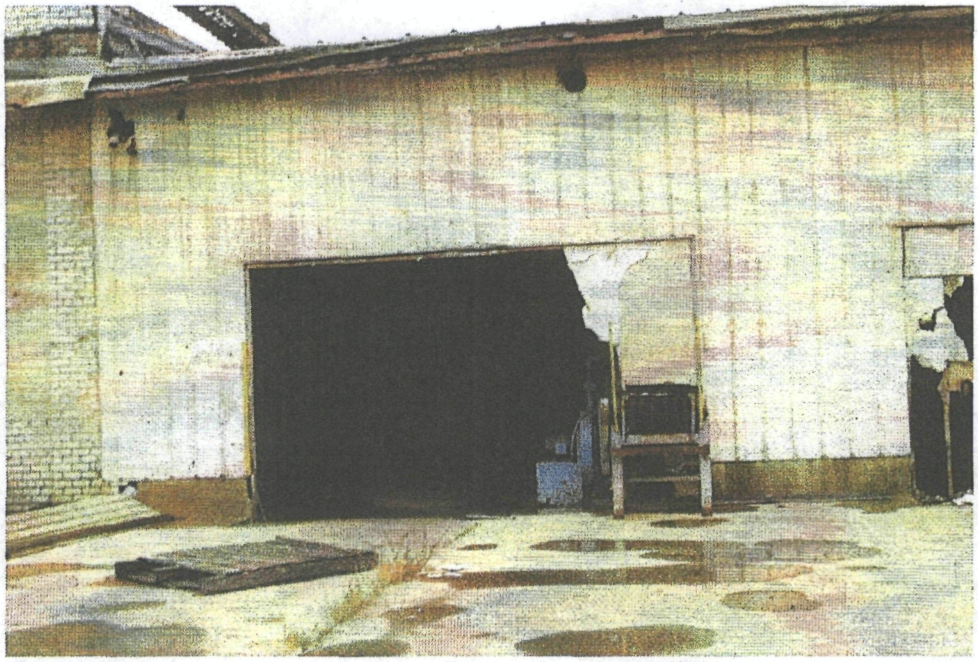

Dico building; shows general condition of onsite buildings
9/19/07

Dico Buildings 1-3 and Maintenance Building; downtown visible in background
9/19/07

Dico South Pond Area
9/19/07

Dico East drainage ditch; full and stagnant
9/19/07

Attachment 8
Risk Assessment Review

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

JAN 2 2 2008

MEMORANDUM

SUBJECT: DICO Site Updated Risk Estimates for Five-Year Review

FROM: Greg McCabe
ENSV/EAMB

TO: Mary Peterson
SUPR/IANE

Per your request, we are providing updated risk estimates for several potential exposure scenarios developed for the DICO (aka Des Moines TCE) site in Des Moines, Iowa. Our understanding is that updated risk estimates are required in order for you to prepare an adequate Five-Year Review report, and to provide you with more up-to-date risk estimates using current EPA risk assessment guidance.

As part of our effort we evaluated information contained in the following documents which were provided for our review: "Draft Des Moines South Area Source Control Operable Unit, Remedial Investigation Report, Volume I of V," dated April, 1992; "Final Remedial Investigation Report for the Des Moines TCE Site, Operable Unit No. 4, Des Moines, Iowa, Volume I," dated July 27, 1995; and, "Final Remedial Investigation Report for the Des Moines TCE Site, Operable Unit No. 4, Des Moines, Iowa, Volume II, Final Baseline Risk Assessment," dated July 27, 1995. Please note that our risk estimates are based on the summary data tables provided to us. We made no attempt to locate and identify any laboratory data packages which may or may not be located in the Superfund site file.

According to the 1995 Remedial Investigation (RI) report (Black & Veatch, 1995a), nearly all of the DICO property was covered with an asphalt cap under the auspices of an Administrative Order issued by EPA in 1994. The 1995 Risk Assessment for the site states that "there are no current risks to contaminated soil that is under the cap because the cap has essentially eliminated a complete exposure pathway." Our understanding is that the integrity of that cap has been maintained, and that there continues to be no current exposure of site workers to the contaminated soil underneath the cap. Therefore, the focus of our effort has been on the development of potential risk estimates for a variety of potential future-use scenarios, assuming a future absence of the asphalt cap.

