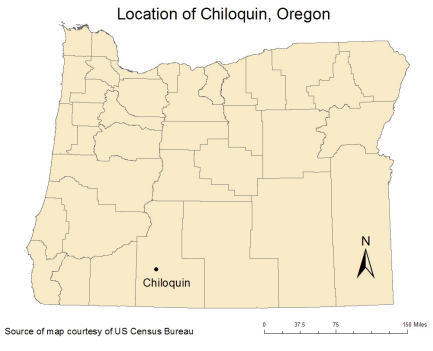
Dear Katie:

I am writing you in response to your request to evaluate and explain the human health implications of gardening on the Chiloquin Schoolyard garden site, located at 548 2nd St., in the town of Chiloquin. We received your request to evaluate levels of dioxin to determine if they could affect children and adults working in the garden. We used dioxin samples that were taken over the entire school property, since we didn't have garden-specific data. We found that the levels on the school property are low and not expected to harm the health of children or adults. As such, we don't have specific recommendations concerning the garden site. The rest of this letter describes our data review and provides details of our assessment.

Background/Statement of Issues

The Chiloquin Junior/Senior High School built a garden on its grounds where students and adults plant, tend, and harvest garden plants. A community member contacted the Department of Environmental Quality (DEQ) regarding health risks for children working in the soil on the garden site. The Chiloquin Schoolyard garden site is located southeast of the former Chiloquin Forest Products site, an adjacent mill site that was contaminated with dioxin compounds in the past. No mill activity ever occurred on the current school grounds. Contaminated material from the mill site was removed, and a soil cap was built. Klamath County is working to redevelop the site.

A community member contacted DEQ to ask about the safety of gardening on the Chiloquin School garden site. Dioxin compounds (collectively called "dioxins") were contaminants of concern during the cleanup of the Chiloquin Forest Products site. During the site's remedial investigation, DEQ consultants took soil samples on the property of the Chiloquin School in order to understand where the contamination was located. Soil samples were taken at surface depth, between zero and six inches.



Dioxins were detected in surface soil on the property of the Chiloquin School [Hart-Crowser, 2007] from 2.9 parts per trillion (ppt) to 198 ppt. A DEQ contractor (Hart-Crowser) evaluated these levels. They found that the specific types of dioxin (dioxins are a class of several related chemicals) were probably from historical pesticide application on the school property rather than from the Chiloquin Forest Products site. Some older types of pesticides (which are no longer used) contained small amounts of dioxin. These pesticides were in use up until the 1970s.

Oregon's Environmental Health Assessment Program (EHAP) used data from this report [Hart-Crowser, 2007], specifically, the levels of dioxins on Chiloquin School property (we presumed that these concentrations are what would be found on the garden site). We examined the public health impacts for people of all ages gardening on the site. Both the Chiloquin elementary school and junior/senior high school are located near the garden. Students, teachers, and community members all use the site. The purpose of this letter is to provide consultation to DEQ and the community member with our results.

Discussion

EHAP evaluated potential exposure to dioxins through contact with soil. Gardening activities put people in contact with soil. When people come into contact with soil, they can get it on their skin and/or swallow it. The Chiloquin School garden site is open to all community members, including teachers, parents and children. EHAP presumes that all age groups (adults and children) work in the garden, and could be exposed to dioxin. As a conservative measure (what we call the "worst realistic exposure" scenario), we presumed that a child would be working regularly in this garden from pre-Kindergarten through 12th grade, 100 days per year, for a total of 14 years.

Dioxin Concentration

EHAP's first step in evaluating dioxin levels is a "screening" analysis where we decide if we need to look more closely at the types of exposures taking place. We do this by comparing the dioxin levels in soil to environmental guidelines called comparison values (CVs), which are set by the Agency for Toxic Substances and Disease Registry (ATSDR). CVs are not meant to be cleanup or action levels. CVs take into consideration the health of all people, including those that are most sensitive to a chemical's effects. When a chemical's level is below the CV, it means that it is unlikely that it will cause health effects. Levels of a chemical above its CV does not necessarily mean there is a health hazard – it just means we need to look more closely at the type of exposure taking place.

For dioxins, EHAP evaluated a single value, called the dioxin toxic equivalent (TEQ), to determine if there could be risks for health effects. This approach is based on research that shows many dioxins are structurally similar and have similar health effects on humans and animals. The TEQ method is used to account for the toxic effects of *all* dioxin compounds, based on the toxicology of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). TCDD is the most potent of all dioxin compounds. The TEQ is calculated by assigning each dioxin compound a relative value based on how toxic it is compared to TCDD. These values are then added together. This value, the TEQ, is treated like a single concentration. EHAP prefers this method because not every

dioxin compound has a CV, but there is a CV for TCDD. This method has been approved by the Environmental Protection Agency (EPA) and the World Health Organization (WHO).

The TEQ concentrations for the samples we reviewed are presented in the Appendix, and the sample locations can be seen in Figure 1.

In order to estimate the reasonably highest concentration to which a child could touch or accidentally swallow, EHAP used EPA's ProUCL software. ProUCL gives us a 95% upper confidence limit (UCL), a dioxin concentration that is above the average, but below the maximum value. The UCL is the highest reasonable concentration a child could come into contact with, when considering exposure over a long period of time. Using a UCL accounts for variability of sample results across the site while still being protective. The UCL for dioxin in soil on the Chiloquin School property was 63 ppt – since there are no dioxin samples specific to the garden site, EHAP presumed this to be the dioxin concentration. This is the concentration of dioxin in the garden soil that we assumed adults and students would come into contact with while working in the garden.

To evaluate child exposure, EHAP used ATSDR's Environmental Media Evaluation Guide (EMEG) of 50 ppt as a CV, which is based on the health effect of behavioral changes in rhesus monkeys who were exposed to dioxin. The EMEG is specific to children and to chronic, or long-term exposure (*i.e.*, 365 days or more). The UCL concentration of 63 ppt is higher than ATSDR's child-specific CV (50 ppt) for dioxin. This does not mean that we expect harmful effects in children who would be exposed to this concentration. Rather, it means that we must do a more in-depth evaluation, which is presented in the following sections.

EHAP believes that adults are unlikely to experience any health problems from gardening on the site. ATSDR's CV for adults is 700 ppt (also based on behavioral changes in rhesus monkeys). This concentration is over 10 times higher than the UCL concentration of 63 ppt. It should be noted that these CVs take into account long-term exposure for people who are most sensitive to being exposed to chemicals.

Child Exposure Scenario and Dose Calculation

To determine if this level of dioxin could harm the health of children gardening on the Chiloquin School garden site, we must estimate how much soil with this concentration of dioxin could get into people's bodies. To do this, we used a process similar to EPA's human health risk assessment process to calculate the dose of dioxin that they might get from contact with soil during gardening activities.

Dose calculation requires assumptions about the frequency and intensity with which people come into contact with contaminants in soil. Here, we used assumptions that were specific to the age and activity type of children doing gardening activities. For the complete list of the exposure assumptions EHAP used to calculate dose, see the Appendix.

EHAP developed an exposure scenario based on children of age 5 to 18 years working in the community garden. To do this, we made several assumptions. This includes factors such as:

- Number of days per year spent gardening
- Total number of years spent gardening
- Amount of soil a person accidentally swallows
- Amount of soil that touches a person's skin
- Total surface area of a person's skin that comes into contact with soil
- Body weight

As previously stated, in order to ensure our evaluation is health protective, we developed a "worst exposure" scenario. This scenario is based on a child who works at the garden site, exposed to a concentration of 63 ppt, for the entire duration of their school career (pre-Kindergarten to 12th grade). The two assumptions we made for this scenario are: A child would work in the garden 100 days each year. Each time they worked there, they would accidentally swallow a certain amount of soil and get a certain amount of soil on their head, arms, hands, and legs. We verified through the community member (who originally inquired to DEQ) that this exposure scenario is appropriate and adequate for the student population.

See the Appendix for the specific factors about the assumptions EHAP made.

