Attachment B-16

(1/4 mile = 1320 feet)	* *using 100 md results in 0 value result	*max injection 39 at 6% porosity and 58 at 10% porosity (10% is conservative value; 6% is unlikely for any injection zone.)		using 20-year ZEI	Injectate viscosity at wellhead conditions	Maximum Specific Gravity	Maximum Injection Rate, gpm	Date of first Injection	Open Hole Diameter, ins.	Orig Avg Hor Perm, kh/net thickness, md**	Injection Interval Net Porosity*	Injection Interval Net Thickness, ft	Original Temperature at Midpoint, deg F	Compressibility of Formation, cu ft/cu ft/psi	Measured Viscosity of Reservoir Fluid	Specific Gravity	Compressibility of Liquid	Depth of Pressure Measurement, ft.	Pressure in Injection Zone or Interval, psi	Pressure in USDW, psi	Input Parameters
	Con	10% porosity r any injection zor	hig	835 feet	2.4	1.193	35		7.875	10	0.06	296	100	7.00E-09	1.325	1.2	0.00000317	2850	1282	97.9	· · · · ·
	Constant Values Variable Values	1e.)	highest values	827 feet	2.4	1.193	35		7.875	10	0.06	296	100	7.00E-08	0.65	1.2	0.00000317	2850	1282	97.9	Itera
				827 feet	2.4	1.193	35		7.875	10	0.06	296	100	7.00E-08	1.325	1.2	3.17E-06	2850	1282	97.9	Iterations
			Ιον	219 feet	2.4	1.193	35		7.875	10	0.06	296	100	4.30E-05	1.325	1.2	3.17E-06	2850	1282	97.9	
		•	lowest values	205 feet	2.4	1.193	35		7.875	10		296	100	7.00E-09	1.325	1.2	3.17E-06	2850	1282	97.9	
				186 feet	2.4	1.193	35		7.875	10		296	100	7.00E-09	1.325	1.2	3.17E-06	2850	1282	101.7	HARANA SANAYAN MANANA MANA

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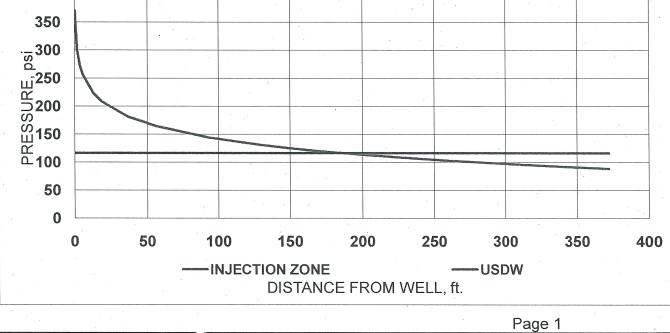
10/25/2012

	CALCULAT	TION OF INJECTION		REEFFECTS
Facility Name	,		West Bay Exploration C	company
Well Name			USEPA Permit Number	VVell Class
Country	West I	Bay #22	MI-075-2D-0009	Class II
County Jac	ckson	State Michigan	October 25, 2012	Analyst
			ational Information	
Reference Eleva	tion of Well, ft.	Injection Rate, gpm -35.0	Minimum Injectate Specific Gravity 1.193	Date of First Injection 10/25/2012
Radius of Well B	ore, ft.	Duration of Additional Inj., months		Current Cum. Injected Volume, gals
0.32	28125	240	2.4	
		nost Underground Sou	Irce of Drinking Water Int	formation
Name of Lowerm			si Specific Gravity of Water in USDW	
	Sandstone	97.9	1.00	
Depth to Base of			ft Pressure at Base of USDW, psi	
	226	226	112.60	<==Assumes psig
			one Information	peig
Formation at Lor	o of Injection Zone	Porosity of Effective Injection Zon		Pressure at 1 op of 12, psi
	a Dolomite	0.06	1.2	1184.3
Depth to Top of I		Permeability of Active IZ, md	Viscosity of Connate Fluid, cp	Measured Pressure in IZ, psi
	662	10	#REF!	1282
Effective Thickne		Compressibility of IZ, psi	Compress. of Connate Fluid, psi	Depth of Pressure Measurement, ft
	296	7.00E-09	3.170000E-06	2850
Z			and Cone of Endangerin	
1	87	slFeet to Potential Conduit 1,320	ZONE OF ENDANGERING INF	
Plume Radius, V	/olume X 3	Max Safe Injection Rate, gpm	Viscosity to use	Specific Gravity to use
1	627	39	0.70	1.19
450 400 			ASE OF USDWS	
법250 SS200 비150 네 100 50 0				500 2000
	0	500	1000 1	
	0			DW

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10/25/2012

CALCULAT	FION OF INJECTION I	INDUCED PRESSUF	<i>\E EFFECTS</i>
Facility Name		Operator	
	1	West Bay Exploration C	ompany
Well Name		West Bay Exploration C	Twell Class
West E	Bay #22	MI-075-2D-0009	Class II
County	State	Date	Analyst
Jackson	Michigan	October 25, 2012	
		ional Information	
Reference Elevation of Well, ft.	Injection Rate, gpm	Minimum Injectate Specific Gravity	Date of First Injection
	-35.0	1.193	10/25/2012
Radius of Well Bore, ft.	Duration of Additional Inj., months	Viscosity of Injectate, cp	Current Cum. Injected Volume, gals
0.328125	240	2.4	
Lowerm	nost Underground Sourc	ce of Drinking Water Inf	formation
Name of Lowermost USDW	Hydrostatic Pressure in USDW, psi		
Marshall Sandstone	101.7	1.00	
Depth to Base of USDWs, ft	Depth of Pressure Measurement, ft		
226	226	116.40	<==Assumes psig
		ne Information	
Formation at Top of Injection Zone			Pressure at 1 op of IZ, psi
Niagara Dolomite	1	1.2	1184.3
Depth to Top of Injection Zone, ft	Permeability of Active IZ, md	Viscosity of Connate Fluid, cp	Measured Pressure in IZ, psi
2662	10	#REF!	1282
Effective Thickness of IZ, ft	Compressibility of IZ, psi	Compress. of Connate Fluid, psi	Depth of Pressure Measurement, ft
296	7.00E-09	3.170000E-06	2850
Calculatio	on of Critical Pressure an	nd Cone of Endangerin	ig Influence
CRITICAL PRESSURE RISE, ps	si Feet to Potential Conduit	ZONE OF ENDANGERING INF	LUENCE RADIUS,ft.
190	1,320	186	
Plume Radius, Volume X 3	Max Safe Injection Rate, gpm	Viscosity to use	Specific Gravity to use
399	60	0.70	1.19
	DEL ATIONOLUE		▲
	RELATIONSHIP	OF PRESSURES)
	AT THE BAS	SE OF USDWS	
400			· · · · · · · · · · · · · · · · · · ·
350			· · ·



Pageth to Base of USDWs, ft Pressure in USDW, psi Depth of Pressure Measurement, ft. Source, range of value Value ow value high value Depth of Pressure Measurement, ft. 226 (using USDW base) 226 226 97.9 101.7 Depth of Pressure Measurement, ft. 226 (using USDW base) 226 226 97.9 101.7 Depth of Pressure Measurement, ft. 226 (using USDW base) 226 226 101.7 Depth of Pressure Measurement, ft. 226 (using USDW base) 226 226 1235 1282 Pressure in Injection Zone or Interval, psi Depth of Pressure Measurement, ft. 2862 + (370.2) 2850 1235 1282 Compressibility of Liquid temperature and pressure 0.0000031 2850 1.325 0.85 1.325 Original Temperature at Midpoint, deg F co. Co. 1.325 0.65 1.325				2.4	c_gravity_viscosity_liquids.html	Injectate viscosity at wellhead conditions
Intervent Source, range of value Value Iow value					http://www.csgnetwork.com/specifi	
neter Source, range of value Value Iow value					taken from	
neter Source, range of value Value Iow value				1.193	from permit	Maximum Specific Gravity
neter Source, range of value Value Iow value				35	from permit	Maximum Injection Rate, gpm
Ineter Source, range of value Value Iow value New value	•					Date of first Injection
Image Source, range of value Value Iow value Name				7.875	from permit	Open Hole Diameter, ins.
Intervent Source, range of value Value Jow value		100	10	10	10 md from literature survey (low)	Orig Avg Hor Perm, kh/net thickness, md
Interval Source, range of value Value low value low value high value /s, ft 226 (0.433 to 0.45) 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 101.7 101.7 n Zone, ft midpoint of formation depth (see 226 1235 1282 ne or Interval, psi below) x (0.433 to 0.45) 2662 1235 1282 surement, ft. 2662 + (370/2) 2850 1.325 1.325 surement, ft. 100 1.325 1.325 1.325 1.325		ç -	ο.o	U.U0	per SOP 6%"	Injection Interval Net Porosity
neter Source, range of value Value low value low value high value /s, ft permit 226 (0.433 to 0.45) 226 97.9 101.7 surement, ft 226 (using USDW base) 226 97.9 101.7 surement, ft 226 (using USDW base) 226 101.7 101.7 no or Interval, psi 226 (using USDW base) 101.7 101.7 101.7 numement, ft 226 (using USDW base) 226 11.3 101.7 numement, ft 1.0 (assume pure H2O) 1 11.2 11.2 11.2 11.2 11.2 11.2 12.3 1282		2)	0.00		Injection Interval Net Thickness, It
Ineter Source, range of value Value low value high value /s, ft permit 226 (0.4333 to 0.45) 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 101.7 101.7 surement, ft. 226 (using USDW base) 226 101.7 101.7 surement, ft. 226 (using USDW base) 226 1235 1235 n Zone, ft midpoint of formation depth (see 1 120 (assume pure H2O) 1 n Zone, ft midpoint of formation depth (see 1235 1282 1235 1282 ne or Interval, psi below) x (0.4333 to 0.45) 2860 1235 1282 surement, ft. 2662 + (3702) 2850 1282 1282 surement, ft. 2662 + (3702) 1.2 1.2 1.2				2	conservative value per Bill, based	
Ineter Source, range of value Value low value high value /s, ft permit 226 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 226 101.7 101.7 surement, ft. 226 (using USDW base) 226 101.7 101.7 101.7 surement, ft. 226 (using USDW base) 226 1235 1235 1235 no or Interval, psi below) x (0.4333 to 0.45) 2662 1235 1282 1235 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 1282 surement, ft. 2662 + (370/2) 2850 1285 1282 1282 surement, ft. 2662 + (370/2) 1.2 1.2 1.2 <td></td> <td>· .</td> <td></td> <td></td> <td>80% of thickness (common</td> <td></td>		· .			80% of thickness (common	
neter Source, range of value Value low value low value low value high value /s, ft permit 226 x (0.4333 to 0.45) 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 97.9 101.7 surement, ft. 226 (using USDW base) 226 101.7 norment, ft. 226 (using USDW base) 226 1 norment, ft. 1.0 (assume pure H2O) 1 1 ne or Interval, psi below) x (0.4333 to 0.45) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1282 1282 surement, ft. 2662 + (370/2) 2850 1282 1282 surement, ft. 2662 + (370/2) 2850 1282 1282 surement, ft. Baseline: 1.2 1.325 1.325 1.325 1.325 1.325 1.325				100	Co.	Original Temperature at Midpoint, deg F
neter Source, range of value Value low value low value high value /s, ft permit 226 x (0.433 to 0.45) 226 97.9 101.7 surement, ft 226 (using USDW base) 226 97.9 101.7 surement, ft 226 (using USDW base) 226 101.7 n Zone, ft midpoint of formation depth (see 262 1235 1235 ne or Interval, psi below) x (0.433 to 0.45) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1285 1282 surement, ft. 2662 + (370/2) 2850 1282 1282 surement, ft. 2662 + (370/2) 2850 1282 1282 surement, ft. 2662 + (370/2) 2850 1.25 1282 surement, ft. Baseline: 1.2 1.325 0.65 1.325 1.325 1.325					per discussion with West Bay Exp.	
neter Source, range of value Value low value high value /s, ft permit 226 x (0.4333 to 0.45) 226 226 surement, ft. 226 (using USDW base) 226 37.9 101.7 surement, ft. 226 (using USDW base) 226 37.9 101.7 nzmement, ft. 226 (using USDW base) 226 37.9 101.7 nzmement, ft. 226 (using USDW base) 226 326 326 nzmement, ft. midpoint of formation depth (see 1 1235 1285 ne or Interval, psi below) x (0.4333 to 0.45) 2850 1235 1282 surement, ft. 2662 + (370/2) 2850 1.25 1282 surement, ft. 2662 + (370/2) 1.325 1.325 1.325 surement, ft.		7.00E-09	7.00E-07		limestone.	Compressibility of Formation, cu ft/cu ft/psi
neter Source, range of value Value low value low value high value /s, ft 226 x (0.4333 to 0.45) 226 97.9					to 7e-9 ZEI SOP: 4.3E-5 for	
neter Source, range of value Value Iow value Iow value high value /s, ft permit 226 (0.4333 to 0.45) 226 97.9 97.9 97.9 97.9 97.9 10 surement, ft. 226 (using USDW base) 226 226 10 226 10					ft/psi; range for sound rock is 7e-6	
neter Source, range of value Value low value high value /s, ft permit 226 worde 226 97.9 10.0					FOT SOP:default is 7e-7 ft/cu	
neter Source, range of value Value Iow value high \ /s, ft permit 226 x (0.4333 to 0.45) 226 97.9 <t< td=""><td></td><td>1.325</td><td>0.65</td><td>1.325</td><td>(higher is more conservative)</td><td>Measured Viscosity of Reservoir Fluid</td></t<>		1.325	0.65	1.325	(higher is more conservative)	Measured Viscosity of Reservoir Fluid
neter Source, range of value Value Iow value Iow value high v /s, ft permit 226 x (0.4333 to 0.45) 226 226 97.9					per SOP Appendix A: .65 - 1.325	
neter Source, range of value Value low value high v /s, ft permit 226 (0.4333 to 0.45) 226 97.9 1235<			a de la constante de la consta	1.2	Baseline: 1.2	Specific Gravity
neter Source, range of value Value Iow value high v /s, ft permit 226 (using USDW base) 226 97.9 <td< td=""><td></td><td>•</td><td></td><td>0.00000317</td><td>temperature and pressure</td><td>Compressibility of Liquid</td></td<>		•		0.00000317	temperature and pressure	Compressibility of Liquid
neter Source, range of value Value Iow value high v /s, ft permit 226 (wing USDW base) 226 97.9					psi/cubic ft ; varies with	
neter Source, range of value Value Iow value high v /s, ft permit 226 226 226 226 97.9 <			· · ·		from SOP default is 3.17e-6	
neter Source, range of value Value Iow value high v /s, ft permit 226 226 226 226 97.9 <		* * . •		2850	2662 + (370/2)	Depth of Pressure Measurement, ft.
neter Source, range of value Value Iow value high v /s, ft permit 226 226 226 226 97.9 <		1282	1235		below) x (0.4333 to 0.45)	Pressure in Injection Zone or Interval, psi
neter Source, range of value Value Iow value Iow value high value /s, ft permit 226 226 97.9 <td></td> <td>•</td> <td></td> <td></td> <td>midpoint of formation depth (see</td> <td></td>		•			midpoint of formation depth (see	
neter Source, range of value Value Iow value high value /s, ft permit 226 226 97.9				2662		n Zone,
Parameter Source, range of value Value low value high value USDWs, ft permit 226 226 97.9 3 V, psi 226 x (0.4333 to 0.45) 226 97.9 3 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>Specific Gravity, USDW</td>						Specific Gravity, USDW
ParameterSource, range of valueValuelow valuehigh valueUSDWs, ftpermit226V, psi226 x (0.4333 to 0.45)97.9Parameter226 (using USDW base)226				226		Depth of Pressure Measurement, ft.
ParameterSource, range of valueValuelow valuehigh valueUSDWs, ftpermit226V, psi226 x (0.4333 to 0.45)97.9				226	226 (using USDW base)	Depth of Pressure Measurement, ft.
Parameter Source, range of value Value low value high value USDWs, ft permit 226		101.7	97.9		226 x (0.4333 to 0.45)	Pressure in USDW, psi
Source, range of value Value low value				226	permit	USDWs,
		igh value			Source, range of value	Parameter

Values used

*6% is unlikely for any injection zone;10% is conservative value.