December 30, 2014

Mr. Mostafa Mehran
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, Arkansas 72118

Re: Response to ADEQ Correspondence Dated November 24, 2014
Second Quarter 2014 Progress Report
Whirlpool Corporation
Fort Smith, Arkansas
EPA No. ARD042755389
AFIN No. 66-00048
CAO LIS 13-202

Dear Mr. Mehran:

ENVIRON International Corporation (ENVIRON), on behalf of Whirlpool Corporation, is submitting this response to comments in your November 24, 2014, comment letter on ENVIRON's response dated October 22, 2014, regarding the Second Quarter 2014 Progress Report.

GENERAL COMMENTS

<u>Plume Stability</u>

The Arkansas Department of Environmental Quality (ADEQ) asserted that the Second Quarter 2014 data indicates *"as average trichloroethene (TCE) concentration in the source area decreases, the concentration of TCE at the property boundary increase and contributes to the expansion of the TCE plume at the property boundary."* We disagree with this statement and wonder if the reference to expansion was intended to refer to the northern *plume* boundary, rather than the northern *property* boundary. .

The plume has not expanded at the north property boundary. The data at the north property boundary has remained consistent regardless of the concentration of TCE in in Area 1. In fact, as the remedial activities have been completed TCE concentrations in wells in the neck area have decreased as documented in the Third Quarter Progress Report submitted to ADEQ on November 14, 2014, and fourth quarterly groundwater monitoring data that will be submitted with the Fourth Quarter 2014 Progress Report due February 13, 2015, to ADEQ. The decrease in TCE concentrations measured during the fourth quarter in the vicinity of the neck area has resulted in the separation of the northern groundwater plume from the plume originating in Area 1 and migrating to the southeast.

80% of the monitoring wells tracking the effectiveness of the remediation efforts are reporting that TCE concentrations are stable or decreasing based upon statistical comparison of successive data sets versus comparison of two individual data sets. Groundwater monitoring of the TCE plume is now being completed by sampling 96 monitoring wells located on the

Whirlpool property and north of the site. Three of the 23 boundary monitoring wells exhibit concentrations above the RADD RALs including two wells near the northern boundary of the plume (i.e. MW-61 and MW-63), that have shown slight increases and historical fluctuations in TCE detection; therefore, a variation in the plume boundary. We appreciate ADEQ's concern about this variation, though we believe it is not unexpected at this stage of the remediation and monitoring process. We further understand ADEQ's use of the term plume stability requires all monitoring wells exhibit stable or decreasing concentrations, but this should not preclude continued description of groups of wells or a majority of the wells that exhibit stable or decreasing TCE concentrations.

TCE concentrations measured during the second quarter (groundwater monitoring performed between May 12 and 16, 2014) indicate source area monitoring wells exhibit stable to decreasing concentration trends and northern plume boundary wells exhibit stable concentrations excluding the two boundary wells identified above. The increases in TCE concentration at boundary well MW-61 [4.7 micrograms per liter (µg/L) to 6.6 µg/L from first quarter to second quarter 2014] resulted in the plume expanding at this specific location. When the second quarter plume area [464,210 square feet (ft^2)] is compared to the first quarter plume area (431,400 ft^2 [1]), the plume expanded approximately 32,800 ft^2. The isoconcentration contours are illustrative depictions used to provide guidance in visualizing the occurrence and concentration of constituents in groundwater between and beyond data points but do not imply certainty where data are extrapolated.

We continue to work diligently toward meeting the two year remediation goals agreed to in the remedial action decision document (RADD). With submitted test data comprising only three of the eight quarters covered by the current RADD, the overall results are very encouraging. As described in the Third Quarter report submitted on November 14, 2014, the data is now showing the positive impact of our remediation efforts. TCE concentrations in the targeted oxidant injection areas have decreased by as much as 80% in all but two areas. Natural attenuation of TCE is also occurring in both onsite and offsite groundwater. We anticipate further success from the second oxidant injection to be evident once our Fourth Quarter groundwater monitoring data is gathered, analyzed and validated.

