APPENDIX C

LIST OF CHEMICALS, MATERIALS, AND OTHER SUBSTANCES USED IN DRILLING, CEMENTING, AND COMPLETION ACTIVITIES

Table C-1
List of Chemicals Used in Drilling Operations

Product Trade Name	Chemical	Composition*	Initial Hazard	Amount on Location	Units	Initial Concentration	Units	Amount Left in Wellbore	Units	Residual Concentration	Residual Hazard	Remarks on Residual Materials
Aquagel	Bentonite (mineral)	44%	Irritant	8,000	lbs.	10 lbs/BBL	by weight	None	lbs.	0.00%	None	Sodium montmorillonite - clay
Baracat	Cationic polymer	4.40%	Irritant	36	gals.	1 lbs/BBL	by volume	None	gals.	0.00%	None	Shale inhibitor
Baroid	Barite (mineral)	up to 48%	Irritant	24,000	lbs.	As needed	by weight	None	lbs.	0.00%	None	Barium sulphate - weight material - as needed for well control
Baro-Lift	Monofilament polymer	2.19%	Irritant	75	lbs.	0.5 lbs/BBL	by weight	None	lbs.	0.00%	None	Rope material - sweeps drill cuttings
BaroSeal	Inert material	up to 10%	Irritant	3,200	lbs.	As needed	by weight	None	lbs.	0.00%	None	Inert materials - for lost circulation, granules, wood, paper, minerals
Baro-Trol Plus	Hydrocarbon powder	up to 25%	Irritant	2,000	lbs.	As needed	by weight	None	lbs.	0.00%	None	Lignite - stabilizes shales
Bicarbonate of Soda	$NaHCO_3$	1.10%	Irritant	500	lbs.	<0.25 lbs/BBL	by weight	None	lbs.	0.00%	None	Baking soda - calcium treatment
DAP	Diammonium phosphate	35.10%	Irritant	4,800	lbs.	8 lbs/BBL	by weight	None	lbs.	0.00%	None	No hazardous polymerization would occur
EZ-Mud	Polyacrylamide/polyacrylate	8.77%	Irritant	180	gals.	2 lbs/BBL	by volume	None	gals.	0.00%	None	Shale inhibitor
HC-2 (Foamer)	Inner salt of alkyl amines	As needed	Irritant	440	gals.	As needed	by volume	None	gals.	0.00%	None	Hole cleaning while air drilling - allows air drilling in wet holes - biodegradable
Lime	Calcium hydroxide	As needed	Irritant	500	lbs.	As needed	by weight	None	lbs.	0.00%	None	pH control - no hazardous decomposition products
PlugIt	Cedar fiber	As needed	Irritant	3,200	lbs.	As needed	by weight	None	lbs.	0.00%	None	Inert - lost circulation material, wood fibers
PolyAc	Sodium polyacrylate	4.40%	Irritant	4,000	lbs.	1 lbs/BBL	by weight	None	lbs.	0.00%	None	Control fluid loss
Sawdust	Wood by-product	As needed	Irritant	4,000	lbs.	As needed	by weight	None	lbs.	0.00%	None	Inert - lost circulation material, wood fibers
Soda Ash	Sodium carbonate	As needed	Irritant	200	lbs.	As needed	by weight	None	lbs.	0.00%	None	Calcium treatment
X-Tend II	Polyacrylamide/polyacrylate	0.22%	Irritant	24	lbs.	0.05 lbs/BBL	by weight	None	lbs.	0.00%	None	Bentonite extender - aids in water reclamation

* Assumes a 600 BBL mud system.

Source: GEC 2003.

Table C-2
List of Chemicals Used in Cementing Operations

Product Trade Name	Chemical	Composition*	Initial Hazard	Amount on Location	Units	Initial Concentration	Units	Amount Left in Wellbore	Units	Residual Concentration	Residual Hazard	Remarks on Residual Materials
Cement	Portland type III - $CaCO_3$ gypsum and silica	65% to 98%	Irritant	378,530	lbs.	2047lbs/BBL	by weight	100%	lbs.	0.00%	None	Used to isolate formations from each other and support steel casing
Pozmix	Silica and aluminum oxides	35%	Irritant	7,651	lbs.	210 lbs/BBL	by weight	100%	lbs.	0.00%	None	When cement hardens the chemicals become inert
Calcium Chloride	$CaCl_2$ - inorganic salt	1%	Irritant	320	lbs.	1.00%	by weight	100%	lbs.	0.00%	None	Decreases thickening time, no hazardous decomposition products
Diacel LWL	Polysaccharide	0.10%	Irritant	12	lbs.	0.10%	by weight	100%	lbs.	0.00%	None	Fluid loss additive
Flocele	Polysaccharide	0.29%	None	48	lbs.	0.25lbs/sk	by weight	100%	lbs.	0.00%	None	Cellophane flakes
FWCA	Polysaccharide	0.20%	Irritant	40	lbs.	0.65%	by weight	100%	lbs.	0.00%	None	Free water control additive
Gel	Bentonite	8% to 10%	Irritant	3,300	lbs.	8.00%	by weight	100%	lbs.	0.00%	None	Sodium montmorillonite - clay
Pheno Seal	Cellulose paper and resin	4%	Irritant	452	lbs.	4.00%	by weight	100%	lbs.	0.00%	None	Fluid loss additive
Salt	NaCl	3% to 8%	Irritant	1,205	lbs.	8.00%	by weight	100%	lbs.	0.00%	None	No hazardous decomposition chemicals