Non-Cancer Risk for Children

EHAP calculated non-cancer risk, the likelihood of any health problem other than cancer, by dividing the dioxin dose by ATSDR's Minimal Risk Level (MRL) for dioxin (see equation below). An MRL is the daily dose of a chemical, below which scientists consider it unlikely to harm people's health. It is based on long-term (a year or more) exposure.

$$Hazard\ Quotient\ = \frac{Calculated\ Dose}{MRL}$$

This equation gives us a number value called the hazard quotient (HQ). If the HQ is below 1.0, it is unlikely that non-cancer health effects will occur.

The Appendix shows the estimates for non-cancer risk, based on the UCL concentration of dioxin on the garden site. The HQ from dioxin exposure, through skin contact and accidentally swallowing soil on the garden site, is 0.3. Since this value is less than 1, EHAP believes that non-cancer health effects are unlikely.

Cancer Risk for Children

TCDD is considered a *known human carcinogen* by the International Agency for Research on Cancer and the US National Toxicology Program. This is based on studies in humans who were exposed in the workplace and in industrial accidents. TCDD is associated with several types of cancers, unlike many chemicals which cause cancer in a specific organ or tissue. It is believed that exposure causes multiple disruptions in cells, which can eventually causes cells to become cancerous.

EHAP calculated excess cancer risk, the probability of developing dioxin-related cancer from this site over a person's entire lifetime, by multiplying the dioxin dose by California EPA's (CalEPA) Cancer Slope Factor (CSF) for TCDD. A CSF is a value used to estimate risk of cancer associated with exposure to a cancer-causing substance. It is based on probability of risk of cancer *over a person's lifetime*. The equation below gives us a decimal value, which is the probability of additional cancer cases in a population where everyone would get the same dose of a chemical for a certain period of time.

$$Cancer\ Risk = Calculated\ Dose\ \times CSF$$

The Appendix shows our steps in calculating cancer risk, based on the UCL concentration of dioxin on the Chiloquin School garden site. The lifetime cancer risk from dioxin exposure, through skin contact and accidentally swallowing soil on the garden site, is approximately 2 out of 1,000,000 people exposed (0.000002). EHAP considers this to be a very low risk because this estimate is not distinguishable from the range of variability of cancer cases occurring without this potential dioxin exposure. To put things into perspective, approximately one out of three women, and one out of two men in the United States will develop cancer at some point in their lives [ACS, 2013]. This 2-out-of-a-million risk is *in addition* to these numbers. Depending on the type of cancer, a population with no known environmental exposure will already have a large number of cancer cases.

Comparison to dioxin concentrations in urban areas

The concentrations of dioxin in the soil of Chiloquin Elementary School and Chiloquin Junior-Senior High School are similar to concentrations of dioxin compounds found in urban areas. Dioxins are created by many human activities (*e.g.*, burning wood and fossil fuel) and do not easily degrade or break down in the environment. This means that dioxin levels in urban areas are higher than in rural areas. The levels measured here are within the range of dioxin found in several residential neighborhoods in Seattle [WA-DOE, 2011].

Conclusions

EHAP concludes that accidentally swallowing or coming into contact with dioxin in soil at the Chiloquin School garden site is not expected harm the health of adults or children gardening there. The levels of dioxin that have been measured are too low to cause health effects in adults and children working on gardens on the school grounds.

Recommendations

EHAP does not have any further recommendations at this time.

Public Health Action Plan

To date, we have taken the following actions:

- Reviewed dioxin levels in the soil at Chiloquin Elementary and Junior-Senior High Schools.
- Communicated results to the community member spearheading the school garden project.
- Provided guidance for healthy gardening practices.

We will take the following public health actions in the future:

- Send this letter health consultation to DEQ and the community member connected to the school garden project.
- Respond to community members' questions or concerns about gardening on the Chiloquin school grounds.

If you have any questions, please contact Todd Hudson by phone at 971-673-0024 or by email at todd.hudson@state.or.us.