<u>ADEQ Recommendation for Additional MIP Locations</u>

We agree that little or no electron capture device (ECD) impact was characterized at M-307 since the maximum response was 4.5 µV x 10^{-5} which is significantly below the ECD threshold for further investigation of 1 µV x 10^{-6} (see MIP Narrative issued on September 18, 2014). The

[1] A comparison of the areas of the plumes during each quarter of 2014 is presented in the Annual Report to be submitted on January 15, 2015. The area of the first quarter plume was adjusted slightly to 431,400 square feet from 426,000 square feet as described in the October 22, 2014 response to ADEQ comments on the Second Quarter Progress Report.

Property Boundary Investigation Report describes the investigation performed at DP-39 (east of M-307, near the west edge of Area 1) including collection of soil and groundwater samples analyzed by an offsite laboratory.

No further investigation was recommended west of DP-39 due to:

- Southeasterly groundwater flow direction at this area;
- Very low TCE concentrations in soil samples from Probe DP-39 [<0.002 milligrams per kilograms (mg/kg) up to 0.007 mg/kg];
- Very low TCE concentration in groundwater from Probe DP-39 (18.1 µg/L, cross-gradient and closer to Area 1);
- A very low ECD response characterized in M-307; and
- All sediment samples collected from the subject drainage feature near M-307 exhibited no TCE impact.

No further screening with MIPs is necessary for this area.

TABLE 4: EVALUATION OF VOLATILE ORGANIC COMPOUNDS IN SOIL VAPOR

The calculation of potential vapor intrusion risk estimates from groundwater is performed as discussed in Section 3.3.1 of the Human Health Risk Assessment that was included as Appendix A to the *Revised Risk Management Plan* (2013). Specifically, the indoor air concentration resulting from groundwater vapor intrusion into a building are estimates using the attenuation factor (α) described by Johnson and Ettinger (1991). The α is derived in Johnson and Ettinger's 1991 journal article and the total effective diffusion (D_{eff}^{T}) input is calculated using a soil-water profile in the Vadose Zone estimated using the van Genuchten soil-water retention equation with default water retention parameters appropriate for silty clay (USEPA 2004a).

The inputs to the risk calculations are included in the following tables (attached to this response letter):

- Toxicity values – Attachment C.1;
- Physical and Chemical Properties – Attachment C.2;
- Calculated Soil Moisture Profile for silty clay Vadose Zone soil for a depth to water of 12 feet – Attachment C.3;
- Building characteristics (e.g. size, air exchange rate) – bottom of Attachment C.4;
- Calculation of total effective diffusion and α – top of Attachment C.4 for each chemical evaluated; and
- Risk calculations for offsite groundwater – Attachment C.5 and Attachment C.6.

We are aware that the methodology described in the Human Health Risk Assessment and summarized above differs from USEPA's generic implementation of the Johnson and Ettinger Model (JEM). USEPA does not use a continuous soil moisture profile, but rather uses a step-function with a capillary fringe in the JEM. EPA's simplified implementation generally results in a drier Vadose Zone than is calculated using either the van Genuchten soil-water retention equation or HYDRUS. Using the site specific data in the JEM enhances the model. USEPA's generic spreadsheets will accept the D_{eff}^{T} from either the van Genuchten equation or HYDRUS by substituting the D_{eff}^{T} in USEPA's "INTERCALCS" sheet with the D_{eff}^{T} from either of these calculations.

If you have any questions or comments please contact me at your earliest convenience.

