Terry Bower - Gradient -

EMAR3 21.1 V1
EMCSF 21.1 V2

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Via email

December 8, 2009

Ms. Kira Lynch, MS ECL-113
US Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Subject: 2009 Garden Vegetable Sampling

Dear Ms. Lynch:

On September 29, 2009, FMC submitted a Work Plan for collecting vegetable and soil samples from the (b) (6) family garden and a reference garden (b) (6) family garden). The protocols described within this Work Plan were also used to collect vegetable and soil samples from two additional gardens (JRS1 and JRS2) located on property owned by J.R. Simplot.

The primary purpose of this letter is to communicate the analytical results of the garden sampling performed during fall 2009. While significant work has been done previously to estimate an uptake factor to extrapolate homegrown produce concentrations from EMF RI soil and wheatgrass data, these 2009 soil and vegetable data indicate that, while higher vegetable cadmium concentrations generally correlate with higher soil cadmium concentrations, they do not support development and use of a "simple" linear relationship between cadmium in soils and cadmium in vegetables. Consequently, the 2009 empirical data from the (b) (6) and (b) (6) reference gardens were used to estimate potential risks to a hypothetical receptor with an upper-bound ingestion rate, e.g., homegrown intake of vegetables averaged over the year, associated with detected and extrapolated cadmium concentrations. The use of the empirical data greatly reduces the uncertainty in estimating risk for this pathway.

Measured Cadmium Concentrations in Vegetables

The laboratory data associated with the 2009 vegetable and soil samples obtained from the four sampled EMF study area gardens are provided in Attachment 1, and the cadmium concentrations are summarized in Table 1. A site map of the area, annotated with the four garden locations, is shown in Figures 1a and b. The Eastern Michaud Flats Remedial Investigation ("RI") 0-2 inch bgs undisturbed surface soil cadmium concentration data from 1992/1993 are also shown on these figures.

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FMC

As shown in Table 1, the two JRS garden locations (JRS1 and JRS2) contain lower cadmium concentrations in the 0-6 inch bgs tilled garden soil compared to the adjacent 0-2 inch bgs untilled soils. Due to tilling, the garden soil cadmium concentration was reduced by approximately one-third. However, at the (b) (6) garden, the 0-6 inch garden soil sample was found to contain a slightly higher cadmium level (12.6 mg/kg) than the 0-2 inch soil sample (11 mg/kg) collected from adjacent grass covered areas outside the tilled garden plot. This is an unexpected result because 0-2 inch increment soils should contain a higher cadmium concentration than 0-6 inch soils given the surficial mode of contamination (i.e., aerial deposition) documented in the SRI Addendum report (MWH, 2009). The most logical explanation for this apparent discrepancy is that the 0-2 inch untilled(b) (6) sample was collected in an area near the garden that was historically tilled, or disturbed in some other manner, most likely during construction of the home, garages, or the previous use of the garden area for equipment storage by the prior residents. This is further supported by the fact that the nearest undisturbed RI soil sampling location contains approximately a 2-fold higher cadmium concentration (20.2 mg/kg) than the tilled garden soil.

At the (b) (6) reference location, the cadmium concentration in garden soil and adjacent untilled soil, as well as the RI sample concentration, are quite similar. It is likely these concentrations represent the variability in the background cadmium soil concentration. Analytical results for a fertilizer used in the (b) (6) garden are also included in Attachment 1.

Risk Estimates Based on Measured Vegetable Concentrations

Conservative risk estimates were developed for a hypothetical high-end vegetable gardener based on the data collected at the (b) (6) and (b) (6) gardens, and conservative extrapolations to the range of other non-sampled vegetables that might be grown. While the (b) (6) garden (located approximately 2 miles north-northeast of the EMF facilities) is considered generally representative of background conditions, the (b) (6) family garden is located adjacent to the EMF facilities, and directly downwind (northeast) of the primary contamination source (former ore handling area). The (b) (6) garden is within the limited area north of the facilities which the 1998 ROD defined as an area where cadmium concentrations in surface soil exceed a hazard quotient of one.

To estimate risks for the hypothetical high-end vegetable gardener, cadmium concentrations within each of the various vegetables classes (e.g., root vegetables, garden fruits, etc.) that may be grown were initially characterized based on the empirical data. The extent to which each vegetable class contributes to the total homegrown vegetable consumption rate assumed to be applicable to a high-end receptor was then estimated. This was done by using ingestion rates of each vegetable within the various vegetable classes to develop a relative intake for that vegetable class which, when combined with the assumed (and measured) cadmium concentrations for each vegetable class are applied to the total vegetable intake for use in estimating dose. The risk is obtained by dividing

the dose estimate by the toxicological reference dose (RfD) of cadmium. The methodology, outlined above, is described in greater detail in Attachment G of the SRI Addendum.

As shown in Table 1, the cadmium concentration assigned to a vegetable class at the (b) (6) and (b) (6) locations was generally defined as the maximum concentration measured in a vegetable within that vegetable class. However, in the case of garden fruits (not including tomatoes), the maximum garden fruit concentration detected at all four sampled locations (i.e., (b) (6), JRS1 and JRS2) was used to characterize the cadmium concentration in this vegetable class. This step was taken because the detected garden fruit concentrations do not correlate well with corresponding garden soil concentrations and the maximum garden fruit concentration was taken in a garden with a lower soil concentration. Tomatoes were considered separately from other garden fruits because the measured tomato concentrations exhibit a correlation to soil concentration.