The results of our effort generally concur with the earlier risk assessment (Black & Veatch, 1995b) done on the site. That is, our effort shows that the levels of contamination present at the site would present an unacceptable potential risk to human health if exposure pathways to site contamination were to become complete, for example, by the removal of the asphalt cap. We should note here that our review was done using current EPA guidance. Changes to EPA guidance since the completion of the 1995 risk assessment include the development of updated toxicity values for a number of compounds, development of dermal exposure guidance, development of guidance governing exposure of construction workers, development of the Johnson & Ettinger model for evaluating vapor intrusion of volatile contaminants into buildings, and the development of guidance for evaluating early-life exposure to carcinogenic contaminants with a mutagenic mode of action. However, it is unlikely that these changes would result in any significant impact to the overall conclusion of the 1995 risk assessment; i.e., exposure to site contaminants could result in potential risks to human health.

Scope of Review

We would like to stress that our effort did not evaluate all areas of contamination at the site, nor did we attempt a detailed examination of risks that may be present at the site. There are several reasons for the screening level nature of our review. First, the assessment of the presence or absence of potential health risks in the absence of the existing remedy for the completion of the Five-Year review does not warrant an extensive evaluation of potential site risks. Beyond that, the information available for our review would not support a detailed risk assessment for a number of reasons. Essentially, all of the soil data we evaluated is over ten years old, making a detailed assessment of current conditions impossible. Data presentation in the available reports is also poor in some aspects. For example, the results from surface soil sampling locations SB15-SB28 appear to be missing from Appendix 7 of the 1995 RI report. Also, surface soil sampling has been insufficient to identify any "hot spots," or isolated areas of elevated contaminant concentrations, which might be present in site soils.

We made no attempt to verify the adequacy of the soil removal action in the area of the former Aldrin tank, where exceedingly high levels of pesticide were found, nor did we include the apparent "soil pile" located in the eastern portion of the facility in our review. Our review also did not include an evaluation of building interiors at the site. Thus, any potential health risk which may, or may not, result from exposure to contaminants in these areas was not addressed in our review. We also did not consider any potential ecological risks associated with the site, and would suggest that the Region 7 ecological risk assessors be consulted regarding any such potential risk. Finally, because risk management decisions are usually based on the presence of carcinogenic contaminants, our review focused only on potential risks from exposure to carcinogens.

Given these caveats, we did attempt to perform a screening level evaluation of potential health risks to future users of the site. Our evaluation included the main exposure scenarios we thought one might expect to be present, should the site property ever be released for unrestricted use. These exposure scenarios include future residential exposure, future construction worker exposure, future 'recreational' use of the South Pond area, and vapor intrusion into building interiors from contaminated groundwater. Following are the results of our evaluation.

Future Residential Scenario

EPA risk assessment guidance is based on the concept of a "reasonable maximum exposure" (RME), which is defined as "the highest exposure that is reasonably expected to occur at a site" (EPA, 1989). RMEs are estimated for individual pathways. If an individual or a population is exposed via more than one pathway, then the combination of exposures across all those pathways also represents an RME. Typically, EPA calculates risk assuming a particular "exposure area." EPA guidance states that "...if you assume that an exposed individual moves randomly across an exposure area, then the spatially-averaged soil concentration can be used to estimate the true average concentration over time" (EPA, 1992). Because of the inherent uncertainty in knowing precisely the true average, or mean, contaminant concentration at a site, EPA generally uses an Upper Confidence Limit (UCL) of the mean concentration to represent the exposure point concentration (EPC) for a given contaminant at a site. Typically, a 95% UCL is used, though other UCLs can also be derived (for purposes of our evaluation, only the 95% UCL was used). These UCLs can be readily calculated using EPA's ProUCL software program which is able to calculate 15 different UCL values, and recommend the most statistically valid UCL (EPA, 2007). It is important to note that it is possible for the UCL of a given data set to be higher than the greatest possible mean concentration for that data set, due to issues such as small sampling size or a large degree of data variability. In those instances, EPA recommends that the risk assessment be based on the maximum detected contaminant concentration, rather than on the exceedingly high UCL of the mean (EPA, 1989).