Sincerely,

Todd Hudson
Public Health Toxicologist
Environmental Health Assessment Program

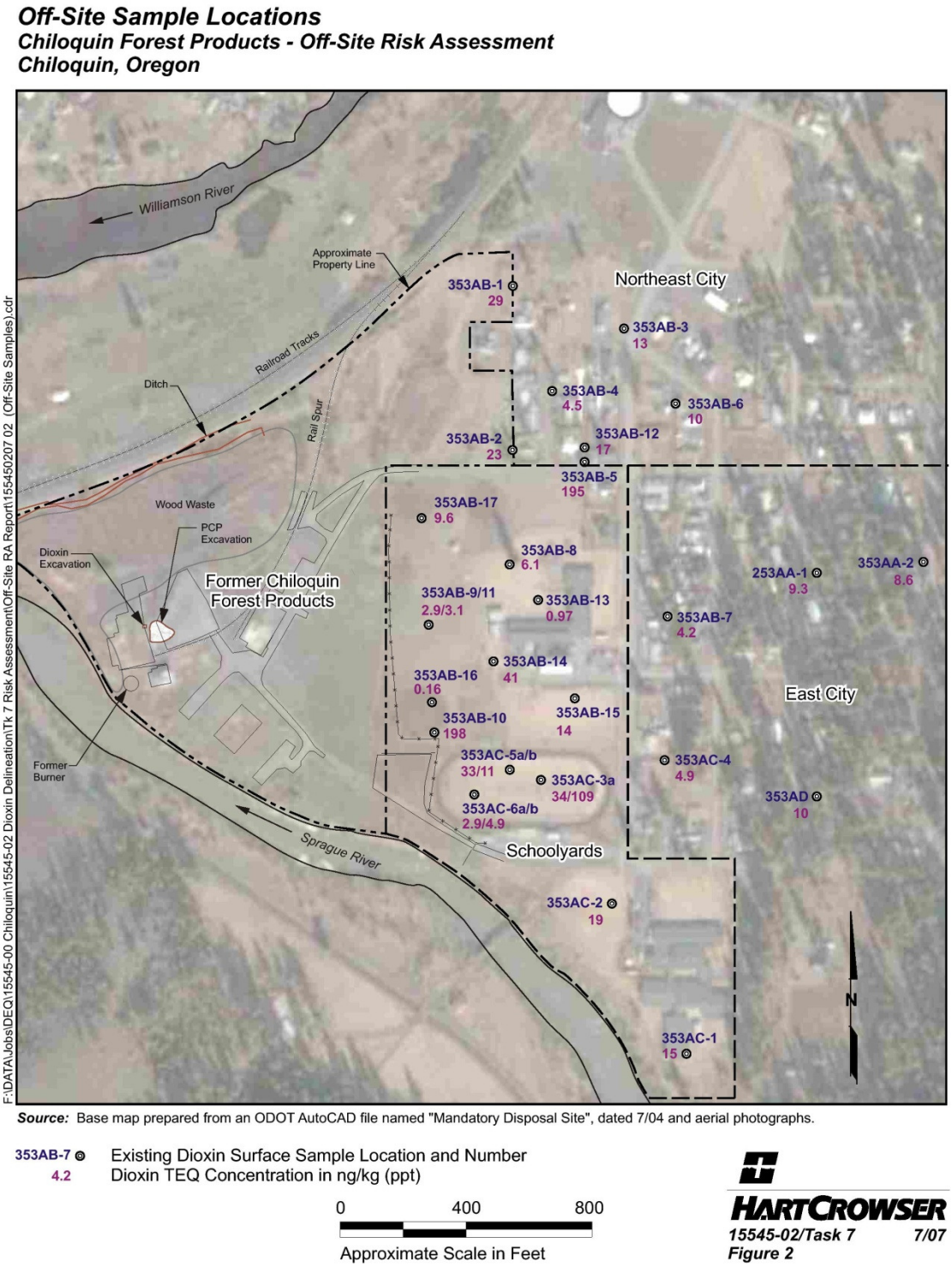


Figure 1. Location of dioxin samples on the Chiloquin Schools property (image courtesy of Hart-Crowser).

REPORT PREPARATION

This Letter Health Consultation for the Chiloquin School garden site was prepared by the Oregon Environmental Health Assessment Program under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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References

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Appendix. Dose and risk calculations

This appendix describes the equations and assumptions used to calculate the dose and risk for cancer and non-cancer health effects from chronic TCDD exposure. All estimates assume that children from pre-Kindergarten to 12th grade would be working in the garden for their entire school career, and could swallow or have skin contact with contaminated soil.

A. Sample Concentrations

Table 1. Dioxin TEQ concentrations in surface soil samples taken from the Chiloquin School garden site.

Sample Number	**Depth (feet)**	TEQ Conc (ppt)
353AB-17	0.0 – 0.2	9.6
353AB-9	0.1 – 0.5	2.9
353AB-11	0.1 – 0.5	3.1
353AB-8	0.1 – 0.5	6.1
353AB-13	0.1 – 0.5	0.97
353-AB16	0.0 – 0.2	0.16
353-AB14	0.1 – 0.5	41
353AB-10	0.1 – 0.5	198
353AB-15	0.1 – 0.5	14
353AC-5A	0.0 – 0.1	33
353AC-5B	0.1 – 0.5	11
353AC-6A	0.0 – 0.1	2.9
353AC-6B	0.1 – 0.5	4.9
353AC-3A	0.0 – 0.1	34
353AC-3B	0.0 – 0.1	109
353AC-2	0.1 – 0.5	19
353AC-1	0.1 – 0.5	15

ppt = parts per trillion
TEQ = Toxic Equivalent
Conc = Concentration
Source: Hart-Crowser [2007]

B. Dose calculations

Ingestion
The formula used to calculate an oral exposure dose is as follows:

$$D = \frac{C \times IR \times CF \times F \times ED}{BW \times AT}$$

Where:

Parameter	
Term	Description
D	= exposure dose
C	= contaminant concentration
IR	= intake rate of contaminated soil
CF	= conversion factor
F	= frequency of exposure
ED	= exposure duration
BW	= body weight
AT	= averaging time

Dermal contact

The formula used to calculate a dermal exposure dose is as follows:

$$\mathrm{DAD} = \frac{\mathrm{C_{soil}} \times \mathrm{CF} \times \mathrm{AF} \times \mathrm{ABS_d} \times \mathrm{F} \times \mathrm{ED} \times \mathrm{EV} \times \mathrm{SA}}{\mathrm{BW} \times \mathrm{AT}}$$

Where:

Parameter	
Term	Description
DAD	= dermal absorbed dose
C_{soil}	= contaminant concentration in soil
CF	= conversion factor
AF	= adherence factor of soil to skin
ABS_d	= dermal absorption fraction for soil
F	= frequency of exposure
ED	= exposure duration
EV	= event frequency
SA	= total surface area of skin available for contact (i.e., not covered by clothing and shoes)
BW	= body weight
AT	= averaging time

Non-cancer and cancer risk

The method for generating non-cancer and cancer exposure risk is identical except for the way in which the averaging time (AT) is calculated. For non-cancer, the exposure duration or ED is used to calculate the AT. For cancer, adult lifetime (78 years) is used to calculate the AT.

Non-cancer	Cancer
AT = ED x 365 days/year	AT = adult lifetime x 365 days/year

C. Risk calculations

1. Non-cancer

The formulas used to calculate non-cancer risk for the ingestion and dermal contact routes of exposure are as follows:

Ingestion	Dermal contact
$HQ_{ingestion} = \frac{D}{\text{Health guideline}}$	$HQ_{dermal} = \frac{DAD}{\text{Health guideline}}$

Where:

Parameter	
Term	Description
$HQ_{ingestion}$	= hazard quotient for ingestion
D	= exposure dose
HQ_{dermal}	= hazard quotient for dermal contact
DAD	= dermal absorbed dose

Once a hazard quotient (HQ) is calculated for each route of exposure (ingestion and dermal contact), both values are added together to generate a subtotal HQ for all routes of exposure (for one age group).

$$\mathrm{HQ_{subtotal}} = \mathrm{HQ_{ingestion}} + \mathrm{HQ_{dermal}}$$

Where:

Parameter	
Term	Description
$HQ_{subtotal}$	= hazard quotient for all routes of exposure
$HQ_{ingestion}$	= hazard quotient for ingestion
HQ_{dermal}	= hazard quotient for dermal contact

A HQ is calculated for each age group: 5-10 years, 11-15 years and 16-18 years. These HQs are added together to generate a HQ that represents continuous exposure from 5-18 years of age.

$$\mathrm{HQ_{total}} = \mathrm{HQ_{5-10\ years}} + \mathrm{HQ_{11-15\ years}} + \mathrm{HQ_{16-18\ years}}$$

2. Cancer

The formulas used to calculate cancer risk for the ingestion and dermal contact routes of exposure are as follows:

Ingestion	Dermal contact
$\mathrm{Cancer\ risk_{ingestion}} = \mathrm{D} \times \mathrm{CSF}$	$\mathrm{Cancer\ risk_{dermal}} = \mathrm{DAD} \times \mathrm{CSF}$

Where:

Parameter	
Term	Description
D	= exposure dose
DAD	= dermal absorbed dose
CSF	= cancer slop factor

The method for calculating total cancer risk is similar to the method for estimating an HQ for all routes of exposure. The cancer risk values for each route of exposure (ingestion and dermal contact) are added together to generate a total cancer risk.

$$\mathrm{Cancer\ risk_{subtotal}} = \mathrm{Cancer\ risk_{ingestion}} + \mathrm{Cancer\ risk_{dermal}}$$

A cancer risk is calculated for each age group: 5-10 years, 11-15 years and 16-18 years. These are added together to generate a cancer risk (over one's entire lifetime) that represents continuous exposure from 5-18 years of age.

$$\text{Cancer Risk}_{\text{total}} = \text{Cancer Risk}_{5-10\text{ years}} + \text{Cancer Risk}_{11-15\text{ years}} + \text{Cancer Risk}_{16-18\text{ years}}$$

D. Assumptions

EHAP calculated non-cancer and cancer doses that reflect a higher than expected level of exposure to TCDD in soil at the Chiloquin Junior and Senior High School. To generate our estimates, we assumed that pre-Kindergarten through 12th grade students would be exposed to TCDD concentration in soil equivalent to the 95% upper confidence limit of the mean (0.0000629 mg/kg). We also presumed that students could be exposed for 100 days per school year over their entire school career (a 14-year period). 100 days per year is an approximation based on the growing season specific to areas of higher elevation in eastern Oregon.

An oral dose was calculated by assuming children would accidentally ingest 200 mg/day of the most heavily contaminated soil.

To calculate a dose for dermal contact, EHAP assumed that children's head, arms, hands, and legs would come into contact with contaminated soil.

See Tables 2 and 3 for a complete list of the values used to generate the dose and risk calculations for ingestion of and dermal contact with soil, and Table 4 for the results of these calculations.

Table 2. Exposure factors for ingestion dose calculations

Parameter		Value	Unit	Source/rationale
Term	Description			
C	= contaminant concentration	0.0000629	mg/kg	95% upper confidence limit of the mean for soil samples from the schoolyard of the Chiloquin Junior and Senior High School This value is equivalent to 62.9 parts per trillion (ppt).
IR	= intake rate of contaminated soil	200	mg/day	The intake rate is taken from Table 5-1 of the EPA Exposure Factor Handbook [2011].
CF	= conversion factor	0.000001	kg/mg	---
F	= frequency of exposure	100	days/year	An approximation based on the growing season specific to areas of higher elevation in eastern Oregon.
ED	= exposure duration	14	years	Children attend the Chiloquin Elementary and the Chiloquin Junior and Senior High School. They could potentially participate in gardening for their entire school career.
BW	= body weight	31.8 (ages 5-10) 64.2 (ages 11-18)	kg	EPA divides children between ages 5 to 18 years into two weight groups: 5 to 10 years and 11 to 18 years. These weights are from Table 8-3 of the EPA Exposure Factor Handbook [2011].
AT	= averaging time	---	days	---
Adult lifetime		78	years	The value for adult lifetime is taken from Table 18-1 EPA Exposure Factor Handbook [2011].
Health guideline		1.00 E-9	mg/kg-day	This is ATSDR's MRL for chronic oral exposure to TCDD.
Cancer slope factor		1.30 E+5	$(mg/kg/day)^{-1}$	Cancer slope factor determined by the California Office of Environmental Health Hazard Assessment (OEHHA).

Abbreviations: EPA = Environmental Protection Agency, ATSDR = Agency for Toxic Substances and Disease Registry, MRL = Minimal Risk Level, TCDD = 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Table 3. Exposure factors for dermal contact dose calculations

Parameter		Value	Unit	Source/rationale
Term	Description			
C_{soil}	= contaminant concentration in soil	0.0000629	mg/kg	95% UCL of the mean for soil samples from the schoolyard of the Chiloquin Junior and Senior High School
CF	= conversion factor	0.000001	kg/mg	---
AF	= adherence factor of soil to skin	0.2	mg/cm^2-event	This is the default adherence factor for children; this value is more conservative than a time weighted average adherence factor for this population. [ATSDR, 2012].
ABS_d	= dermal absorption fraction for soil	0.03	unitless	This is the dermal absorption fraction for TCDD and other dioxins. [ATSDR, 2012]
F	= frequency of exposure	100	days/year	An approximation based on the growing season specific to areas of higher elevation in eastern Oregon. This is the number of days per year that each child spends working in the community garden.
ED	= exposure duration	14	years	Children attend the Chiloquin Elementary and the Chiloquin Junior and Senior High School. They could potentially participate in gardening for their entire school career.
EV	= event frequency	1	events/day	This value is based on professional judgment.
SA	= surface area available for contact	6280 (ages 5-10)	cm^3	This is the sum of the 95th percentile surface area values for the head, arms, hands, and legs. EPA divides children between ages 5 to 18 years into three skin surface area groups: 5 to 10 years, 11 to 15 years and 16 to 18 years. The value for each body part is from Table 7-2 of the EPA Exposure Factor Handbook [EPA, 2011].
		9360 (ages 11-15)		
		14140 (ages 16-18)		
BW	= body weight	31.8 (ages 5-10)	kg	EPA divides children between ages 5 to 18 years into two weight groups: 5 to 10 years and 11 to 18 years. These weights are from Table 8-3 of the EPA Exposure Factor Handbook [2011].
		64.2 (ages 11-18)		
AT	= averaging time	---	days	---
Adult lifetime		78	years	The value for adult lifetime is taken from Table 18-1 of the EPA Exposure Factor Handbook [EPA, 2011].
Health guideline		1.00 E-9	mg/kg-day	This is ATSDR's MRL for chronic oral exposure to TCDD. Agency for Toxic Substances and Disease Registry.
Cancer slope factor		1.30 E+5	$(mg/kg/day)^{-1}$	Cancer slope factor determined by the California Office of Environmental Health Hazard Assessment (OEHHA).

Abbreviations: UCL = Upper Confidence Limit, ATSDR = Agency for Toxic Substances and Disease Registry, = 2,3,7,8-Tetrachlorodibenzo-p-dioxin, EPA = Environmental Protection Agency, MRL = Minimal Risk Level, TCDD

Table 4. Calculated non-cancer and cancer risks from ingestion and dermal exposure to dioxin-containing soil at the Chiloquin School garden site.

Age Group (years)	Effect	Ingestion	Dermal	Subtotal
5-10	Noncancer	$1.08x10^{-1}$	$2.04x10^{-2}$	$1.29x10^{-1}$
	Cancer	$1.08x10^{-6}$	$2.04x10^{-7}$	$1.29x10^{-6}$
11-15	Noncancer	$5.37x10^{-2}$	$1.51x10^{-2}$	$6.88x10^{-2}$
	Cancer	$4.47x10^{-7}$	$1.26x10^{-7}$	$5.73x10^{-7}$
16-18	Noncancer	$5.3x10^{-2}$	$2.28x10^{-2}$	$7.65x10^{-2}$
	Cancer	$2.68x10^{-7}$	$1.14x10^{-7}$	$3.82x10^{-7}$
	Total (all ages)		**Noncancer**	$2.74x10^{-1}$ ($.3^{\dagger}$)
			Cancer	$2.24x10^{-6}$ ($.000002^{\dagger}$)

† Final results are rounded.