To estimate worst-case risks to a hypothetical high-end vegetable gardener, conservative assumptions were made to characterize concentrations in commonly grown vegetable classes for which data were not developed in the recent sampling event. Specifically, in the absence of site-specific data, the garden fruit maximum previously described was also used to characterize the cadmium concentration in the (b) (6) and (b) (6) gardens for the class of vegetables which includes asparagus, cabbage and broccoli. This assumption was made on the basis that Table 4-2 of Attachment G to the Supplemental Human Health Risk Assessment (HHRA) (IRM, 2009) shows that uptake of cadmium into these two groups of vegetables is similar. Additionally, no data were available to characterize lettuce concentrations at the (b) (6) and (b) (6) gardens. Consequently, to estimate a lettuce concentration the maximum root vegetable concentration measured at the (b) (6) and, separately, the (b) (6) reference garden, was divided by the ratio of root vegetable-to-lettuce concentrations (0.515) presented in Table 4-2 of Attachment G to the Supplement HHRA (IRM, 2009).

The cadmium concentrations used to characterize exposure for each vegetable class at the (b) (6) and (b) (6) reference gardens are shown in Table 1, where the basis of the assumptions are also summarized. These vegetable class-specific exposure concentrations were combined with estimates of the relative intake of each vegetable class, based on EPA distributions of vegetable intakes, to derive an exposure concentration for all vegetable classes combined (Table 2). This combined exposure concentration is applied to the total full year garden vegetable ingestion rate estimates to calculate cadmium dose rates. The basis of the relative vegetable class intake rates, along with moisture content, Fr_{MC}, and correction for the fraction lost during preparation, L_p, is provided in Table 3.

In Table 4, the ingestion rates for each of the exposure scenarios evaluated are shown. The first scenario, the per capita exposure, represents the 95th percentile of the entire population (i.e., consumers and non-consumers of homegrown vegetables). This scenario

is evaluated separately for both a combined adult/child receptor, as well as the child alone. The second "consumer-only" scenario applies to individuals who acknowledged consuming homegrown vegetables during the FDA survey period. This scenario also includes both the combined adult/child receptor as well as the child alone. Note that the homegrown vegetable ingestion rates for the consumer-only scenario represent roughly half of the wet weight mass of all vegetables (homegrown and store-bought) consumed under the per capita scenario. The viability of producing and canning/preserving the mass of vegetables required under the "consumer-only" receptor scenario is considered extremely conservative, particularly given the climate (relatively short growing season) in Pocatello.

The results of the risk calculations are shown in Table 5 for hypothetical high-end receptors living at a worst-case location (e.g., (b) (6) garden) and a reference location (b) (6) garden). All risks are below a hazard quotient (HQ) of one, indicating that there is no potential for adverse effects to occur from ingesting homegrown vegetables under the scenarios evaluated. The actual risks associated with the recent year's garden production practices at the worst-case location, i.e. the (b) (6) garden, would be substantially lower.

Please call me with any questions, or to discuss further.

Sincerely,

Barbara E. Ritchie
Associate Director, Environment
FMC Corporation

cc: Doug Tanner, Waste and Remediation Manager
State of Idaho Department of Environmental Quality
444 Hospital Way #300
Pocatello, ID 83201

RCRA/CERCLA Program Manager
Shoshone-Bannock Tribes
P.O. Box 306 – Pima Drive
Fort Hall, ID 83203

Alan Prouty, JR Simplot

References:

MWH. 2009. *Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit.* November 2009.

IRM. 2009. *Supplemental Human Health Risk Assessment Addendum for the FMC Undeveloped Areas and Northern Properties.* October 2009.

Figure 1a
Garden Locations with 0-2" RI Surface Soil Cadmium Concentrations

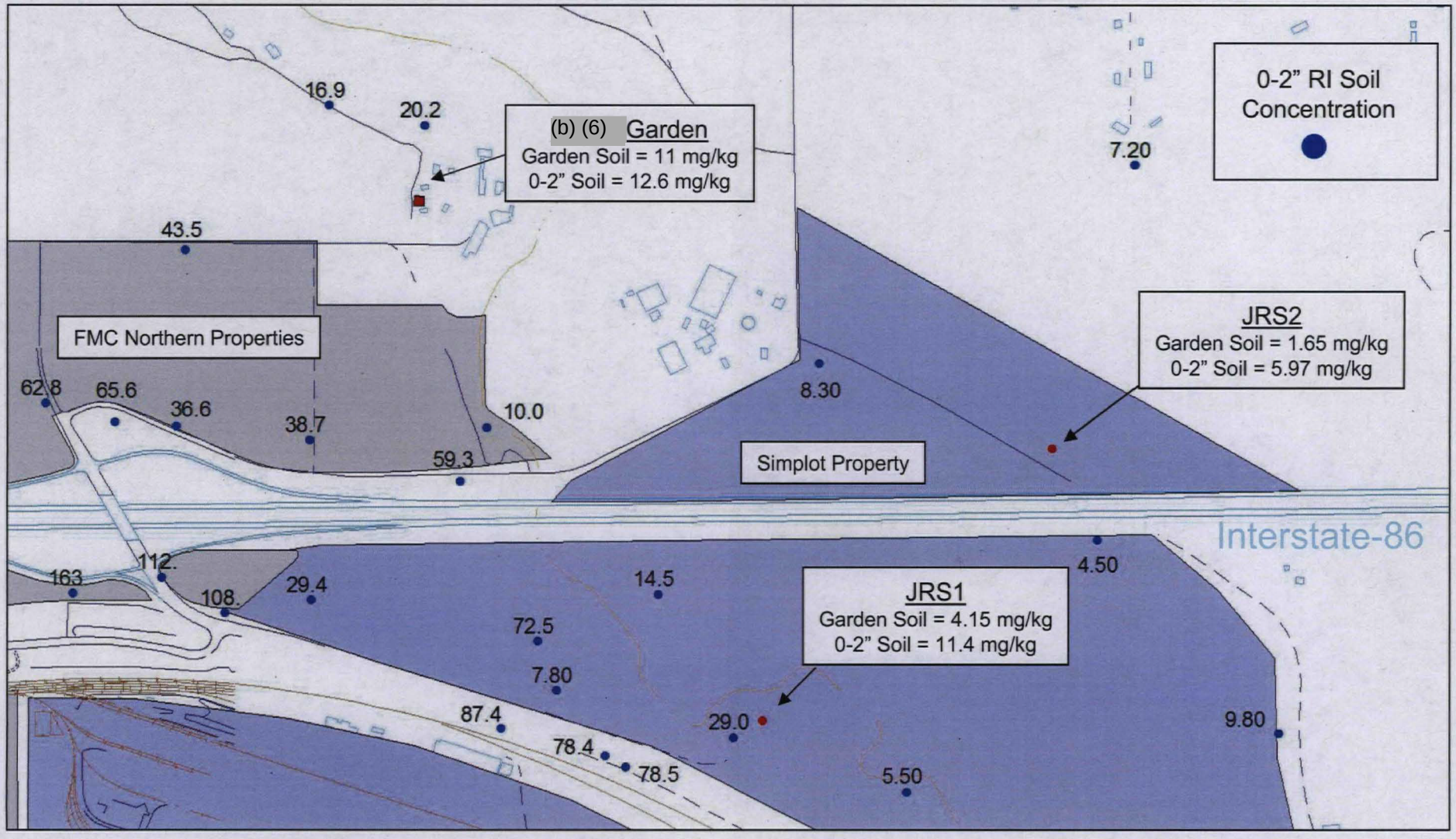

Figure 1b
Garden Locations with 0-2" RI Surface Soil Cadmium Concentrations

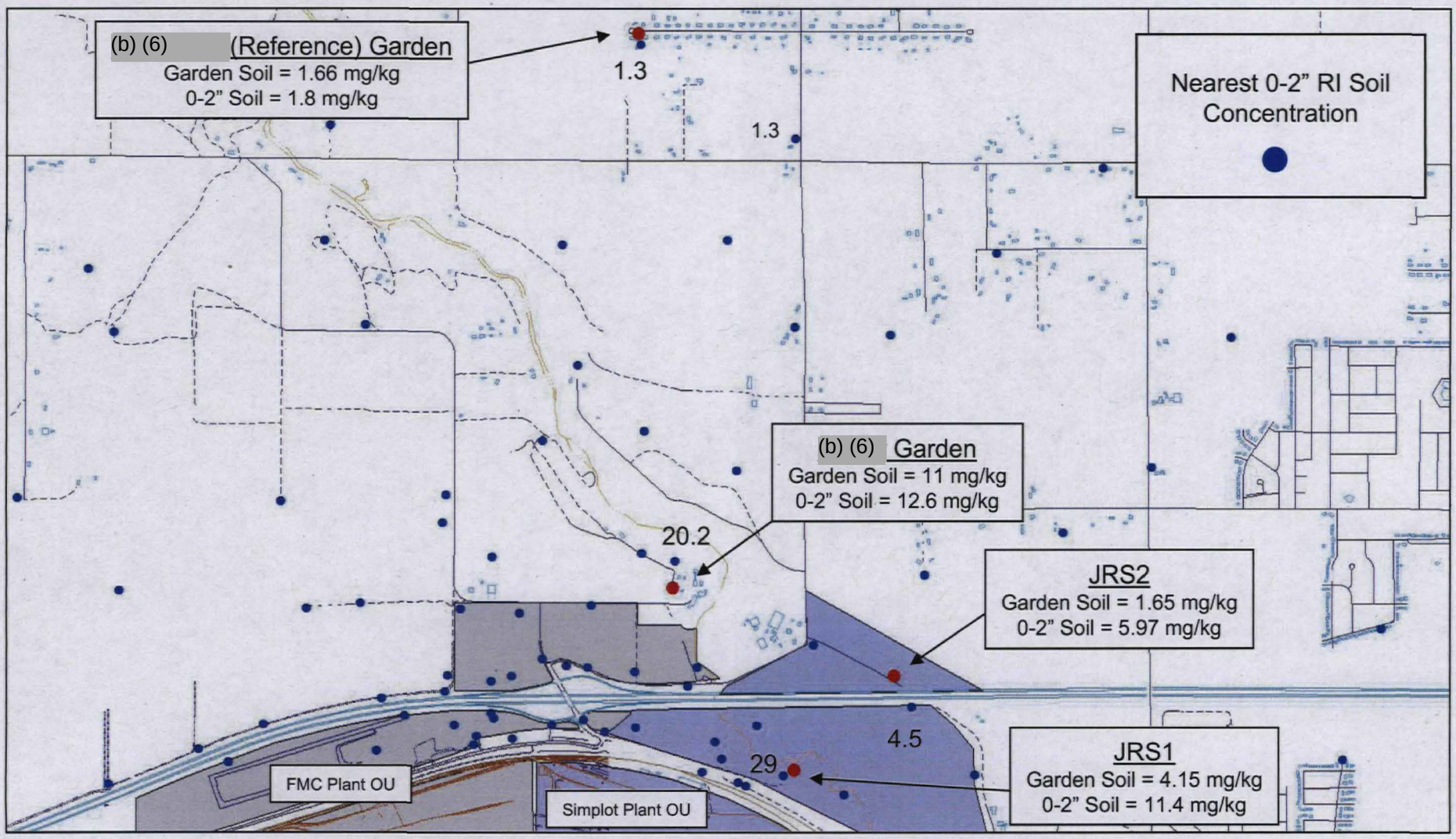

TABLE 1. EPA Groundwater Sample Results from Rowland Well (RW-1 and RW-1 DUP) Compared to EMF Groundwater Representative Concentrations and Comparative Values

ANALYTE	Michaud 95th Percentile (a)	Bannock 95th Percentile (a)	Groundwater Comparative Values (CVs)	Source of Groundwater CV (b)	Rowland Well EPA Sample RW-1	Rowland Well EPA Sample RW-1 DUP
COMMON IONS (mg/l)						
Alkalinity, bicarbonate	198	171				
Calcium	97.71	68.75			63.2	63.1
Chloride	192.90	52.42	250	Sec. Standard	20.7	20.7
Magnesium	33.59	19.20			22.2	22.5
Potassium	12.72	10.52			6.22	6.25
Sodium	74.28	27.53			40.3	40.7
Sulfate	72.57	43.40	250	Sec. Standard	42.6	42.5
PHYSICAL PARAMETERS						
Spec.Conductivity (umhos/cm)	1136	569				
pH	(c)	(c)	6.5 to 8.5	Sec. Standard		
Temperature (degrees Celcius)	(c)	(c)				
Total Dissolved Solids (mg/l)	867	412	500	Sec. Standard		
Redox (mV)	(c)	(c)				
NUTRIENTS AND FLUORIDE (mg/l)						
Nitrate (NO3 as N)	5.52	1.60	10	MCL	1.74 (d)	1.65 (d)
Phosphorous (Total as P)	0.33	0.31			0.0296	0.0289
Fluoride	0.80	0.60	4	MCL	0.243	0.281
METALS (mg/l)						
Aluminum	0.0977	0.5472	0.05 to 0.2	Sec. Standard	0.03 U	0.031 U
Antimony	0.1000	0.1340	0.006	MCL	0.001 U	0.001 U
Arsenic	0.0141	0.0170	0.01	MCL	0.0022	0.0025
Barium	0.2297	0.1204	2	MCL	0.11	0.11
Beryllium	0.0020	0.0040	0.004	MCL	0.001 U	0.001 U
Cadmium	0.0050	0.0050	0.005	MCL	0.00013 U	0.00013 U
Chromium	0.0114	0.0110	0.1	MCL	0.01 U	0.01 U
Cobalt	0.0145	0.0108	0.73	PRG	0.005 U	0.0052 U
Copper	0.0085	0.0109	1	Sec. Standard	0.0027	0.0029
Iron	0.7690	0.8402	0.3	Sec. Standard	0.02 U	0.021 U
Lead	0.0020	0.0068	0.015	TT Action Level	0.00071	0.00078
Manganese	0.0518	0.0201	0.05	Sec. Standard	0.002 U	0.0021 U
Nickel	0.0200	0.0200	0.73	PRG	0.01	0.012
Selenium	0.0057	0.0055	0.05	MCL	0.0013 U	0.0013 U
Silver	0.0050	0.0052	0.1	Sec. Standard	0.01 U	0.01 U
Thallium	0.0040	0.0400	0.002	MCL	0.00063 U	0.00065 U
Vanadium	0.0745	0.1000	0.18	PRG	0.01 U	0.01 U
Zinc	0.0501	0.1700	71	PRG	0.0274	0.0268

(a) The Bannock and Michaud representative concentrations are 95th percentile values for pre-1994 data as presented in Table 4.4-1 in the EMF RI Report with the exception of the representative arsenic concentration that is a 95% Upper Prediction Limit as described in Section 4.4 of the Groundwater Current Conditions Report for the FMC Plant OU.

(b) Sec. (Secondary) Standard per National Secondary Drinking Water Regulations; MCL means Maximum Contaminant Level per National Primary Drinking Water Regulations; PRG means Preliminary Remedial Goal for Tap Water per EPA Region VI PRG Table (3/8/2008); TT Action Level means Treatment Technique action level per the National Primary Drinking Water Regulations.

(c) Representative values were not calculated for pH, temperature and redox during the EMF RI.

(d) EPA results for Rowland well samples are for nitrate + nitrite as N.

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December 8, 2009

(b) (6)
1135 Rowland Rd
Pocatello, ID 83204-7416

Dear (b) (6):

I would like to thank you once again for allowing FMC to test your home grown vegetables and garden soils. As our representative discussed with you prior to the sampling, your vegetables and soil were analyzed for the metal cadmium. We committed to provide you with the testing results and an explanation of the results, which we are now doing with this letter.

You also allowed FMC access to collect soil samples randomly located on your property, in conjunction with sampling of soils from a neighboring property, and those analytical results will be provided to you once they are available.

Cadmium occurs naturally in soil and plants, and there is some level of cadmium in all vegetables. FMC tested your vegetables and garden soils to measure concentrations of cadmium because the proximity of your property to the Eastern Michaud Flats (EMF) superfund site may have added additional cadmium to your soils by deposition of some amount of wind-blown dust containing cadmium from historic dry phosphate ore handling at Simplot and former FMC (EMF) facilities. Current science suggests that some plants and vegetables can take up cadmium from the soil in which they are grown, although a clear relationship between soil concentration and plant uptake is not well understood.

FMC collected samples of vegetables on September 30, 2009 and soil on October 7, 2009 from your garden area and your lawn around the garden. Several vegetables of each vegetable type were combined together as one sample for analysis. This means, for example, that we have one result for cadmium concentration in tomatoes, but six tomatoes were combined into this one sample. Samples of garden soil were taken from locations where a vegetable plant being sampled was located. The garden samples were taken from the surface to six inch depth, which includes the root growing area, and all garden soil samples were combined into one sample. FMC also took shallow soil samples from other nearby areas of your yard and these were combined into a single sample for laboratory analysis.

While you had grown other vegetables in the garden (pumpkins, red potatoes, peppers, peas, cucumbers, and beets), samples of these vegetable types were not collected either because the remaining crop had been damaged by voles (potatoes, peas), there was an insufficient quantity to sample (cucumbers, beets), they are representative of a vegetable class already sampled (peppers), or, as we understand, you had no plans to consume the grown vegetable (pumpkin). You indicated that this is the first year that you gardened and that you did not apply soil amendments, such as compost, or fertilizers and that at the time of the sampling you had essentially ended harvesting vegetables from the garden for the year.

The results of this testing are presented below. The concentrations for all samples are presented in units of milligrams cadmium per kilogram of vegetable or of soil (mg/kg). These units are also sometimes referred to as parts-per-million (ppm). The vegetable samples below are shown as wet weight and dry weight. The laboratory dried the sample before analyzing to increase the sensitivity of the analysis. 'Wet weight' concentrations are discussed because that is how vegetables are most commonly eaten.

(b) (6) **Garden Sample Results**

Vegetable	Percent moisture	Dry weight cadmium mg/kg	Wet weight cadmium mg/kg
Snap ("Pole") beans	86.8	<0.05[1]	<0.007[1]
Corn	72.3	0.06	0.017
Tomatoes	94.8	0.82	0.043
Squash	95.4	0.19	0.009
Onions	88.2	1.21	0.143
Onions (duplicate)	88.2	1.04	0.123
Carrots	93.4	1.97	0.130

[1] No cadmium detected; value is the analytical detection unit

Soils	Dry weight cadmium mg/kg
Garden (0-6 inch)	12.7
Garden (duplicate) (0-6 inch)	12.5
Undisturbed yard (0-2 inch)	11.0

Please refer to the attached sheets for additional information that may be helpful to you in providing perspective on evaluating these results. For the reasons explained in those sheets, FMC does not believe that it is necessary for you to take any precautionary measures with respect to cadmium levels measured in produce from your garden at this time, however you may want to consider applying soil amendments annually and fertilizing your garden soil as appropriate in order to improve the soil quality over time. Should your gardening practices or the quantities or varieties of produce you grow change substantially in the future, feel free to contact us to discuss any questions you may have.

Please do not hesitate to contact me by phone at 215/299-6700 or Kira Lynch, US EPA Region 10 Remedial Project Manager at 206/553-2144 if you wish to discuss this further.

Sincerely,

Barbara Ritchie
Associate Director, Environment
FMC Corporation

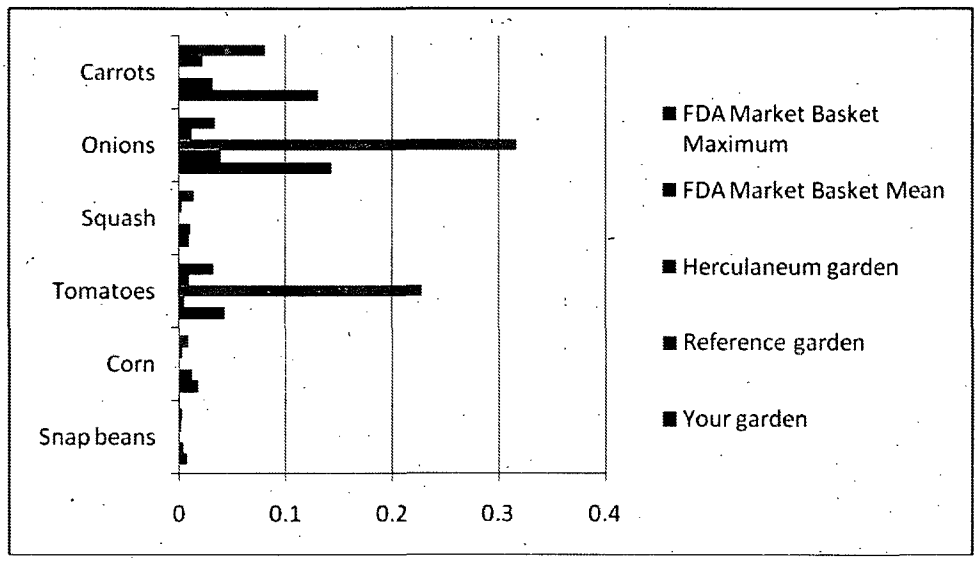
cc: Kira Lynch, US EPA
Alan Prouty, JR Simplot Co.

Cadmium: Questions and Answers

How does cadmium in my garden vegetables compare with cadmium in vegetables from other sources?

Cadmium occurs naturally in soil and plants, and there is some level of cadmium in all vegetables. The table and chart below compare cadmium levels (all are mg/kg wet weight) in vegetables from your garden with other sources of information.

Vegetable	Your garden	Reference garden	Herculaneum garden	FDA Market Basket Average	FDA Market Basket Maximum
Snap ("Pole") beans	<0.007	0.004		0.001	0.003
Corn	0.017	0.012		0.003	0.008
Tomatoes	0.043	0.005	0.228	0.009	0.032
Squash	0.009	0.011		0.003	0.014
Onions	0.143	0.039	0.317	0.012	0.034
Carrots	0.13	0.031		0.022	0.081



The reference garden is in Pocatello, located about two miles from the EMF facilities. The FDA concentrations in vegetables are taken from the nationwide Total Diet Study Market Basket Survey and include foods analyzed between 1991 and 2005.[1] Herculaneum is a smelter community in Missouri where the Agency for Toxic Substances and Disease Registry (ATSDR) tested vegetables grown in home gardens for

[1] FDA Total Diet Study, 2007, http://www.fda.gov/downloads/Food/FoodSafety/FoodContaminantsAdulteration/TotalDietStudy/UCM184301.pdf

cadmium and other metals as part of an Exposure Investigation[2]. In Herculaneum, ATSDR concluded "The consumption of these fruits and vegetables is not likely to result in adverse health problems from cadmium exposure if consumed occasionally for a few months each year."

Are there other important sources of cadmium exposure in addition to vegetables?

For non-smokers, dietary intakes are the most important source of cadmium exposure. Cadmium is highest in leafy vegetables (*e.g.* lettuce and spinach), potatoes, and grains. Cadmium is also high in peanuts, sunflower seeds, shellfish, and organ meats[3]. Recent studies estimate that typical intakes of cadmium through diet are approximately 15 micrograms/day (μg/day) for children (age 1-11 years) and 23 μg/day for adults (20+ years). Cigarettes are considered the most important source of cadmium exposure for those who smoke.

How does cadmium in the soil in my garden compare with cadmium in other soils?

Cadmium occurs naturally, and thus all soil contains cadmium. According to studies done by the U.S. Geological Survey, natural background levels of cadmium are typically below 1 mg/kg, but can be found as high as 8 mg/kg.

The U.S. EPA has established a risk-based screening level for cadmium in residential soil of 70 mg/kg. This screening level is based on direct-contact exposure scenarios, meaning that the EPA assumes that an individual, including a young child, ingests some soil, breathes some dust from the soil, and gets some soil on their skin. The EPA uses screening levels as a guide for where further investigation is necessary. Screening levels are sometimes used as cleanup levels.

How do regulatory bodies assess acceptable levels of cadmium exposure?

Combined cadmium intake from all sources is the important exposure metric. The U.S. EPA and state environmental agencies establish risk-based screening levels for cadmium in soil by considering how people are most likely to be exposed to soil. The U.S. Food and Drug Administration (FDA) sets limits on cadmium in some foods, specifically fish. Limits in shellfish are 3 mg/kg in crustacean (crabs for example) and 4 mg/kg in molluscan shellfish (oysters for example). These limits are sometimes based on both risk and practicability/achievability.

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[2] ATSDR Health Consultation: Exposure Investigation, Herculaneum Lead Smelter Lead Site, June 9, 2005.

[3] FDA reports the following levels (mg/kg) of cadmium in food: spinach average 0.144, max 0.524; peanuts average 0.056, max 0.117; sunflower seeds average 0.478, max 0.657; shrimp average 0.017, max 0.226; beef liver average 0.058, max 0.176.

What are the health effects of too much cadmium exposure?

First, it's important to be clear that your potential exposure from your vegetable garden is very low compared to levels where health effects have been observed. Ingesting very high levels of cadmium (many times higher than in your vegetables) can irritate the stomach and may cause vomiting and diarrhea. Long term chronic exposure to very high levels of cadmium can lead to kidney damage. Breathing high levels of cadmium can lead to lung irritation, and prolonged inhalation of cadmium is suspected to cause cancer.

The tomatoes, onions and carrots in my garden contain more cadmium than the FDA reported in their survey of produce around the country. The tomatoes and onions contain cadmium at concentrations much less than ATSDR indicated were not a problem at Herculaneum because of the short growing season. What does that mean?

Typical levels of cadmium in vegetables in the U.S. are well below those associated with the possibility of health risks. Cadmium in some vegetables in your garden are in between; somewhat higher than typical, but still below levels deemed by ATSDR in other communities to not represent health risks. The EPA assumes that about half of a family's total yearly vegetable consumption may come from their home grown garden. Based on this assumption, and the cadmium concentration in your garden vegetables, your cadmium intake would fall within a range considered acceptable by the EPA.

Should my family be tested for cadmium and what would that tell us?

The Centers for Disease Control (CDC) has tested a cross section of the U.S. population for cadmium in blood and urine. Cadmium is found at detectable levels in the urine of more than half of those tested, and in the blood of somewhat fewer than half. The CDC data provide a reference range than can be used by medical doctors to assess whether individuals have been exposed to higher levels of cadmium than are found in the general population. Based on what we know about the levels of cadmium in your garden soil and vegetables, it is probable that your family's cadmium levels will fall within the range measured by the CDC for the general population and thus testing is not warranted.

Where can I go for additional information?

Centers for Disease Control Fact Sheet
http://www.cdc.gov/exposurereport/pdf/factsheet_cadmium.pdf

ATSDR Toxicological Profile Fact Sheet
http://www.atsdr.cdc.gov/tfacts5.pdf

EPA Fact Sheet
http://www.epa.gov/epawaste/hazard/wastemin/minimize/factshts/cadmium.pdf

TABLE 1
MEASURED AND ASSUMED VEGETABLE CONCENTRATIONS USED TO CHARACTERIZE CADMIUM CONCENTRATIONS IN EACH VEGETABLE CLASS

Soil/Vegetable Class	Indiv Soil/Vegetables	(b) Garden Location		(b) (6) Reference Garden Location		JRS1 Garden Location	JRS2 Garden Location
		MEASURED DW Conc (mg/kg)	ASSUMED DW Conc (mg/kg)	MEASURED DW Conc (mg/kg)	ASSUMED DW Conc (mg/kg)	MEASURED DW Conc (mg/kg)	MEASURED DW Conc (mg/kg)
Soil	Garden Soil	12.6	--	1.66	--	4.15	1.65
	0-2" Undisturbed Soil	11	--	1.8	--	11.4	5.97
	Nearby RI Undisturbed Soil	20.2	--	1.3	--	29	4.5
Asp, broc, cabbage	**Value to characterize class**	**NA**	**0.283 (1)**	**NA**	**0.283 (1)**	**NC**	**NC**
Beans/Peas	HG Snap beans*	<0.05	--	<0.05	--	NA	NA
	Value to characterize class	**--**	**0.05 (2)**	**--**	**0.05 (2)**	**NC**	**NC**
Corn	HG Corn	0.06	--	<0.05	--	0.09	NA
	Value to characterize class	**--**	**0.06**	**--**	**0.05 (2)**	**NC**	**NC**
Lettuce, spinach, etc.	**Value to characterize class**	**NA**	**3.83 (3)**	**NA**	**0.74 (3)**	**NC**	**NC**
Garden Fruits (excluding tomatoes)	HG Cues	NA	--	NA	--	0.283	NA
	HG Pumpkin	NA	--	NA	--	NA	0.102
	HG Summer Squash	0.19	--	0.2	--	NA	0.099
	Value to characterize class	**--**	**0.283 (1)**	**--**	**0.283 (1)**	**NC**	**NC**
Tomatoes	HG Toms	0.82	--	0.21	--	0.417	NA
	Value to characterize class	**--**	**0.820**	**--**	**0.210**	**NC**	**NC**
Root Vegetables	HG Onions	1.21	--	0.32	--	NA	NA
	HG Onions (Duplicates)	1.04	--	0.34	--	NA	NA
	HG Carrots	1.97	--	0.38	--	NA	NA
	Value to characterize class	**--**	**1.970 (4)**	**--**	**0.380 (4)**	**NC**	**NC**

NA = Not Analyzed
NC = Not characterized because risks are not calculated for this garden.
*Snap beans FDA concentration is the maximum for green beans.
(1) Value is from JRS1 cucumbers.
(2) Non detect assumed at the detection limit.
(3) Scaled from root vegetables using the 0.515 concentration ratio of lettuce to potatoes from Hough et al. 2004, Environ Health Perspect 112:215–221.
(4) Maximum used to characterize class.

TABLE 2
CONSERVATIVE ESTIMATE OF EXPOSURE CONCENTRATION FOR EACH GARDEN EVALUATED

Vegetable Categories	DRY WT ADJUST*	(b) (6) Location	(b) (6) Reference Location
	% Ingested Based on $IR(N_{dw})_{P95\text{-}Class}$ (Dry Weight)	Assumed Cd DW Conc (mg/kg)	Assumed Cd DW Conc (mg/kg)
Asp, broc, cabbage	9.7%	0.283	0.283
Beans/Peas	21.8%	0.05	0.05
Corn	18.7%	0.06	0.05
Lettuce, spinach etc.	1.2%	3.83	0.74
Garden Fruits (w/o tomatoes)	11.1%	0.283	0.283
Tomatoes	5.3%	0.82	0.21
Roots	32.1%	1.97	0.38
Estimated Exposure Concentration		**0.80**	**0.22**

* See Table 3 for ingestion rates.

TABLE 3
HOMEGROWN VEGETABLE INGESTION RATE ADJUSTMENT FACTORS

Assigned Vegetable Category	Consumer Only Ingestion Rates - Gardeners all Regions (1997/2009 EFH)						Adjust to Dry Weight	
	Veg Intake	1997 EFH Source	IR_{P95} (Wet Weight)	$IR(N)_{P95-i}$ (Wet Weight)	Fr_{MC-i} EFH T9-27	L_{P-i} EFH T13-7	P95 (Dry Weight)	$IR(N_{dw})_{P95-i}$ (Dry Weight)
Asp, broc, cabbage	HG Asparagus	T13-35	1.63E+00	5.07E-02	0.923	0.230	1.26E-01	3.15E-02
Asp, broc, cabbage	HG Broccoli	T13-38	9.74E-01	3.03E-02	0.907	0.140	9.07E-02	2.26E-02
Asp, broc, cabbage	HG Cabbage	T13-39	2.35E+00	7.31E-02	0.926	0.110	1.73E-01	4.32E-02
Beans/Peas	HG Lima*	T13-46	1.71E+00	5.32E-02	0.702		5.09E-01	1.27E-01
Beans/Peas	HG Peas	T13-52	1.54E+00	4.79E-02	0.889	0.020	1.71E-01	4.26E-02
Beans/Peas	HG Snap beans	T13-57	2.01E+00	6.25E-02	0.903	0.180	1.96E-01	4.87E-02
Corn	HG Corn	T13-41	3.13E+00	9.73E-02	0.760	0.260	7.52E-01	1.87E-01
Lettuce, spinach etc.	HG Lettuce, spinach etc.	T13-45	1.03E+00	3.20E-02	0.954	0.220	4.74E-02	1.18E-02
Garden Fruits	HG Cues	T13-42	2.79E+00	8.67E-02	0.961	0.180	1.10E-01	2.74E-02
Garden Fruits	HG Okra	T13-47	1.21E+00	3.76E-02	0.896	0.120	1.26E-01	3.14E-02
Garden Fruits	HG Peppers	T13-53	8.45E-01	2.63E-02	0.928	0.130	6.11E-02	1.52E-02
Garden Fruits	HG Pumpkin	T13-56	1.79E+00	5.56E-02	0.916	0.190	1.50E-01	3.74E-02
Tomatoes	HG Toms	T13-59	3.52E+00	1.09E-01	0.940	0.150	2.13E-01	5.30E-02
Roots	HG Onions	T13-48	9.20E-01	2.86E-02	0.908	0.050	8.45E-02	2.10E-02
Roots	HG Carrots	T13-40	1.08E+00	3.36E-02	0.878	0.190	1.32E-01	3.28E-02
Roots	HG Beets	T13-37	1.36E+00	4.23E-02	0.873	0.280	1.72E-01	4.29E-02
Roots	HG Potatoes*	T13-60	4.28E+00	1.33E-01	0.790	0.220	9.01E-01	2.24E-01
		TOTALS	3.22E+01	1.00E+00			4.02E+00	1.00E+00

1997 EFH is the Exposure Factors Handbook while T refers to table with the subsequent numbers being the table number (EPA/600/P-95/002F, August 1997). These are consistent with the 2009 Draft Exposure Factors Handbook (EPA/600/R-09/052A, July 2009).

*Assumes that the net post cooking loss of potatoes is associated with peeling and that the change for lima beans was due to water gain and is therefore not included.

Vegetable Categories	WET WT ADJUST			DRY WT ADJUST
	% Ingested Based on $IR(N)_{P95-Class}$ (Wet Weight)	$Fr_{MC-Class}$ (P95)	$L_{P-Class}$ (P95)	% Ingested Based on $IR(N_{dw})_{P95-Class}$ (Dry Weight)
Asp, broc, cabbage	15.4%	0.921	0.155	9.7%
Beans/Peas	16.4%	0.834	0.075	21.8%
Corn	9.7%	0.760	0.260	18.7%
Lettuce, spinach etc.	3.2%	0.954	0.220	1.2%
Garden Fruits	20.6%	0.933	0.245	11.1%
Tomatoes	10.9%	0.940	0.150	5.3%
Roots	23.7%	0.831	0.206	32.1%
TOTAL ADJUSTMENT		0.875	0.184	

IR_{P95} = The 95th percentile vegetable ingestion rate of vegetables [gWW/kg-day].

$IR(N)_{P95}$ = Normalized ingestion rate for the individual vegetable, i, based on the 95th percentile of the "consumer only" intake distribution (unitless),

Fr_{MC} = The fraction moisture content in the homegrown produce (unitless).

L_P = The fraction loss during vegetable preparation, e.g. paring, peeling (unitless).

TABLE 4
DRY WEIGHT HOMEGROWN VEGETABLE INGESTION RATES ADJUSTED FOR PREPARATION LOSSES

Homegrown Vegetable Intake Scenarios	IR_{P95} [g_{WW}/kg_{BW}-day]	HG_{Veg} in West[1]	IR_{HG-95} [g_{WW}/kg_{BW}-day]	Fr_{MC}[2]	L_P[2]	IR_{HG-ADJ} [g_{DW}/kg_{BW}-day]
Residential Receptor: per capita HG intake						
All Ages Combined	11.40 *	0.057	0.650	0.875		0.081
1-11 yrs	17.05 *	0.057	0.972	0.875		0.121
Consumers Only						
All Ages Combined - West Seasonal Ave			5.04 #	0.875	0.184	0.513
1-11 yrs			9.03 ^	0.875	0.184	0.920

* Per capita ingestion rates from 2007 Food Intake Table 7A (EPA/600/R-05/062F, March 2007)
\# Consumer only seasonal average from Table 13-33 of 1997 EFH (EPA/600/P-95/002F, August 1997)
^ Consumer only children from 2008 CEFH Table 13-4 (EPA/600/R-06/096F, Sept 2008)

[1]Fraction HG from Table 13-7.1 of 1997 EFH (EPA/600/P-95/002F, August 1997)
[2]See Table 3. A correction is only applied to the consumers only since the per capita intake is based on "as eaten".

IR_{P95} = The 95th percentile vegetable ingestion rate of vegetables [gWW/kg-day].
HG_{Veg} = The fraction of homegrown vegetables as reported in EPA 1997 (unitless).
IR_{HG-95} = The wet weight 95th percentile homegrown vegetable ingestion rate (mgWW/kg-day),
Fr_{MC} = The fraction moisture content in the homegrown produce (unitless).
L_P = The fraction loss during vegetable preparation, e.g. paring, peeling (unitless).
IR_{HG-ADJ} = The dry weight ingestion rate of homegrown vegetables adjusted for moisture content and, for "consumers only", preparation losses (gDW/kgBW-day).

TABLE 5
HAZARD QUOTIENTS FOR CONSUMPTION OF HOMEGROWN VEGETABLES

Homegrown Vegetable Intake Scenarios	$HQ_{Veg\text{-}REF}$ (unitless)	HQ_{Veg}(b) (6) (unitless)
Residential Receptor: per capita HG intake		
All Ages Combined	0.02	0.07
1-11 yrs	0.03	0.10
Consumers Only		
All Ages Combined	0.11	0.41
1-11 yrs	0.20	0.74