Sincerely,

ENVIRON International Corporation

Michael F. Ellis, PE
Principal

LIST OF ATTACHMENTS

Appendix C: Risk Calculations and Input Parameters

APPENDIX C
Risk Calculations and Input Parameters

Appendix C

Risk Calculations and Input Parameters

Contents:

Attachment C.1: Toxicity Values
Whirlpool, Fort Smith, Arkansas

Chem Group	Chemical	CASRN	Cancer Classification			ADAF			URF $(mg/m^3)^{-1}$			RfC (mg/m^3)			
			Group	Ref	Note	Y/N	f_{oral}	f_{inh}	Value	Ref	Notes	Value	UF	Ref	Notes
VOC	Acetone	67-64-1	ID	1		N						3.1E+01	100	129	111
VOC	Benzene	71-43-2	A	1		N			7.8E-03	1	60	3.0E-02	300	1	
VOC	Bromoform	75-25-2	B2	1		N			1.1E-03	1				126	90
VOC	Carbon Disulfide	75-15-0				N						7.0E-01	30	1	
VOC	Chlorobenzene	108-90-7	D	1		N						5.0E-02	1,000	126	
VOC	Chloroform	67-66-3	B2	1		N			2.3E-02	1		5.0E-02	100	117	
VOC	Dibromochloromethane	124-48-1	C	1		N								126	90
VOC	1,2-Dichloroethane	107-06-2	B2	1		N			2.6E-02	1		7.0E-03	3,000	126	
VOC	1,1-Dichloroethene	75-35-4	C	1		N						2.0E-01	30	1	
VOC	cis-1,2-Dichloroethene	156-59-2	ID	1		N								1	90
VOC	trans-1,2-Dichloroethene	156-60-5	ID	1		N								1	90
VOC	Methylene Chloride	75-09-2	LC	1		Y	1	1	1.0E-05	1	159	6.0E-01	30	1	
VOC	Tetrachloroethene	127-18-4	LC	1		N			2.6E-04	1		4.0E-02	1,000	1	
VOC	Toluene	108-88-3	ID	1		N						5.0E+00	10	1	
VOC	1,1,1-Trichloroethane	71-55-6	ID	1		N						5.0E+00	100	1	
VOC	Trichloroethene	79-01-6	HC	1		Y	0.202	0.244	4.1E-03	1	159	2.0E-03	100	1	
VOC	Vinyl Chloride	75-01-4	A	1		N			4.4E-03	1	79	1.0E-01	30	1	

References

Toxicity values were selected following the hierarchy of sources defined by USEPA (Human Health Toxicity Values in Superfund Risk Assessment, 2003), as discussed in Appendix A, Section 4 of the ADEQ-approved Revised Risk Management Plan, which was used as the basis for the ADEQ Remedial Action Decision. Values are current as of March 5, 2014.

1 USEPA. Integrated Risk Information System (IRIS). On-line database.

117 USEPA. NCEA. 2003. Risk Assessment Issue Paper for: Derivation of Provisional Subchronic and Chronic RfCs for Chloroform [CASRN 67-66-3]. January 23.

126 Provisional Peer Reviewed Toxicity Values for Superfund (PPRTV) Database.

129 ATSDR. 2013. Minimal Risk Levels. March.

Notes:

60 IRIS provides a range of 2.2E-6 to 7.8E-6 (ug/m3)-1 as the inhalation URF for Benzene.

79 For evaluating partial lifetime exposures that include early-life exposure, the unit risk factor is also used in risk calculations that do not prorate the early-life exposure, per USEPA's May 2000 Toxicological Review.

90 Inadequate data exist to derive a toxicity value, according to the indicated reference.

111 Value as published is an MRL in the indicated reference.

159 Because the chemical has a mutagenic mode of action according to USEPA, the SF and URF are adjusted by the following age-dependent adjustment factors (ADAFs) before use: 10 for ages 0 to 2; 3 for ages 2 to 16; and 1 for ages 16 and older (USEPA 2005).