In our review, we attempted to identify areas where an individual could receive an RME based on Figures 6-11 through 6-21 of the 1992 RI report (Eckenfelder,1992), and Figure 3-2 of the 1995 RI report. The main contaminants of potential concern (COPCs) in surface soil at the DICO facility are volatile organic compounds (VOCs) and pesticides, though other contaminants are present in specific areas. To evaluate exposure of future potential residents to contaminants in the surface soil, we selected as the exposure area roughly a one-half acre location directly west of the production building. This area was selected for two reasons: 1) there were sufficient samples collected to allow for the determination of a 95% UCL for TCE and PCE, and 2) it was felt this area could present an RME to future on-site residents. The surface sample locations evaluated are generally identified as locations SB-28 through SB-39, and other nearby sampling locations. According to Section 4.2.5 of the 1992 RI report, these samples were taken from the top two feet of soil. Because our risk estimates for future residential use here are based on standard default exposure assumptions, it is possible to develop residential risk estimates using health-based screening levels which were also based on those same default assumptions. The screening levels used in our evaluation were published by EPA Region 6 (EPA, 2006). These screening levels are based on a 1E-06 lifetime cancer risk. By comparing the Region 6 screening levels with contaminant concentrations at the DICO facility, one can quickly derive potential risk estimates for future residential use of the site using the following equation:

$$\text{estimated risk} = \frac{\text{contaminant concentration}}{\text{residential soil screening level}} \times 1\text{E-06}$$

We should note that for TCE and PCE there was wide variability in the sample results, as evidenced by isolated high concentrations of each contaminant. Because of the known presence of these contaminants, it is possible that the highest contaminant concentrations are not outliers, but rather, represent localized areas of higher concentrations. According to EPA guidance (EPA, 1989), it would be inappropriate to simply disregard such sampling results in the absence of any valid scientific reason for doing so. Thus, these values were retained in the calculation of the 95% UCL. In Table 1 below, in accordance with EPA guidance (EPA, 1989), risk estimates for TCE and PCE are based on the lower of the 95% UCL of the data or the maximum contaminant concentration. For all other contaminants, the EPC used in estimating risk is the maximum concentration, because insufficient sampling has been conducted to support a statistically valid 95% UCL of the arithmetic mean.

Table 1 – Residential Scenario, Surface Soil, Risk Estimates

Contaminant	Maximum concentration, µg/kg	95% UCL, µg/kg	EPC, µg/kg	Region 6 screening level, µg/kg	Cancer risk estimate
TCE	55,000	66,841	55,000	43	1E-03
PCE	17,000	576,102	17,000	550	3E-05
Vinyl chloride	760		760	43	2E-05
Aroclor-1254	1600		1600	220	7E-06
Aroclor-1260	2200		2200	220	1E-05
Chromium (assume 1:6 Cr^{+6}:Cr^{+3})	1,284,000		1,284,000	210,000	6E-06
Aldrin	300		300	29	1E-05
Dieldrin	12,000		12,000	30	4E-04
Chlordane	14,000		14,000	1600	9E-06
2,3,7,8-TCDD	0.093		0.093	3.9E-03	2E-05
			Total risk		2E-03

As shown in Table 1, the total risk estimate for the residential scenario is outside EPA's target risk range of 1E-04 to 1E-06 (EPA, 1990). The primary potential cancer risk from surface soil at this location results from the presence of VOCs, pesticides, and dioxin. We would note that Table 3, Appendix 7, of the 1995 RI report shows the presence of dioxin in the following surface soil sample locations: SB-2, SB-6, SB-11, SB-20, SB-21, and SB-33.

In this same area, lead was identified at a concentration of 4,880 mg/kg, which is significantly greater than EPA's residential soil screening level of 400 mg/kg. EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model was used to evaluate the potential health risk to a child living in a residential setting at this location. The potential risk from lead contamination is estimated in terms of the probability of a child having a blood lead concentration of 10 µg/dL. EPA guidance states that such a probability greater than 5% is not acceptable (EPA, 2002a). As shown in the attached IEUBK printout (Attachment 1), given the default model assumptions, there is a 98% probability that a child exposed to the identified lead concentration at this location in a residential setting would have a blood lead level greater than the allowable 10 µg/dL. This is far above EPA's health protection goal of <5% probability of a child blood lead concentration of 10 µg/dL. Please keep in mind that this finding is based on one sample result at this specific location, and cannot be considered representative of other locations at the facility. This finding does, however, show that there are lead concentrations in the surface soil at the facility which could present an unacceptable risk to children living on-site in a residential setting.