*Assumes a 600 BBL mud system.

Source: GEC 2003.

Table C-3
List of Chemicals Used in Completion Operations

Product Trade Name	Chemical	Composition*	Initial Hazard	Amount on Location	Units	Initial Concentration	Units	Amount Left in Wellbore	Units	Residual Concentration	Residual Hazard	Remarks on Residual Materials
Water	H_2O	30%		16,600	gal.	30%	by volume	5,810	gal.	10.50%	None	Approximately 65% recovery of frac fluid
Sand	SiO_2			100,000	lbs.	2.30%	lbs/gallon	100,000	lbs.	N/A	None	There would be a small amount of sand produced during flowback
Nitrogen	Liquid N_2	70%	Asphyxiant	322,000	gal.	70%	by volume	0	gal.	0.00%	None	100% of the Nitrogen would be flowed back - inert
Acid: HAI-85M	15% HCl	15%	Corrosive, flammable, causes burns, toxic by inhalation	500	gal.	15.00%	by volume	0	gal.	0.00%	None	Acid neutralizes to water and CO_2
				0.500	gal.	0.100%	by volume	0.175	gal.			Acid inhibitor - bonds to formation leaving behind chloride
	Quaternary ammonium salts	30%		0.150	gal.	0.030%	by volume	0.053	gal.	0.000307%	None	Ion
	Diethylene glycol	30%		0.150	gal.	0.030%	by volume	0.053	gal.	0.000307%	None	Minimal residual amount
	Propargyl alcohol	10%		0.050	gal.	0.030%	by volume	0.018	gal.	0.000102%	None	Minimal residual amount
	Aromatic naptha	10%		0.050	gal.	0.010%	by volume	0.018	gal.	0.000102%	None	Minimal residual amount
	Ethyl octynol	5%		0.025	gal.	0.005%	by volume	0.009	gal.	0.000051%	None	Minimal residual amount
	Nonylphenol	5%		0.025	gal.	0.005%	by volume	0.009	gal.	0.000051%	None	Minimal residual amount
AQF-2			Flammable	38	gal.	0.22%	by volume	13.3	gal.			Minimal residual amount
	Diethylene glycol	10%		3.80	gal.	0.02%	by volume	1.33	gal.	0.0078%	None	Minimal residual amount
	Ethylene glycol monobutyl ether	30%		11.40	gal.	0.07%	by volume	3.99	gal.	0.0233%	None	Minimal residual amount
GBW-3	Carbohydrate		Mild respiratory irritant	25	lbs.	0.02%	by weight	8.75	lbs.	0.0061%	None	Biodegrades
WG-35	Guar gum		Mild respiratory irritant	300	lbs.	0.21%	by weight	105	lbs.	0.0737%	None	Thermal and enzyme degradation - residual biodegrades
BE-6	2-Bromo-2nitro-1,3-propanedol		Irritant	3	lbs.	0.0021%	by weight	1.05	lbs.	0.0007%	None	Minimal residual amount
Potassium Chloride	KCl		Mild respiratory irritant	2,850	lbs.	2.00%	by weight	997.5	lbs.	0.70%	None	Minimal residual amount

* Assumes a 600 BBL mud system.
N/A = Not applicable.
Source: GEC 2003.

Table C-4
List of Chemicals in Fuel Use

Trade Name	Chemical	Initial Hazard	Amount on Location	Units	Initial Concentration	Units	Amount Left in Wellbore	Units	Residual Concentration	Residual Hazard	Remarks on Residual Materials
Fuel	Diesel	Combustible	3,500 gals	lbs.	0.00%	by volume	N/A	lbs.	0.00%	None	CO_2, water, and small amount of NO_x, CO, and SO_2 - combustion by-product released into atmosphere - no injection into well
Fuel	Gasoline	Combustible	100 gals	lbs.	0.00%	by volume	N/A	lbs.	0.00%	None	CO_2, water, and small amount of NO_x, CO, and SO_2 - combustion by-product released into atmosphere - no injection into well

N/A = Not applicable

Source: GEC 2003.