Attachment C.2: Physical and Chemical Properties Whirlpool, Fort Smith, Arkansas											
Chem Group	**Chemical**	**CASRN**	**H** (unitless)			**D_{air}** (m^2/d)		**D_{water}** (m^2/d)		**HENRY Ref Temp (°C)**
			Value	**Adjusted**	**Ref**	**Value**	**Ref**	**Value**	**Ref**	**Value**
VOC	Acetone	67-64-1	1.6E-03	1.1E-03	44	1.1E+00	44	9.8E-05	44	2.5E+01
VOC	Benzene	71-43-2	2.3E-01	1.6E-01	44	7.6E-01	44	8.5E-05	44	2.5E+01
VOC	Bromoform	75-25-2	2.2E-02	1.3E-02	44	1.3E-01	44	8.9E-05	44	2.5E+01
VOC	Carbon Disulfide	75-15-0	1.2E+00	9.3E-01	44	9.0E-01	44	8.6E-05	44	2.5E+01
VOC	Chlorobenzene	108-90-7	1.5E-01	9.8E-02	44	6.3E-01	44	7.5E-05	44	2.5E+01
VOC	Chloroform	67-66-3	1.5E-01	1.1E-01	44	9.0E-01	44	8.6E-05	44	2.5E+01
VOC	Dibromochloromethane	124-48-1	3.2E-02	2.4E-02	44	1.7E-01	44	9.1E-05	44	2.5E+01
VOC	1,2-Dichloroethane	107-06-2	4.0E-02	2.7E-02	44	9.0E-01	44	8.6E-05	44	2.5E+01
VOC	1,1-Dichloroethene	75-35-4	1.1E+00	8.1E-01	44	7.8E-01	44	9.0E-05	44	2.5E+01
VOC	cis-1,2-Dichloroethene	156-59-2	1.7E-01	1.2E-01	44	6.4E-01	44	9.8E-05	44	2.5E+01
VOC	trans-1,2-Dichloroethene	156-60-5	3.9E-01	2.8E-01	44	6.1E-01	44	1.0E-04	44	2.5E+01
VOC	Methylene Chloride	75-09-2	9.0E-02	6.6E-02	44	8.7E-01	44	1.0E-04	44	2.5E+01
VOC	Tetrachloroethene	127-18-4	7.5E-01	4.9E-01	44	6.2E-01	44	7.1E-05	44	2.5E+01
VOC	Toluene	108-88-3	2.7E-01	1.8E-01	44	7.5E-01	44	7.4E-05	44	2.5E+01
VOC	1,1,1-Trichloroethane	71-55-6	7.1E-01	5.0E-01	44	6.7E-01	44	7.6E-05	44	2.5E+01
VOC	Trichloroethene	79-01-6	4.2E-01	2.9E-01	44	6.8E-01	44	7.9E-05	44	2.5E+01
VOC	Vinyl Chloride	75-01-4	1.1E+00	9.0E-01	44	9.2E-01	44	1.1E-04	71	2.5E+01

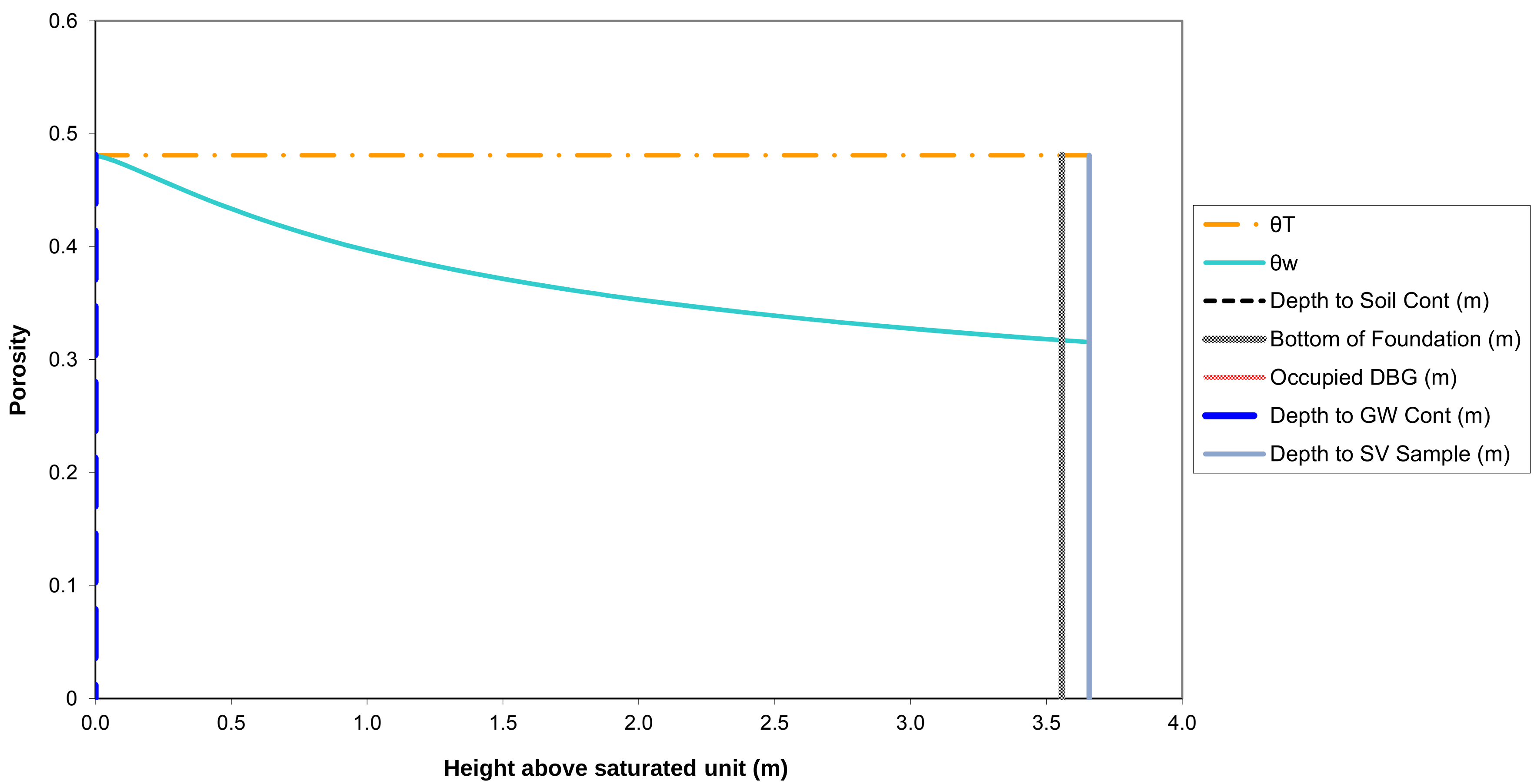
References:

Physical and chemical parameters were selected following the hierarchy of sources used by USEPA (Soil Screening Guidance: Technical Background Document, 1996), as discussed in Appendix A, Section 54 of the ADEQ-approved Revised Risk Management Plan, which was used as the basis for the ADEQ Remedial Action Decision.

44 USEPA. 1996. Soil Screening Guidance: Technical Background Document and User Guide. Office of Emergency and Remedial Response. EPA/540/R-95/128. May.

71 USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response. OSWER 9355.4-24. December.

Appendix C.3: Soil Moisture Profile for Residential Building (Slab on Grade)
Whirlpool, Fort Smith, Arkansas



Notes:
The soil-water profile in the vadose zone is estimated using the van Genuchten soil-water retention equation with default water retention parameters appropriate for silt clay, as discussed in Appendix A, Section 3.3.1 of the ADEQ-approved Revised Risk Management Plan, which was used as the basis for the ADEQ Remedial Action Decision.

Attachment C.4: Normalized Indoor Air Concentration in a Residential Building (Slab on Grade) due to Vapor Intrusion from Groundwater
Whirlpool, Fort Smith, Arkansas

Chem Group	Chemical	CASRN	D_{air} (m^2/day)	D_{water} (m^2/day)	H (unitless)	D_{crack} (m^2/day)	D_{eff}^T (m^2/day)	α_{soil}	α_{slab}	α_{∞}	C_{bldg} (L-water/m^3)
VOC	Acetone	67-64-1	1.07E+00	9.85E-05	1.14E-03	1.72E-01	1.87E-02	6.80E-02	2.73E-03	1.86E-04	2.12E-04
VOC	Benzene	71-43-2	7.60E-01	8.47E-05	1.59E-01	1.22E-01	8.15E-04	3.17E-03	2.73E-03	8.67E-06	1.38E-03
VOC	Bromoform	75-25-2	1.29E-01	8.90E-05	1.34E-02	2.07E-02	1.64E-03	6.37E-03	2.73E-03	1.74E-05	2.33E-04
VOC	Carbon Disulfide	75-15-0	8.99E-01	8.64E-05	9.26E-01	1.44E-01	2.93E-04	1.14E-03	2.73E-03	3.12E-06	2.89E-03
VOC	Chlorobenzene	108-90-7	6.31E-01	7.52E-05	9.77E-02	1.01E-01	9.32E-04	3.63E-03	2.73E-03	9.91E-06	9.68E-04
VOC	Chloroform	67-66-3	8.99E-01	8.64E-05	1.07E-01	1.44E-01	1.11E-03	4.32E-03	2.73E-03	1.18E-05	1.27E-03
VOC	Dibromochloromethane	124-48-1	1.69E-01	9.07E-05	2.38E-02	2.72E-02	1.27E-03	4.94E-03	2.73E-03	1.35E-05	3.21E-04
VOC	1,2-Dichloroethane	107-06-2	8.99E-01	8.55E-05	2.74E-02	1.44E-01	2.37E-03	9.19E-03	2.73E-03	2.51E-05	6.88E-04
VOC	1,1-Dichloroethene	75-35-4	7.78E-01	8.99E-05	8.10E-01	1.25E-01	3.12E-04	1.22E-03	2.73E-03	3.32E-06	2.69E-03
VOC	cis-1,2-Dichloroethene	156-59-2	6.36E-01	9.76E-05	1.19E-01	1.02E-01	9.72E-04	3.78E-03	2.73E-03	1.03E-05	1.22E-03
VOC	trans-1,2-Dichloroethene	156-60-5	6.11E-01	1.03E-04	2.81E-01	9.81E-02	5.96E-04	2.32E-03	2.73E-03	6.35E-06	1.79E-03
VOC	Methylene Chloride	75-09-2	8.73E-01	1.01E-04	6.60E-02	1.40E-01	1.58E-03	6.14E-03	2.73E-03	1.68E-05	1.11E-03
VOC	Tetrachloroethene	127-18-4	6.22E-01	7.08E-05	4.90E-01	9.99E-02	3.40E-04	1.33E-03	2.73E-03	3.63E-06	1.78E-03
VOC	Toluene	108-88-3	7.52E-01	7.43E-05	1.80E-01	1.21E-01	6.97E-04	2.71E-03	2.73E-03	7.41E-06	1.34E-03
VOC	1,1,1-Trichloroethane	71-55-6	6.74E-01	7.60E-05	4.97E-01	1.08E-01	3.64E-04	1.42E-03	2.73E-03	3.87E-06	1.92E-03
VOC	Trichloroethene	79-01-6	6.83E-01	7.86E-05	2.88E-01	1.10E-01	5.23E-04	2.04E-03	2.73E-03	5.57E-06	1.60E-03
VOC	Vinyl Chloride	75-01-4	9.16E-01	1.06E-04	9.00E-01	1.47E-01	3.44E-04	1.34E-03	2.73E-03	3.66E-06	3.30E-03

Notes:	Crack Soil and Building Characteristics			Crack Soil
	SCS Soil texture class			Sand
	Bulk density	kg/L	ρ_b	1.66
	Total porosity	L/L-soil	θ_T	0.375
	Water-filled porosity	L/L-soil	θ_w	0.054
	Air-filled porosity	L/L-soil	θ_a	0.321
	Residual saturation	L/L-soil	θ_r	0.053
	Hydraulic conductivity	cm/s	K	7.4E-03
	Dynamic viscosity of water	g/cm-s	μ_w	0.01307
	Density of water	g/cm^3	ρ_w	1.0
	Gravitational acceleration	cm/s^2	g	980.7
	Intrinsic permeability	cm^2	k	9.9E-08
	Relative saturation	unitless	S_e	0.004
	van Genuchten N	unitless	N	3.177
	van Genuchten M	unitless	M	0.685
	Relative air permeability	unitless	k_{rg}	0.998
	Permeability to vapor	cm^2	k_v	9.89E-08
	Distance from building foundation to source	m	L_{T-gw}	3.56
	Bldg foundation thickness	m	L_{crack}	0.1
	Bldg foundation length	m		10.00
	Bldg foundation width	m		10.00
	Bldg occupied height	m		2.44
	Bldg occupied volume	m^3		244.00
	Occupied depth below ground	m		0.0
	Bldg area for vapor intrusion	m^2	A_B	100.0
	Ratio of A_{crack} to A_B		η	4E-04
	Area of cracks	m^2	A_{crack}	4E-02
	Air exchange rate	$hour^{-1}$	ach	0.45
	Building ventilation rate	m^3/day	Q_{bldg}	2.64E+03
	Pressure difference between outdoors-indoors	kg/m-s^2	ΔP	1.0
	Viscosity of air	kg/m-s	μ_a	1.8E-05
	Crack length (bldg perimeter)	m	X_{crack}	40
	Crack depth below ground	m	Z_{crack}	0.10
	Crack radius	m	r_{crack}	1E-03
	Soil gas flow rate into bldg	m^3/day	Q_{soil}	7.20

Indoor air concentrations resulting from groundwater vapor intrusion into a building are estimated using the relationships described by Johnson and Ettinger (Heuristic model for predicting the intrusion rate of contaminant vapors into buildings, 1991), which USEPA recommends for screening level calculations, as discussed in Appendix A, Section 3.3.1 of the ADEQ-approved Revised Risk Management Plan, which was used as the basis for the ADEQ Remedial Action Decision.

The effective diffusion term DeffT is calculated based on a silty clay soil, as discussed in Appendix A, Section 3.3.1 of the ADEQ-approved Revised Risk Management Program.

Attachment C.5: Cancer Risk and Hazard Index Calculations for Vapor Intrusion into a Residential Building (Slab on Grade) from Groundwater in Off-Site Wells
Whirlpool, Fort Smith, Arkansas

							Cancer				Noncancer	
Chem Group	**Chemical**	**CASRN**	**Carc Class**	**ADAF**	C_{gw} (mg/L)	C_{air} (mg/m^3)	**URF** (m^3/mg)	f_{inh}	**Risk**		**RfC** (mg/m^3)	**HQ**
VOC	Acetone	67-64-1	ID	N	7.00E-03	1.48E-06					3.1E+01	4.6E-08
VOC	Benzene	71-43-2	A	N	1.20E-04	1.65E-07	7.8E-03		5.3E-10		3.0E-02	5.3E-06
VOC	Bromoform	75-25-2	B2	N	2.53E-02	5.88E-06	1.1E-03		2.7E-09			
VOC	Carbon Disulfide	75-15-0		N	2.60E-04	7.51E-07					7.0E-01	1.0E-06
VOC	Chlorobenzene	108-90-7	D	N	2.40E-04	2.32E-07					5.0E-02	4.5E-06
VOC	Chloroform	67-66-3	B2	N	2.60E-04	3.30E-07	2.3E-02		3.1E-09		5.0E-02	6.3E-06
VOC	Dibromochloromethane	124-48-1	C	N	9.30E-04	2.99E-07						
VOC	1,1-Dichloroethene	75-35-4	C	N	1.90E-03	5.11E-06					2.0E-01	2.5E-05
VOC	cis-1,2-Dichloroethene	156-59-2	ID	N	1.80E-02	2.20E-05						
VOC	trans-1,2-Dichloroethene	156-60-5	ID	N	8.70E-04	1.55E-06						
VOC	Methylene Chloride	75-09-2	LC	Y	2.90E-04	3.21E-07	1.0E-05	1	3.3E-12		6.0E-01	5.1E-07
VOC	Tetrachloroethene	127-18-4	LC	N	1.40E-04	2.49E-07	2.6E-04		2.7E-11		4.0E-02	6.0E-06
VOC	Toluene	108-88-3	ID	N	1.10E-03	1.47E-06					5.0E+00	2.8E-07
VOC	1,1,1-Trichloroethane	71-55-6	ID	N	3.10E-04	5.97E-07					5.0E+00	1.1E-07
VOC	Trichloroethene	79-01-6	HC	Y	5.18E-01	8.31E-04	4.1E-03	0.244	1.9E-06		2.0E-03	4.0E-01
VOC	Vinyl Chloride	75-01-4	A	N	7.60E-04	2.51E-06	4.4E-03		1.6E-08		1.0E-01	2.4E-05
							Cumulative Risk:		2E-06		**HI:**	4E-01

Note:

f_{inh} is the fraction of the inhalation toxicity value that USEPA identified as having a mutagenic mode of action.

Only VOCs detected in the 2nd Quarter 2014 off-site groundwater samples are shown.

Residential risks were calculated assuming residents could be exposed to soil vapor intrusion into indoor air for 24 hours per day and 350 days per year for 30 years.

Attachment C.6: Cancer Risk and Hazard Index Calculations for Vapor Intrusion into a Residential Building (Slab on Grade) from Groundwater at MW-71
Whirlpool, Fort Smith, Arkansas

							Cancer				Noncancer	
Chem Group	**Chemical**	**CASRN**	**Carc Class**	**ADAF**	**C_{gw}** (mg/L)	**C_{air}** (mg/m^3)	**URF** (m^3/mg)	**f_{inh}**	**Risk**		**RfC** (mg/m^3)	**HQ**
VOC	1,1-Dichloroethene	75-35-4	C	N	1.40E-03	3.77E-06					2.0E-01	1.8E-05
VOC	cis-1,2-Dichloroethene	156-59-2	ID	N	5.30E-03	6.49E-06						
VOC	Trichloroethene	79-01-6	HC	Y	1.64E-01	2.63E-04	4.1E-03	0.244	6.1E-07		2.0E-03	1.3E-01
VOC	Vinyl Chloride	75-01-4	A	N	3.30E-04	1.09E-06	4.4E-03		6.8E-09		1.0E-01	1.0E-05
							Cumulative Risk:		6E-07		**HI:**	1E-01

Note:

f_{inh} is the fraction of the inhalation toxicity value that USEPA identified as having a mutagenic mode of action.

Only VOCs detected in the 2nd Quarter 2014 groundwater sample at MW-71 are shown.

Residential risks were calculated assuming residents could be exposed to soil vapor intrusion into indoor air for 24 hours per day and 350 days per year for 30 years.

Attachment C.7: Cancer Risk and Hazard Index Calculations for Intrusion into a Residential Building (Slab on Grade) from Soil Vapor
Whirlpool, Fort Smith, Arkansas

							Cancer			Noncancer	
Chem Group	**Chemical**	**CASRN**	**Carc Class**	**ADAF**	**C_{sv}** (mg/m^3)	**C_{air}** (mg/m^3)	**URF** (m^3/mg)	**Risk**		**RfC** (mg/m^3)	**HQ**
VOC	1,2-Dichloroethane	107-06-2	B2	N	2.30E-04	6.90E-06	2.6E-02	7.4E-08		7.0E-03	9.5E-04
VOC	Tetrachloroethene	127-18-4	LC	N	4.20E-04	1.26E-05	2.6E-04	1.3E-09		4.0E-02	3.0E-04
						Cumulative Risk:		8E-08		**HI:**	1E-03

Note:

Only VOCs detected in the 2nd Quarter 2014 soil vapor sample at VP-1D are shown.

Residential risks were calculated assuming residents could be exposed to soil vapor intrusion into indoor air for 24 hours per day and 350 days per year for 30 years.

Indoor air concentrations due to intrusion of soil vapor were calculated using USEPA's 95th percentile subslab soil gas attenuaion factor of 0.03 (EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compouns and Residential Buildings, 2012), as discussed in Appendix A, Section 6.8.2 of the ADEQ-approved Revised Risk Management Plan, which was used as the basis for the ADEQ Remedial Action Decision.