Because pesticides are a significant contaminant at the site, we evaluated a residential scenario based on potential future occupant exposure to pesticides alone. Because samples analyzed for pesticides in the surface soil are more widely spread across the site, we were unable to identify any areas where sufficient samples were collected in an exposure area to support the use of a 95% UCL as the EPC. Therefore, our evaluation is based on the maximum contaminant concentrations at each location. In examining the site data for areas most likely to represent a RME due to pesticides in surface soil, we selected data from two separate sampling locations. We felt that evaluating two distinct locations from opposite sides of the site might give a somewhat more representative picture of potential risk to hypothetical future residents from pesticide contamination in the surface soil. Sample SP-J is located in the southwest corner of the facility in an area which appears to receive runoff from the former production buildings and the South Pond. Sample SB-33 (aka OG-33) is located south of the production building. As in Table 1, we again compared the maximum concentrations at each location with the Region 6 screening levels for residential soil. Again, by comparing those screening levels with the pesticide concentrations at the DICO facility, one can quickly derive potential risk estimates for future residential use of the site. This comparison is shown in Table 2 below.

Table 2: Residential scenario, pesticides in surface soil, risk estimates

Location	Contaminant	Maximum concentration, µg/kg	Region 6 screening level, µg/kg	Cancer risk estimate
SP-J	Aldrin	820,000	29	3E-02
	Dieldrin	93,000	30	3E-03
			Total risk	3E-02
SB-33	Aldrin	300	29	1E-05
	Dieldrin	12,000	30	4E-04
	Chlordane	14,000	1600	9E-06
			Total risk	4E-04

As can be seen in Table 2, the potential risk to a resident living in either of the two locations evaluated is outside of EPA's target risk range.

Future Construction Worker Scenario

We selected boring DB-56 as the location for evaluation of the future construction worker scenario. As shown in Figure 3-2 of the 1992 RI report, this boring is located in the western portion of the property. Again, because of the widespread nature of the subsurface sampling locations, we could find no areas with sufficient sampling to allow the statistically valid calculation of a 95% UCL using ProUCL. Therefore, the maximum concentrations from boring DB-56 were used in the risk estimate calculation. This location was selected because, based on the data summary in Appendix 1 of the 1995 report, it appears most likely to present the reasonable maximum exposure to a future construction worker. Sample results evaluated here are from the 6 – 8 foot depth interval. When evaluating a construction worker scenario, we typically assume that a construction worker may be exposed to soil contaminants to a depth of 10 feet, roughly what one would expect to be the maximum depth of excavation for a building foundation or utility trench.

Because there are no screening levels which have been developed based on default exposure assumptions for construction workers, it was necessary for us to develop risk estimates. The default exposure assumptions we used are shown in Table 3.

Table 3: Default exposure assumptions for future construction worker scenario

Parameter	Value	Reference
Ingestion rate, IR	330 mg/d	EPA, 2002
Exposure frequency, EF	250 d/yr	EPA, 2002
Exposure duration, ED	1 yr	EPA, 2002
Body weight, BW	70 kg	EPA, 2002
Surface area, SA	3,300 cm^2	EPA, 2002
Events per day, EV	1	EPA, 2002
Averaging time, AT	25,550 days	EPA, 2002
Adherence factor, AF	0.3 mg/cm^2-event	EPA, 2002
Dermal absorption factor,	Contaminant specific	EPA, 2004a

ABSd		
Contaminant Concentration in soil, Cs	Contaminant specific	
Conversion Factor, CF	1E-09 kg/µg	
Cancer Slope Factor, oral, CSF_o	Contaminant specific	
Cancer Slope Factor, dermal, CSF_d	Contaminant specific	

The risk estimates were derived from the following equation, and are shown in Table 4, below.

$$\text{Cancer risk} = Cs \times EF \times ED \frac{[(CSF_o \times IR) + (CSF_d \times AF \times ABSd \times SA \times EV)] \times CF}{BW \times AT}$$

