

Letter Health Consultation

Residential Water Supply Well Volatile Organic Compound Exposure
Near Pasco Sanitary Landfill
Pasco, Franklin County, Washington

March 24, 2014

Prepared by

**The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**



DOH 334-346 March 2014

Foreword

The Washington State Department of Health (DOH) has prepared this letter health consultation with funds from a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous substances. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

The purpose of a letter health consultation is to assess the health threat posed by hazardous substances in the environment and if needed, recommend steps or actions to protect public health. Letter health consultations are initiated in response to health concerns raised by residents or agencies about exposure to hazardous substances.

This letter health consultation was prepared in accordance with ATSDR methodologies and guidelines. However, the report has not been reviewed and cleared by ATSDR. The findings in this report are relevant to conditions at the site during the time of this letter health consultation and should not be relied upon if site conditions or land use changes in the future.

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March 24, 2014

Charles Gruenfelder
Washington State Department of Ecology
4601 N Monroe
Spokane, Washington 99205-1295

Re: Residential Water Supply Well Volatile Organic Compounds (VOCs) Exposure near
Pasco Sanitary Landfill, Pasco, Franklin County, Washington

Dear Mr. Gruenfelder:

At the request of the Washington State Department of Ecology (Ecology), the Washington Department of Health (DOH) completed this Letter Health Consultation. The evaluation focused on possible human exposure to landfill-related contaminants detected in groundwater from a series of 13 residential water supply wells located near the Pasco Landfill NPL Site.

On October 21, 2013, DOH Site Assessments Program met with Ecology at the landfill site to become better familiarized with current site conditions and ongoing cleanup activities. The site visit also helped to refine the scope for this Letter Health Consultation – i.e., to assess potential human health effects from exposure to volatile organic compounds (VOCs) in groundwater from residential water supply wells near Pasco Landfill. DOH completed its follow up review of data from the residential water supply wells and has found using groundwater from residential water supply wells for lawn and garden is not expected to harm people's health. DOH recommends continue limiting groundwater use and routine testing of residential well groundwater for VOCs to assess any notable changes in the maximum levels detected. Additionally, should other non-consumptive uses (e.g., swimming pool wading, showering/bathing, hot tub use) be considered in the future, DOH will evaluate such potential exposures which will result in greater dermal, inhalation, and accidental ingestion. A summary of the findings is included in this letter.

DOH conducts health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

The Pasco Landfill property covers nearly 250 acres and is located about 1.5 miles northeast of the city of Pasco, Franklin County, Washington (See Figure 1). The landfill is accessed via

Dietrich Road north of the intersection of Kahlotus Road with U.S. Highway 12. The landfill began operating as an open burn facility from 1958 through 1971 and was permitted to receive various types of household, commercial, and industrial waste [1].

The landfill is divided into four main areas. Waste materials of different types were segregated for disposal within these different areas in accordance with the operating waste disposal permits. From 1972 through 2001 the landfill accepted commercial and household waste. Between 1972 and 1974, industrial wastes were disposed in selected areas. The industrial waste area received approximately 40,000 drums of industrial wastes, several million gallons of bulk liquid waste, and approximately 10,000 tons of pulp and paper production facility sludges. Septic tank waste, sewage sludges, and animal fat emulsions also were spread (land applied) on the landfill property. [1]. In February 1990, the Pasco Sanitary Landfill was listed as a National Priority List (NPL) site by the U.S. Environmental Protection Agency (EPA). Ecology was later established as the lead agency, and has been overseeing the ongoing interim action cleanup work performed by several potentially liable parties.

Since 1983 to present, several studies have been done and steps taken to characterize the nature and extent of site contamination. In 2002, nearly 5,500 cubic yards of herbicide waste buried in drums was removed [1]. Treatment systems for soil and groundwater were installed at the landfill. Protective covers were placed over specific landfill areas. An extensive groundwater monitoring network was established to assess groundwater quality both within the boundaries of the landfill and within areas lying outside the landfill property. This monitoring network includes both resource protection wells and residential water supply wells. A contaminant plume has been identified which extends nearly 2 miles beyond the landfill's southern boundary. Monitoring results have shown that the size of the contaminant plume has been decreasing over time.

Since 1996, bottled and municipal water from the City of Pasco have been provided to residents whose drinking water wells may have been impacted by landfill-related contamination. Also, a groundwater protection area was created to limit groundwater usage in areas where contamination was found or suspected. The groundwater protection area extends beyond the limits of the plume boundaries. This institutional control limits the type of use for existing residential water supply wells and ensures that no additional residential drinking water wells can be installed in the groundwater protection area.

Results and Discussion

The concentration range for VOCs found in residential well groundwater from 2009 - 2012 is provided in Table 1 [2, 3, 4, 5, 6, 7]. For the monitoring period 2009 - 2012, vinyl chloride (VC) was the only chemical of concern that exceeded its comparison value (CV) of 0.025 ppb [7]. Groundwater from these residential wells is not used as a source of drinking water. However, the groundwater may be used for lawn and garden irrigation purposes. These non-consumptive uses potentially could result in dermal exposure to groundwater. Vinyl chloride absorption through human skin is limited [8].

Contaminants present at concentrations less than CVs are unlikely to pose a health threat. DOH selected the Agency for Toxic Substances and Disease Registry (ATSDR) drinking water health CV Cancer Risk Evaluation Guide (CREG) of 0.025 ppb for exposure to VC. All other VOC concentrations detected in the residential well samples were below their respective reporting limits, or were below their respective CVs. Maximum concentrations of 1,2-dichloroethane and

trichloroethene approached, but did not exceed, the standard comparison values. 1,2-DCA had a concentration of 0.26 ppb compared to a CV of 0.4 ppb. TCE had a maximum concentration of 0.32 ppb compared to a CV of 0.76 ppb.

DOH evaluated both non-cancer and cancer endpoints for dermal exposure to the maximum vinyl chloride concentration found in off-property residential wells located downgradient from the Pasco Landfill site. The input parameters used to complete this exposure assessment are presented in Attachment Table A1. The assessment used a hypothetical exposure duration of 90 days per year. This exposure period approximates the mid-summer period when lawn and garden watering would be most likely to occur. Exposure to contaminated groundwater was assumed to occur only to the hands and feet of people representing three different age categories: adult, older child, and younger child. Other potential non-consumptive water uses (e.g., swimming pool wading, showering/bathing, hot tub use) were not considered by this evaluation. In addition, inhalation of VC released to the air from the source water during a typical irrigation-application cycle was not evaluated or considered to be a likely exposure pathway of concern.

Results of our evaluation show the sum of the hazard quotient (non-cancer risk) is less than 1 (<1). The overall estimated excess cancer risk ranged from about 4×10^{-11} (4 in 100,000,000,000) to 8×10^{-11} (8 in 100,000,000,000). These excess cancer risk values are considered insignificant (Attachment Tables A2 and A3).

Summary of Vinyl Chloride (VC) (ppb) evaluation

- ATSDR's health comparison value Cancer Risk Evaluation Guide is 0.025 ppb.
- State and Federal drinking water standard (MCL) is 2 ppb.
- Maximum VC level found in drinking water was 0.26¹ ppb.
- Acceptable non-cancer hazard quotient = 1.
- Hazard quotient range from dermal contact = < 1.
- EPA target cancer risk range = 1×10^{-4} to 1×10^{-6} .
- Estimated range of excess cancer risk from dermal contact = 4×10^{-11} to 8×10^{-11} .

¹ DOH used the historic maximum VC data from the residential water supply wells when conducting this assessment to determine the most protective conclusion.

Table 1. Summary of groundwater analytical results from residential water supply wells near Pasco Landfill with comparison values, Pasco, Washington (2009-2012).

Compounds	Concentration Range (ppb)	Comparison Value (ppb)	EPA Cancer Class	Comparison Value Reference	Contaminant of Concern (COC)
Tetrachloroethene (PCE)	< 0.02U – 0.41	17	LC	CREG	No
Trichloroethene (TCE)	< 0.02U – 0.32	0.76	CH	CREG	No
1,1-Dichloroethane	< 0.02U – < 1.0 U	800	C	MTCA - B	No
cis-1,2-Dichloroethene	< 1.0 U – 2	70	D	LTHA	No
Vinyl Chloride	< 0.02U – 0.26	0.025	KL	CREG	Yes
1,1,1-Trichloroethane	< 1.0U – < 2.0 U	20,000	IN	RMEG	No
1,1-Dichloroethene	< 0.05 U – < 2.0 U	90	SU	EMEG	No
1,2-Dichloroethane (EDC)	< 0.014U – 0.26	0.4	B2	CREG	No
Chloroform	< 1.0U – < 2.0 U	100	LI	EMEG	No
Methylene Chloride	< 5.0 U	5	B2	CREG	No
1,2-Dichlorobenzene	< 1.0U – < 2.0 U	3000	D	EMEG	No
Benzene	< 0.02U – <0.028U	0.64	A	CREG	No
Ethyl-benzene	< 1.0U – < 2.0 U	1000	D	RMEG	No
1,2,4-Trimethylbenzene	< 1.0U – < 2.0 U	1000	D	EMEG	No
1,3,5-Trimethylbenzene	< 1.0U – < 2.0 U	40		LTHA	No
n-Propyl benzene	< 1.0U – < 2.0 U	160		RSL	No
Isopropylbenzene (cumene)	< 1.0U – < 2.0 U	1000	CN	RMEG	No
n-Butylbenzene	< 2.0 U	78		RSL	No
Naphthalene	< 1.0U – < 2.0 U	200	CN	RMEG	No
Toluene	< 1.0U – 1.4	800	IN	RMEG	No
m,p-Xylene	< 2.0U – < 4.0 U	2000	DI	EMEG*	No
o-Xylene	< 1.0U – < 2.0 U	2000	DI	EMEG*	No
Methyl isobutyl Ketone (MIBK)	< 10 U	130		RSL	No
2-Butanone	< 10 U	6,000	DI	RMEG	No
Acetone	< 25 U	9,000	DI	RMEG	No
1,2,3-Trichloropropane	<1.0 U	0.0012	LC	CREG	No
Chloroethane	<1.0 U	0.4	B2	CREG**	No
1,1,2-Trichloroethane	<1.0 U	0.61	C	CREG	No

CREG - ATSDR's Cancer Risk Evaluation Guide (child)
RMEG - ATSDR's Reference Dose Media Evaluation Guide (child)
EMEG - ATSDR's Environmental Media Evaluation Guide (child)
LTHA - EPA's Lifetime Health Advisory for Drinking Water
RSL - EPA's Regional Screening Level for Tap Water
MTCA B - Washington State Model Toxics Control Act Method B groundwater cleanup level
U - data qualifier: The analyte was not detected at this level
A - EPA: Human carcinogen

B2 - EPA: Probable human carcinogen (inadequate human, sufficient animal studies)
C - EPA: Possible human carcinogen (no human, limited animal studies)
D - EPA: Not classifiable as to health carcinogenicity
SU - EPA: Suggestive evidence of carcinogenic potential
IN - Inadequate information to assess carcinogenic potential
LI - Likely to be carcinogenic to humans
KL - Known/Likely to be carcinogenic to humans
DI - Data are inadequate for assessment of human carcinogenic potential
CN - Carcinogenic potential cannot be determined
CH - Carcinogenic to humans
LC - Likely to be carcinogenic to humans
* Total xylenes value was used as a surrogate
** 1,2-Dichloroethane (EDC) value was used as a surrogate

Conclusion

DOH concludes that using groundwater from residential water supply wells near Pasco landfill for irrigating lawn and garden is not expected to harm people's health.

Recommendations

1. DOH recommends Ecology continue limiting groundwater use from residential water supply wells to only non-consumptive, outdoor uses such as lawn watering or garden use.
2. DOH recommends Ecology continue routine testing of residential well groundwater for VOCs to assess any notable changes in the maximum levels detected.
3. Should additional non-consumptive uses (e.g., swimming pool wading, showering/bathing, hot tub use) be considered in the future, DOH will evaluate such potential exposures which will result in greater dermal, inhalation, and accidental ingestion.

DOH appreciates this opportunity to review the updated sampling data and help with these technical issues. If you have any questions regarding this letter please feel free to contact me at 360-236-3376 or 1-877-485-7316 or by email at Lenford.O'Garro@doh.wa.gov.

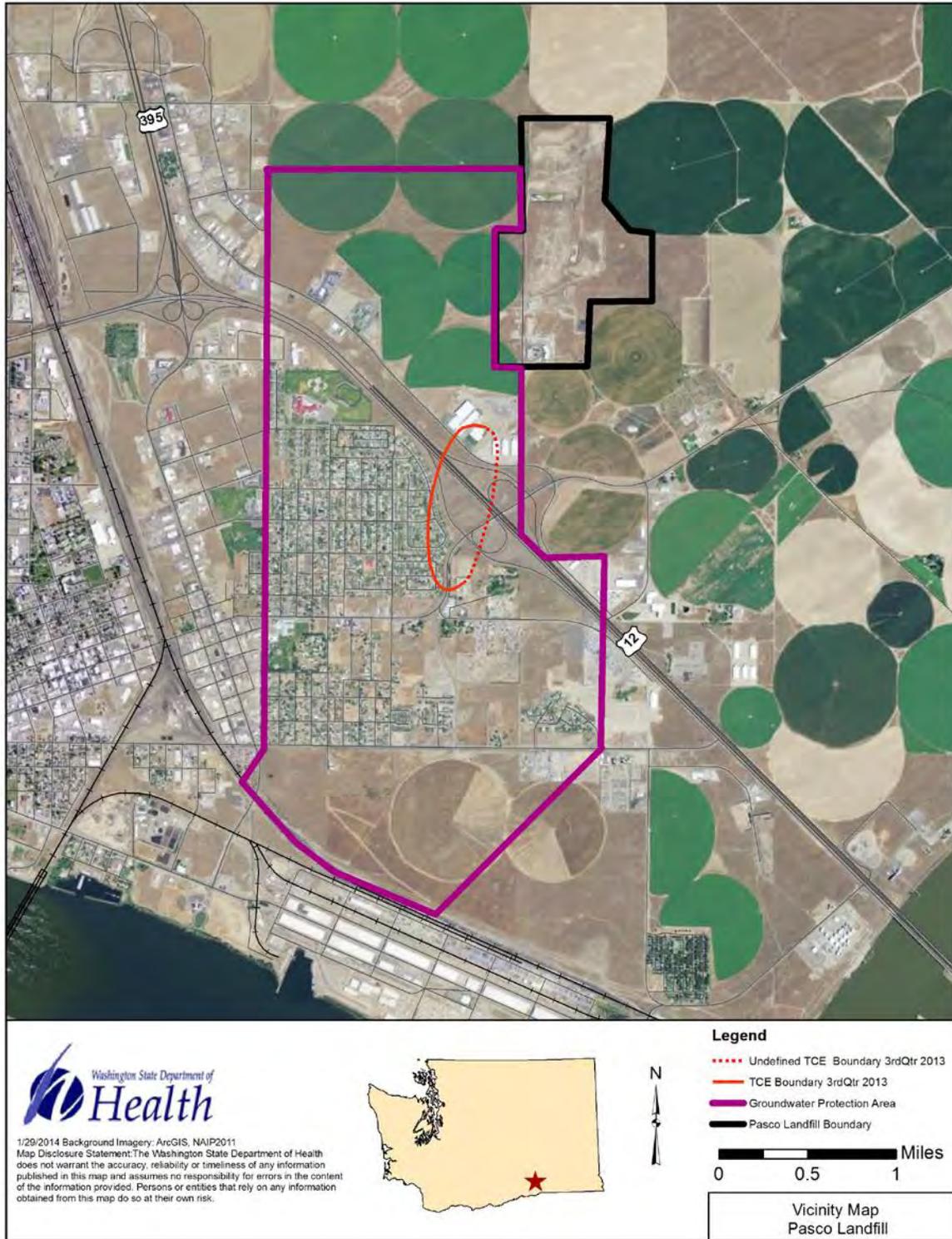
Sincerely,

Lenford O'Garro
Toxicologist
Site Assessments and Toxicology Section

References

1. Washington State Department of Ecology: Pasco Sanitary Landfill Site. Update August 2013, Publication No. 13-09027.
2. Pasco Landfill Site, First Quarter 2009 Ground Water Monitoring and Interim Action Performance Monitoring Report, Prepared By: Environmental Partners, Inc. June 15, 2009
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8. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for Vinyl Chloride. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service; 2006.
9. National Center for Environmental Assessment. Exposure Factors Handbook Volume 1 – General Factors EPA/600/P-95/002Fa: U.S. Environmental Protection Agency; August 1997.
10. Foster, S.A. and Chrostowski, P.C. (1987) Inhalation Exposures to Volatile Organic Contaminants in the Shower. Presentation at the 80th Annual Meeting of APCA. New York, NY. June 21-26, 1987.

Figure 1: Washington state map showing location of the City of Pasco and aerial photograph of the Pasco Sanitary Landfill along with the groundwater protection area in Franklin County, Washington.



Attachments

This section provides calculated exposure dose and assumptions used for exposure to VOCs in groundwater from private wells near Pasco Landfill in Pasco, Washington. This exposure scenario was developed to model exposures that might occur. These scenarios were devised to represent exposures to a child (0-5 years), an older child, and an adult. The following exposure parameters and dose equations were used to estimate exposure doses from direct contact with chemicals in water. As with any scenario, there are uncertainties.

Exposure to VOCs in water via dermal absorption

$$\text{Dermal Absorbed (DA}_{\text{event}}) = \frac{\text{FA} \times \text{Kp} \times \text{Cw} \times [\text{t}/1 + \text{B} + 2 \times \text{tau} \{1 + 3 \text{B}/1 + \text{B}\}]}{\text{ORAF}}$$

$$\text{Dermal Absorbed Dose (DAD)}_{\text{(non-cancer (mg/kg-day))}} = \frac{\text{DA}_{\text{event}} \times \text{EV} \times \text{SA} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}_{\text{non-cancer}}}$$

$$\text{Cancer Risk} = \frac{\text{DA}_{\text{event}} \times \text{EV} \times \text{SA} \times \text{EF} \times \text{ED} \times \text{CSF}}{\text{BW} \times \text{AT}_{\text{cancer}}}$$

Table A1. Exposure assumptions used to estimate dermal exposure to vinyl chloride in Private Wells drinking water near Pasco Landfill, Pasco, Washington.

Parameter	Value	Unit	Comments
Concentration (Cw)	0.26	ug/l	Maximum detected value
Conversion Factor (CF)	0.001	ug/mg	Converts contaminant concentration from micrograms(ug) to milligrams (mg)
Exposure Frequency (EF)	90	days/year	Days between sampling period
Exposure Duration (ED)	0.25 (90 days)	years	Days possible groundwater use
Body Weight (BW) - adult	72	kg	Adult mean body weight
Body Weight (BW) - older child	41		Older child mean body weight
Body Weight (BW) - child	15		0-5 year-old child average body weight
Surface area (SA) - adult	2129	cm ²	Hands and feet surface area Exposure Factors Handbook [9]
Surface area (SA) - older child	1649		
Surface area (SA) - child	809		
Averaging Time _{non-cancer} (AT)	90	days	Days possible groundwater use
Averaging Time _{cancer} (AT)	27375	days	75 years
Cancer Slope Factor (CSF)	1.4	mg/kg-day ⁻¹	Source: EPA
Event frequency (EV)	1	unitless	events/day
Oral route adjustment factor (ORAF)	1	unitless	Non-cancer (nc) / cancer (c) - default
Permeability coefficient (B)	0	unitless	Source: EPA
Dermally absorbed dose per event (DA _{event})	Variable	mg/cm ²	Source: EPA
Dermally absorbed dose (DAD)	Variable	mg/kg-day	Source: EPA
Skin permeability coefficient (Kp)	Variable	cm/hr	Chemical specific: 0.0065
Lag time (tau)	Variable	hr	Chemical specific: 0.0.24
Time concentration calculated (t)	15	min	Model parameters [10]

kg - kilogram

µg/L - microgram per liter

µg/mg - microgram per milligram

cm² - square centimeter
 mg/cm² - milligram per square centimeter
 mg/kg/day - milligrams per kilogram body-weight per day
 cm/hr - centimeter per hour
 hr - hour
 min - minute
 EPA - Environmental Protection Agency

Private Wells Exposure –Non-cancer

Table A2. Non-cancer hazard calculations resulting from dermal exposure to vinyl chloride in private wells drinking water near Pasco Landfill, Pasco, Washington.

Contaminant	Maximum Concentration (ppb)	Scenarios	Estimated Dose (mg/kg/day)	MRL (mg/kg/day)	Dose/ (MRL)
Vinyl Chloride (VC)	0.26	Child	1.66E-8	3.0E-3	5.53E-6
		Older Child	1.24E-8		4.13E-6
		Adult	9.12E-9		3.04E-6

MRL - ATSDR's Minimal Risk Level
 ppb - parts per billion
 mg/kg/day - milligrams per kilogram body-weight per day

Hazard Quotient (HQ) formula:

$$HQ = \frac{\text{Estimated Dose (mg/kg-day)}}{\text{MRL (mg/kg-day)}}$$

MRL - ATSDR's Minimal Risk Level
 mg/kg/day - milligrams per kilogram body-weight per day

Private Wells Exposure – Cancer

Table A3. Cancer hazard calculations resulting from dermal exposure to vinyl chloride in private wells drinking water near Pasco Landfill, Pasco, Washington.

Contaminant	Maximum Concentration (ppb)	EPA Cancer Group	Scenarios	Cancer Potency Factor (mg/kg-day) ⁻¹	Increased Cancer Risk
Vinyl Chloride (VC)	0.26	KL	Child	1.4	7.66E-11
			Older Child		5.71E-11
			Adult		4.20E-11

KL - Known/Likely to be carcinogenic to humans
 ppb - parts per billion
 mg/kg/day - milligrams per kilogram body-weight per day
 Cancer Potency for oral and dermal (EPA)

<u>Estimated Cancer Risk</u>		
Cancer risk estimates do not reach zero no matter how low the level of exposure to a carcinogen. Terms used to describe this risk are defined below as the number of excess cancers expected in a lifetime:		
<u>Term</u>		<u># of Excess Cancers</u>
moderate	is approximately equal to	1 in 1,000
low	is approximately equal to	1 in 10,000
very low	is approximately equal to	1 in 100,000
slight	is approximately equal to	1 in 1,000,000
insignificant	is less than	1 in 1,000,000