Table 4: Future construction worker scenario, risk estimates

Compound	Maximum concentration, µg/kg	CSF_o*, $(mg/kg\text{-}d)^{-1}$	CSF_d#, $(mg/kg\text{-}d)^{-1}$	Cancer risk estimate
Aldrin	5,500	17	17	6E-06
Chlordane	7,900	0.35	0.35	1E-07
Heptachlor	5,000	4.5	4.5	1E-06
Dieldrin	335	16	16	3E-07
			Total risk	7E-06

* all values taken from Integrated Risk Information System (IRIS)
# extrapolated from oral cancer slope factor

As shown in Table 4, the total risk to a future construction worker excavating in this particular location is estimated to be 7E-06, which is within EPA's target risk range. As a reminder, soil sampling efforts at the site do not appear to have been sufficiently detailed to identify any "hot spots" which might exist.

Future Youth Visitor Scenario

There are also no readily available health-based screening levels which have been developed based on default exposure assumptions for recreational use scenarios. Therefore, it was necessary for us to develop cancer risk estimates based on assumptions we believe would represent a reasonable maximum exposure for recreational use of the site. We assumed that the most likely reasonable maximum exposure would be to a youth hiking in the area surrounding the South Pond.

For this evaluation, we assumed an exposure area which would encompass the following surface soil sample locations: SB (OG)-6, SB (OG)-9, SB (OG)-10, SB (OG)-11, SB (OG)-12, SP-F, SP-G, SP-H, and SS-5. With one exception, only detected surface soil concentrations were used. Sample results for SB-6, SB-9, SB-10, SB-11, and SB-12 can be found in Appendix 7 of the *1992 RI* report. Sample results for *SP-F*, *SP-G*, and

SP-H can be found in Appendix 2 of the 1992 RI report. Sample results for SS-5 can be found in Appendix 1 of the 1992 RI report. Sample SS-5 is the one sample where non-detect (ND) concentrations were used in our evaluation. All of the detection limits reported for contaminants at this particular location are much higher than what one would expect. We suspect that this is the result of interference with laboratory analytical tools due to high concentrations of contaminants. Therefore, for those contaminants which are known to be present at the site, we elected to use ½ the detection limit as a proxy for the true contaminant concentration. This is consistent with EPA guidance (EPA, 1989) which recommends against the omission of non-detected results from the risk assessment without justification, and recommends instead the use of ½ the detection limit as a proxy concentration.

Our youth visitor scenario anticipated a youth visiting the South Pond area on average one time per week, from the age of 7 to the age of 16, over a period of 10 years. We also assumed that the youth visitor would walk randomly throughout the South Pond area, favoring no one location over another. Because as many as nine different sampling locations plausibly occur in the South Pond area, we calculated 95% UCLs for the contaminants in question. These UCLs were calculated using EPA's ProUCL statistical software program (EPA, 2007). In accordance with EPA guidance (EPA, 1989), in instances where UCLs were calculated, the lower of the UCL or maximum concentration for each contaminant was used as the exposure point concentration (EPC) in our risk estimates. For several of the contaminants, an insufficient number of samples were taken, or exhibited contamination, to allow the calculation of a statistically valid UCL. For those contaminants, the maximum concentration was used as the EPC. Exposure was assumed to occur by incidental ingestion of, and dermal contact with, contaminated surface soil. The main exposure assumptions we used are shown in Table 5, and the risk estimates we arrived at are shown in Table 6.

Table 5: Future youth visitor scenario, exposure assumptions

Parameter	Value	Reference
Concentration in soil, Cs	Contaminant specific	
Ingestion rate, IR	50 mg/d	BPJ
Skin surface area, SA	4,000 cm^2	EPA, 1997
Exposure frequency, EF	52 d/yr	BPJ
Exposure duration, ED	10 yr	BPJ
Body weight, BW	43 kg	EPA, 1997
Averaging time, AT	25,550 d	EPA, 1989
Event frequency, EV	1 event/d	BPJ
Dermal absorption fraction, ABSd	Contaminant specific	EPA, 2004a
Adherence factor, AF	0.2 mg/cm^2-event	EPA, 2004a

The equation used to evaluate this scenario is essentially the same as the one for the future construction worker scenario shown above: