

# Post Job Report

## Hydraulic Fracture Stimulation

<b>Job Description:</b>	Fracture Stimulation (Treated water)
<b>Prepared By:</b>	Robin Kim
<b>Client:</b>	Arrow Energy
<b>Location:</b>	Moranbah, QLD
<b>Tenure:</b>	PL191
<b>Well No.:</b>	M219FR Zone 2
<b>Geological Seam:</b>	PL1&2 + GR
<b>Geological Interval:</b>	MCM – Moranbah Coal Measures
<b>Treatment Started Date:</b>	7 <sup>th</sup> June 2011
<b>Treatment Finished Date:</b>	7 <sup>th</sup> June 2011
<b>Initial Date on-site for this well:</b>	6 <sup>th</sup> June 2011
<b>Final Date on-site for this well:</b>	8 <sup>th</sup> June 2011
<b>Performed by:</b>	Baker Hughes – Well Services (Australia) Pty Ltd. 108 Poole Street, Welshpool Western Australia 6106



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## 1. SUMMARY

On the 7<sup>th</sup> June 2011, Moranbah Gas Project well M219FR Zone 2 (PL1&2 + GR) was fracture stimulated. The first pumping treatment was a Step down test to determine near wellbore friction.

The main treatment was pumped with small step down test followed straight with a pad.

During the pad stage the pressure declined by around 425 psi with few pressure spikes during the prop stages. After three separate prop step stages during the sweep total of 10 perf balls were dropped.

First set of 5 perf balls were dropped in 10 secs interval after around 61 bbls being pumped. No pressure increase was observed until 3<sup>rd</sup> ball hit the formation resulted in around 40 psi increase with no further increase in pressure.

Second set of 5 perf balls were dropped in 10 secs interval after further 80 bbls were pumped. Again no pressure increase was observed until the 3<sup>rd</sup> ball hit the formation resulting in around 23 psi increase with no further increase in pressure.

Total of 219 bbls were pumped during the perf ball stage before prop stage was resumed. The prop step stages were pumped with sweeps in between achieving max conc of 1.5 ppg.

The sand count on Data Acquisition system was off by 5.1% (reading more) compared to physical volume loaded for the job. All proppant loaded was pumped with flush to perf.

The treatment fluid was treated CSG water (as per Table 1) and proppant used was 20/40 sand.

As required by the Arrow PEN100015907. Hydraulic Fracturing Chemical Risk Assessment water monitoring is required throughout the course of the work.

Samples of the injection water and return water were collected and analyzed for pH, TDS, major cations and anions, metals, THMs, BTEX compounds, naphthalene, phenanthrene and TPH fractions at the following frequencies:

- 20% and 80% of the Injected water volume recovery.
- 20%, 80% and 150% of the Returned water volume recovery.

No treatment sample was taken during this job. During the Zone 1 (GM) Treatment a 20% injection volume sample (based on design) was taken at 1,485 bbls and based on the total well injection volume (based on actual) this was equivalent to 16.23 %.

Zone 1 Injection Volume = 4,466.3 bbls  
 Zone 2 Injection Volume = 1,814.9 bbls  
 Zone 3 Injection Volume = 1,117.9 bbls  
 Zone 4 Injection Volume = 1,752.1 bbls  
 Total Injection Volume = 9,151.2 bbls

**Table 1. Fluid Composition/Usage**

Additives	Designed	Actual Pumped	Total Used	Units
Acetic Acid	105.31	140.06	151.42	L
Sodium Hypochlorite	105.31	109.78	117.35	L

Note: Actual usage is the physical volume pumped down into a well. Total used include volume for priming chemical pumps and flushing the lines. Post fracture product composition uses Actual.

## 2. WELL DETAILS

**Table 2. Reservoir Details**

Parameter	Value	Unit	Source
Formation Name	PL1&2 + GR		Provided
Reservoir Fluid	Water		Provided
Reservoir Temperature	~ 55.5	°C	Estimated (@ 703 m)
Reservoir Viscosity (water)	~ 0.503	cp	Estimated
Reservoir Pressure	~ 822	psi	Estimated
In-situ Permeability	-	md	Estimated
Surface Static Pressure (Pre-frac)	833	psi	Observed
Net Pay	3.2	m	Provided

**Table 3. Perforation Intervals Planned**

M219FR												
PERFORATION INTERVALS												
<b>Note:</b> Depths are in metres GL. Rig = QD Rig 10 GL = 306.72 m TD = 698 mGL											Draft Date: 28/11/10	
Frac No.	Interval (mGL)			Gun (m)			Gun (ft)			Charges (3 spf)		
	Seam	Top	Bottom	Length	Size	Type	Length	Shots	Type	Phasing	Grams	
2	PL1&2	519.80	521.20						Charges (6 spf)			
	PL1&2 Perfs	520.11	520.92	0.81	2 3/4"	HSC	2.67	16	SDP-2750-311NT4	120	15	
	GR Perfs	502.11	503.33	1.22	2 3/4"	HSC	4.00	24	SDP-2750-311NT4	120	15	
	Select Fire			I.D.								
	Proposed Baffle 2	476.00	476.00		3.250 in				MP of Perforations		512 mGL	
	Actual Baffle 2	476.00	476.00		Top-Cc				Pressure at MPP		727 psi	

**Table 4. Perforation Intervals Actual**

FORMATION	PERFORATED COAL SEAMS		GUN:		CHARGES:			
	Date	(m KB)	SIZE	TYPE	SPF	TYPE	WT(g)	#perf
PL1&2 + GR	7/06/2011	520.11 - 520.92	2 3/4	HSC	6.000	SDP-2750-311NT4	15.0	42

Table 5. Completion Details Planned

PRODUCTION CASING - POST CBL & PERFORATING DIAGRAM																																																																																				
		Well: <b>M219FR</b>		DATE: <b>26/11/2010</b>																																																																																
		(Frac Well - MCM Targets)		AMG Coordinates - East: 811821		Datum: AGD 84 XXX		GL (m ASL): 310.00 m		KB elevation: 3.65 m																																																																										
AMG Coordinates - North: 7579290																																																																																				
ITEM No	DESCRIPTION	LTH (m)	DTH RL (m)	MIN I.D. (mm)	MAX O.D. (mm)																																																																															
1	5-1/2" x 15.5ppf K55 Casing (ID 4.950", Burst Pressure 4810psi) (28 Joints) = 431.07m	431.1	490.88																																																																																	
2	5-1/2" x 15.5ppf K55 Marker Joint = 2.94m	2.9	493.80																																																																																	
3	5-1/2" x 15.5ppf K55 Marker Joint = 2.93m	2.9	496.83																																																																																	
4	Frac Collar (Type 248 LTC) - 3.825" Seat & 3.875" Ball (Top-Co) = .32m	0.3	498.84																																																																																	
5	5-1/2" x 15.5ppf K55 Casing (ID 4.950", Burst Pressure 4810psi) (3 Joints) = 35.32m	35.3	472.78																																																																																	
6	5-1/2" x 15.5ppf K55 Marker Joint = 2.92m	2.9	475.88																																																																																	
7	Frac Collar (Series 380 LTC) - 3.250" Seat & 3.500" Ball (CTE - Red) = .32m	0.3	476.00																																																																																	
8	5-1/2" x 15.5ppf K55 Casing (ID 4.950", Burst Pressure 4810psi) (3 Joints) = 23.39m	23.3	499.99																																																																																	
9	5-1/2" x 15.5ppf K55 Marker Joint = 2.94m	2.9	502.87																																																																																	
10	5-1/2" x 15.5ppf K55 Casing (ID 4.950", Burst Pressure 4810psi) (2 Joints) = 35.84m	35.8	538.71																																																																																	
11	Frac Collar (Type 248 LTC) - 2.375" Seat & 3.250" Ball (Top-Co) = .32m	0.3	539.03																																																																																	
12	5-1/2" x 15.5ppf K55 Casing (ID 4.950", Burst Pressure 4810psi) (5 Joints) = 59.85m	59.7	598.88																																																																																	
13	5-1/2" x 15.5ppf K55 Marker Joint = 2.94m	2.9	601.82																																																																																	
14	5-1/2" x 15.5ppf K55 Casing (ID 4.950", Burst Pressure 4810psi) (8 Joints) = 98.10m	98.1	697.72																																																																																	
15	5-1/2" LTC Float Shoe (Type 228 c/w Receiver plate) = .45m	0.5	698.17																																																																																	
16	5-1/2" (Type 211-2) 1st Stage Flexible Cement Plug c/w Type 217 Nose	0.0	698.17																																																																																	
0		0.0	698.17																																																																																	
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Notes: Detail not shown includes 24 x 5-1/2" Casing centralizers		TOTAL	698.17																																																																																	
BRIEF HISTORY ON WELL																																																																																				
<b>Drilling</b> + Overall drilling time was 198.75 hr's + Start date 18/09/10 + Finish date 24/09/10																																																																																				
<b>Cementing</b> Plug bumped at 1000psi, held 1800psi for 5 min, 15bbls cement returned to surface and 0.25bbls bleed back once pressure released.																																																																																				
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<b>CBL/Perforating</b> Vause performed the CBL on the 28/10/2010 using the crane truck. Based on the CBL results it was decided to perforate the lower zone. Used two tandem 3m guns.																																																																																				
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GM	28/10/2010	579.82 - 584.87	2 1/8	HSC	3	RTG-2128-301GH	8.4	58																																																																												
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NOT TO SCALE																																																																																				
WELLSITE SUPERVISOR:																																																																																				
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TUBING INSTALLATION / LAST WORKOVER DATE: :																																																																																				
DRILLING: YES																																																																																				
DRAFTED BY: : D Kubenk																																																																																				
DATE: : 9/06/2010																																																																																				
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### 3. DIAGNOSTIC TECHNIQUES

Analysis of fracture treatment pressure data can provide insight into hydraulic fracture dimensions and can quantify proppant placement problems. The most common diagnostic technique used during hydraulic fracturing activities is Fracture Pressure Analysis.

Real-time Fracture Pressure Analysis allows stimulation practices to be optimized and measures taken in real-time to minimize potential proppant placement problems.

The most popular Fracture Pressure Analysis technique was presented by Nolte and Smith. It involves plotting the log of net treating pressure vs. log of pumping time. Net pressure is the difference between bottom-hole fluid pressure in the fracture and total fracture closure stress.

Several regimes of fracture growth can be determined using the Net Pressure Plot (see Figure 1).

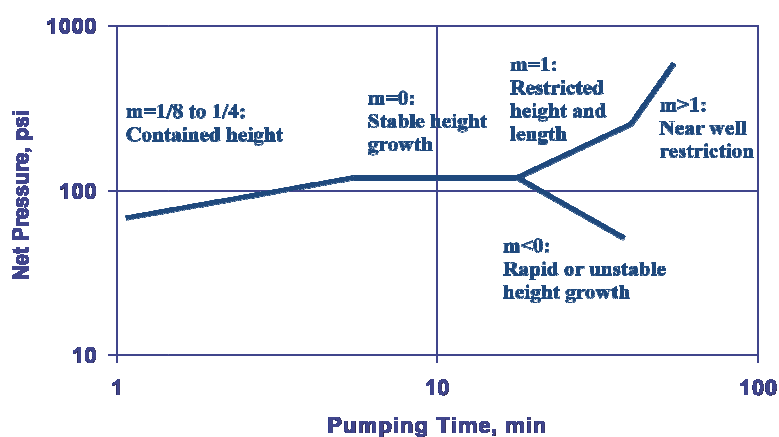


Figure 1 - Net Pressure Plot

The optimum treating pressure response is indicated by a positive slope of 1/2 to 1/4 indicating lateral fracture growth with restricted height.

A zero slope indicates stable height growth with continued propagation of length.

Negative slopes indicate unstable height growth while steep positive slopes indicate tip screen-outs or restricted extension.

Generally, a higher slope indicates a restriction nearer the wellbore.

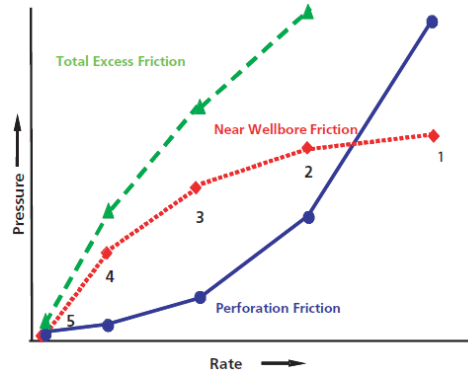
The interpretation of the fracture pressure response shown by the plot is dependent on the assumptions of the particular model from which it was derived. It also requires knowledge of variations in bottom-hole fracture pressure during the job. This technique is used by many service companies to interpret fracture behavior during pumping.

It should be noted that the curves are non-unique and can be affected by other factors such as:-

- Perforation and near well bore erosion;
- Perforation and near wellbore bridging/packing;
- Changes in leak off due to fissures; and
- Perm changes, etc and due to changes in the fluids (primarily friction with water Fracs, but it can be density or viscosity changes).

Prior to the Main Fracturing treatment a step down test is performed and analyzed to calculate perforation ( $P_{perf}$ ) and near wellbore Pressure (friction) losses (NWBPL). Since the step down analysis is performed using surface treating pressure, the pipe friction needs to be entered for analysis credibility. This analysis is used to determine near wellbore pressure loss effects (i.e., problems with anomaly high pressures which may cause a near wellbore screen-out) and if there are potential issues with the entry of sand through the perforations.

This analysis is performed after fracture propagation has been established. Then during the step down the rate is decreased in a stair-step fashion for a short period of time while the pressure stabilizes. As the injection rate decreases, the pressure will also decrease as a result of perforation and near wellbore pressure losses. The relationship between the decreasing rate and pressure results in a determination of near wellbore pressure losses.

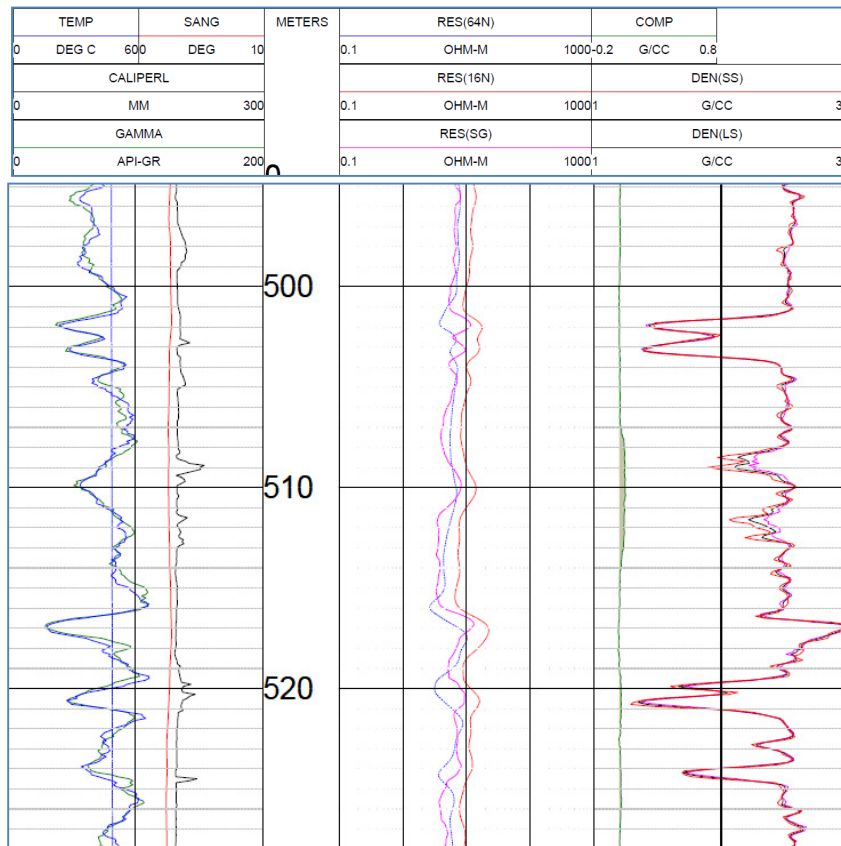


### 4. GEOLOGICAL OVERVIEW

Hydraulic Fracturing was carried out on 5 intervals in this well, whose details and depth are highlighted in yellow below.

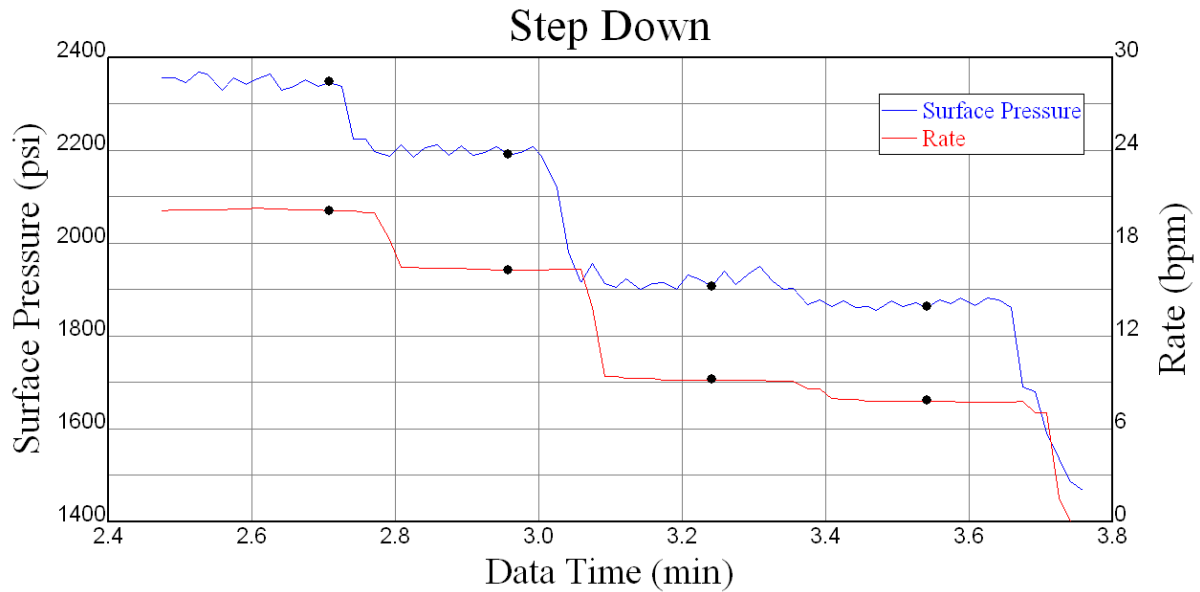
This report only covers the Fracture Stimulation treatment of Zone 2 – PL1&2 + GR seam

SUMMARY OF STRATIGRAPHY						
Seam / Formation	MD From (m)	MD To (m)	TVD. From (m)	TVD To (m)	Thickness (m)	Comments
Alluvium	0	14			14	
BOW	64	64			0	
FCCM 4b	120.10	130.00			9.9	
FCCM 4a	146.40	154.60			8.2	
FCCM 3	183.80	192.00			8.2	
FCCM 2	215.70	223.70			8	
CO	268.00	268.40			0.4	
FCCM 1	271.20	285.30			14.1	
FHF	331.30	355.60			24.3	
FHF	365.00	383.00			18	
QA1&QA21	420.60	424.70			4.1	
QA22-Seam	446.20	448.00			1.8	Qa22 now split from the "QA"
QB-Seam	462.80	464.80			2	
CO	480.00	481.70			1.7	"Z" split from GR to QB
GR	501.80	503.60			1.8	
PL1&2	519.80	521.20			1.4	
CO	524.00	524.70			0.7	probably a GP0 equivalent
GM	578.50	585.20			6.7	
CO	601.30	601.70			0.4	
GML	621.40	624.20			2.8	
CO	626.10	626.70			0.6	
CO	632.50	632.80			0.3	
CO	645.80	647.10			1.3	
CO	658.20	659.50			1.3	
CO	670.70	671.90			1.2	
GL	694.40	697.90			3.5	

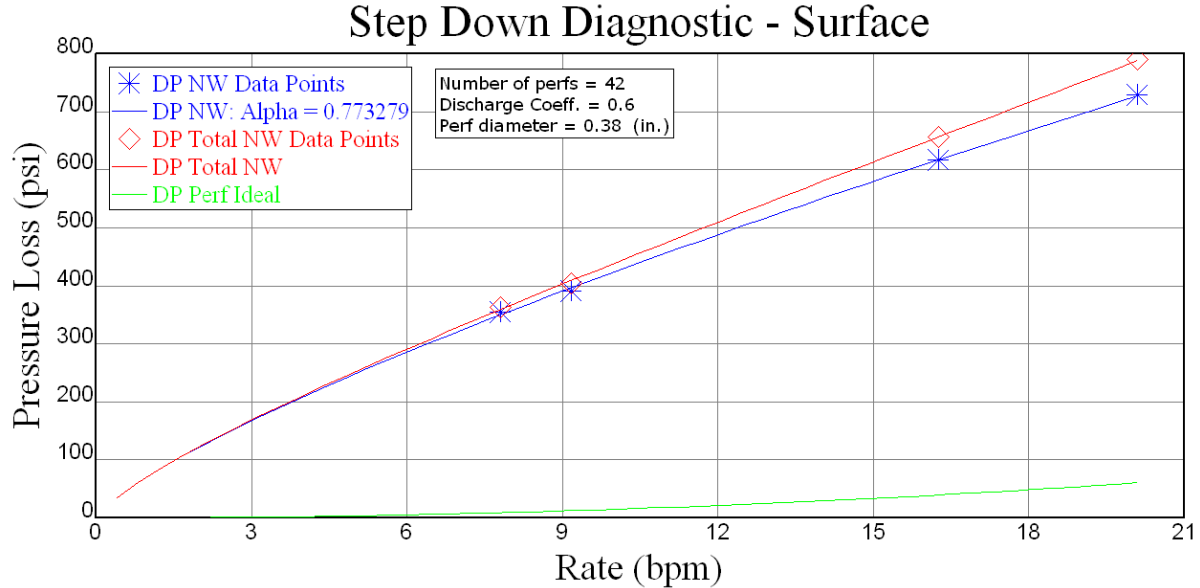




### 5. STEP DOWN TEST



The Step Down test is a diagnostic analysis to determine if the downhole losses correspond to perforation or formation restriction. An alpha coefficient for the graph near 0.5 indicates tortuosity and +/- 2 indicates perforation problems. In this case the coefficient found of 0.773279 indicates that there are signs of near wellbore tortuosity but total difference in pressure were 862 psi which indicates possible both tortuosity and perf restriction.



## 6. MAIN TREATMENT

**Table 6. Main Treatment Summary**

Parameter	Value			Units
Ave Rate	20.5			bpm
Ave STP	2,130.6			psi
Breakdown Pressure (Surface)	2,534			Psi
Max Surf Treating Pressure reached	2,534			psi
ISIP (end of Step Down Test)	1,485			psi
ISIP (end of main treatment)	1,523			psi
Fracturing Gradient (end of SDT)	1.33			psi/ft
Fracturing Gradient (end of main)	1.36			psi/ft
Friction Pressure ( $\Delta P$ , end of SDT)	862			psi
Friction Pressure ( $\Delta P$ , end of main)	165			psi
Treatment Fluid Type	Treated water			
Treatment Pad Volume	253.5			bbls
Treatment Total Volume (Clean)	1,814.9			bbls
Treatment Flush Volume	41.7			bbls
Scheduled Proppant	25,500	0	0	lbm
Proppant Placed	26,450	0	0	lbm
Proppant Type	20/40	16/30	100 Mesh	

Figure 1. Treatment Plot – Main Frac

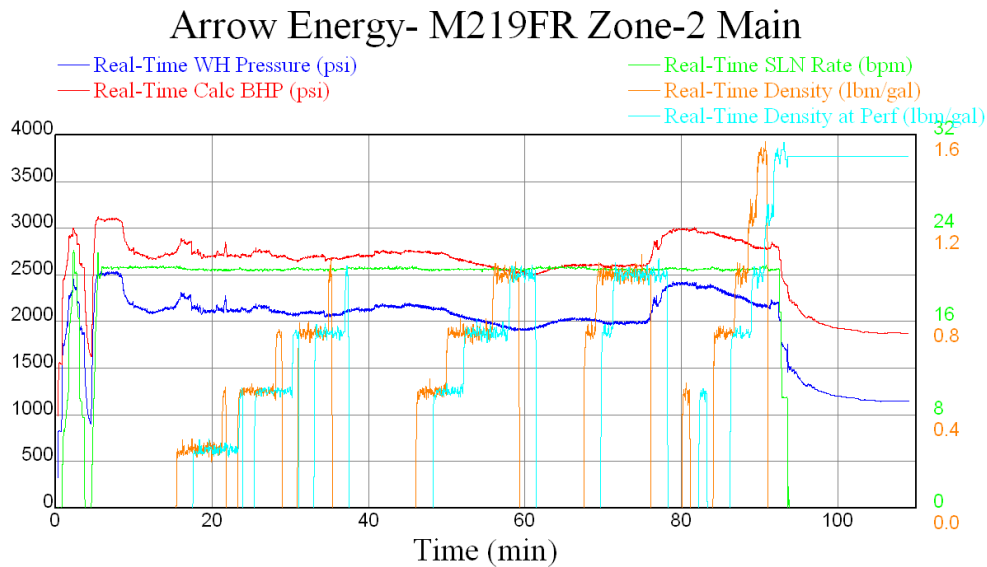
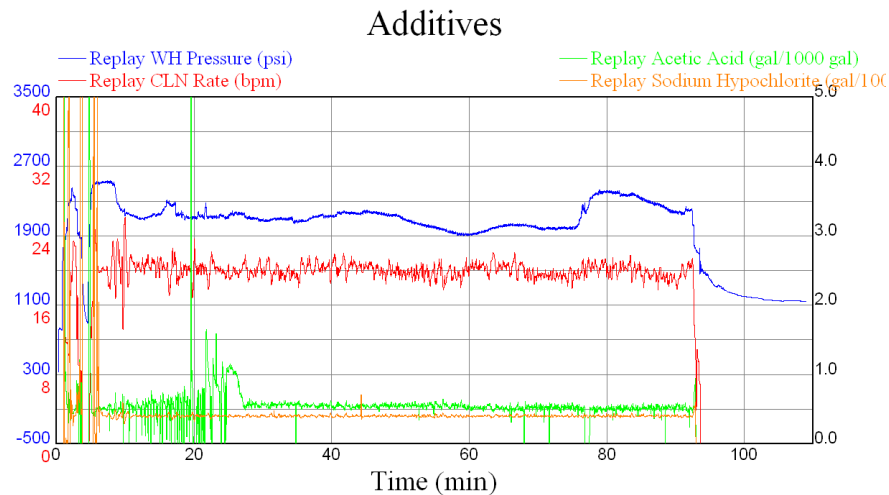


Figure 2. Treatment Plot – Additives



## 7. HISTORY MATCH

### 6.1 Calculated Values at End of Treatment

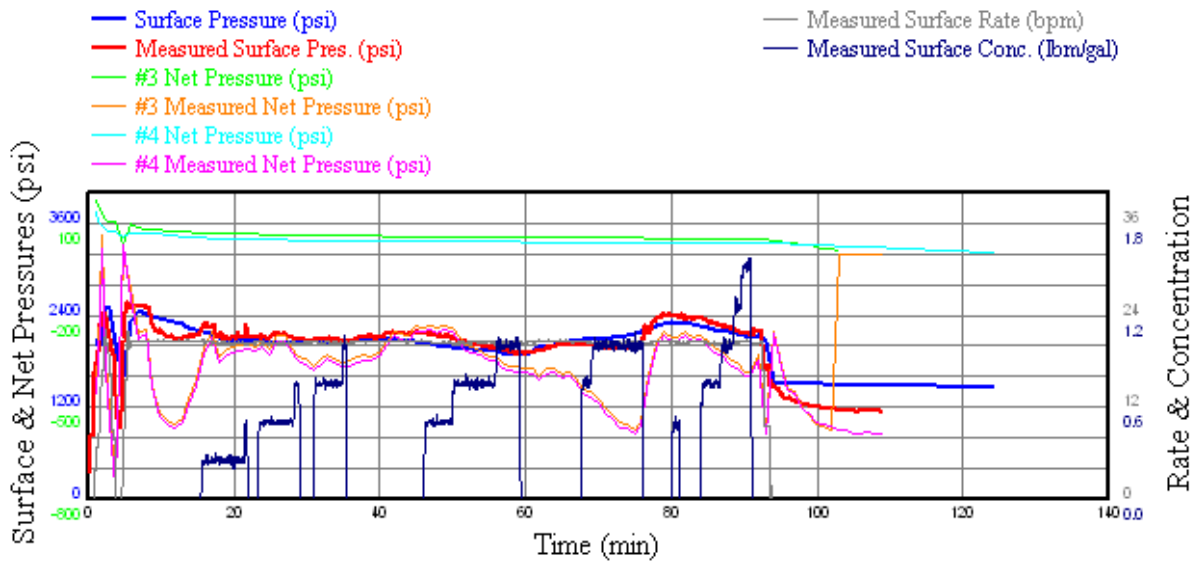
*This is a Non-unique solution and the output numbers should be used with caution*

	GR	PL1&2	
Slurry Volume Injected	823.33	1021.6	(bbl)
Liquid Volume Injected	810.02	1004.9	(bbl)
Fluid Loss Volume	731.49	795.89	(bbl)
Frac Fluid Efficiency	0.11154	0.22093	
Net Frac Pressure	50.585	36.24	(psi)
Length (one wing)	96.498	101.9	(m)
Upper Frac Height	24.125	25.476	(m)
Lower Frac Height	24.125	25.476	(m)
Upper Frac Height (TVD)	478.6	495.04	(m)
Lower Frac Height (TVD)	526.84	545.99	(m)
Total Frac Height	48.249	50.952	(m)
Max. Frac Width at Perfs	0.0098247	0.021652	(ft)
Avg. Hydraulic Frac Width	0.0065498	0.014435	(ft)

### 6.2 History Match

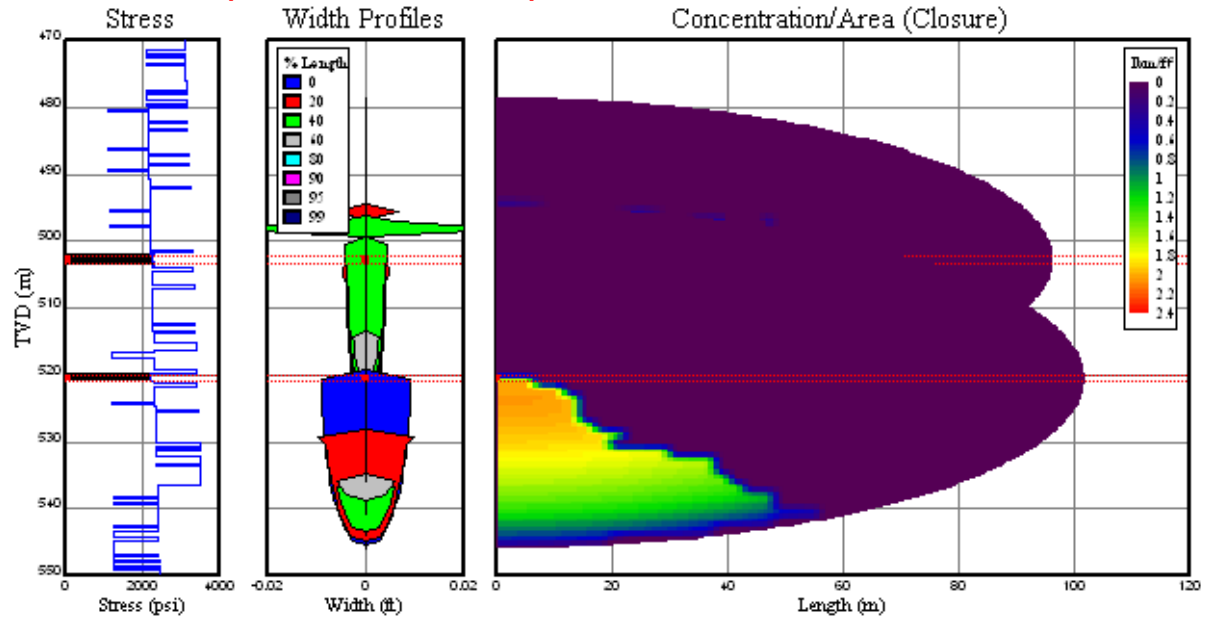
*This is a Non-unique solution and the output numbers should be used with caution*

#### Surface & Net Pressures History match



### 6.3 Fracture Profile

*This is a Non-unique solution and the output numbers should be used with caution*



## 8. APPENDIX 1 – DAILY REPORT



### FRACTURING OPERATIONS – DAILY REPORT

Base/Location: Roma	Date: 7/6/11	Page 1 of 1
---------------------	--------------	-------------

Job Type: Frac	Supervisor: Clayton James
Personnel: Clayton James, Joe Hopkins, Anthony TeWano, Mark Reddy, Craig Missner, Justin Steele, John Trelor, Robin Kim, Luis Keohler, Michael Reimen	Lease: M219FR

#### DETAILS

Safety Issues/Topics	Lifting, Pinch points, Swing paths, 3 <sup>rd</sup> Party Operations, Tag Lines, Slips Trips and Falls, High Pressure Lines, Local Wildlife, Working at Heights, Vehicle Movement, Fork Lift Movement, Chemicals
Equipment Mobilized	N/A
Shift Meeting Held	0600

#### PROJECTS and EQUIPMENT USED

Clean Area	Yes	Oils Checked	Yes
Parts Used	None	Units Fuelled Up	Yes

#### CONSUMABLES and INVENTORY

--	--	--	--

#### TIME BREAKDOWN

Time	DESCRIPTION
0600	Got to location
0745	Vause tied on well head and we greased drive lines and worked on chem pumps and loaded 10 bags of 20/40
0830	Fired guns
0845	Bleeding off surface Vause comes off
0900	Vause is going back down
0935	Vause shut in well head
0945	Jeff dropped ball
1000	Working on chem. Pump and test rates
1035	Safety meeting
1045	Psi test 5005 prv 4359
1230	Shut down dropped 10 balls during job at 785 barrels
1245	Shut in
1250	Vause safety meeting and start loading 6 bags of 20/40
1340	Vause is unhooking off well
1345	Safety meeting
1400	Finished loading chem and noticed leak on suction manifold will be running with one pump
1427	Set psi test to 5000 and prv to 4319
1430	Started job opening psi is 936
1527	We shut down pumped 1 6768lbs of sand
1537	Monitor well
1540	Started to load sand and we made the call to run with one pump and Jeff okayed it
1545	Vause safety meeting and then boys started to rip suction manifold off 33 and check valves out of 34
1645	Got suction manifold off and valves checked and sand loaded
1700	Grease high pressure iron valves
1730	Head back to camp

#### STATUS AT COMPLETION OF PROJECT

No of BBS reports:0	Area Left Tidy:: Yes	:
HAZ/Near miss reports:0	Convoy Procedures: Yes	:

#### COMMENTS /OBSERVED FAULTS/SAFETY

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Supervisor: Clayton James      Date: June 7/2011 \_\_\_\_\_

Company Rep: Jeff Dzeryk      Date: June 7/2011 \_\_\_\_\_

## 9. APPENDIX 2 – EQUIPMENT LIST

Fracturing Equipment:	2 x	2000 HHP Rhino Quintaplex 6.5" Fluid End Frac Pump
	1 x	Mobile Frac Blender (MFB) 125E TM Blender
	1 x	Mobile Sand Storage Trailer Mounted (220,000 lb)
	1 x	Computerised Stimulation Treatment Van/Container (STV/STC 1400) c/w BJ Services Job Master™ and Isoplex™ Data Acquisition System and BJ Fracman™ (single panel for multiple pump control system)
	1 x	Iron Truck (Full 1502 3" Iron package)
	1 x	lot 4 inch Suction and Discharge Hoses
	2 x	3" HP Nitrogen Charged Back Pressure, In Line Over Pressure Relief Valve
	1 x	set of Pressure Transducers and Cables
	2 x	Chemical Transfer Pump c/w Hoses
	1 x	Personnel Communications System
	1 x	Crew Container (Canteen) with Field Lab
	1 x	Forklift – 4.5 MT Manitou
	1 x	10 inch suction hose with snorkel package (not used on this well)
	2 x	500 bbls capacity Mobile Frac tanks
	2 x	5" Wellhead, Frac head and flow-back iron (only 1 set used on this well)
	2 x	Crew Vehicle
	Wire Line Equipment: (Vause Wireline)	1 x
1 x		Crew Vehicle
Crane Equipment: (LCR)	1 x	50T Slew Crane and lifting gear
	1 x	Crew Vehicle
Transfer Pumps: (Coates Hire)	2 x	Sykes CP200, 200 mm (8") Centrifugal Pumps
	1 x	Sufficient length of 8" lay-flat hose

### 10. APPENDIX 3 – MAIN TREATMENT SCHEDULE (DESIGNED)

PROPPANT SCHEDULE

Completion Component	(m)	(m)	(in)	(in)	(bbls/m)	(bbls)	(gals)		
	Top	Bottom	OD	ID	Cap.	Volume	Volume		
Casing	0.00	698.17	5.500	4.950	0.0780935	54.52	2289.95		
Tubing	0.00				0	0.00	0.00		
								(m)	
Perf No.	Seam	Top	Bottom	SPF	No.	Dia.	Displace	Zone	Gap
1	QA1 & QA21	420.91	424.47	3	35	0.38	32.87	4	22.04
2	QA22	446.51	447.73	6	24	0.38	34.87	3	54.38
3	GR	502.11	503.33	6	24	0.38	39.21	2	16.78
4	PL1 & 2	520.11	520.92	6	16	0.38	40.62	2	57.9
5	GM	578.82	584.87	3	60	0.38	45.20	1	
6									

Client Arrow  
Well No M219FR  
Zone No 2  
Location QLD  
Date 7-Jun-11  
Treatment Type Fracture Stimulation  
Fluid Type Treated Water  
Sand Type 20/40  
Supervisor Clayton James  
Engineer Robin Kim  
Client Rep Jeff Dzeryk

Stage	Fluid	Clean Fluid Volume			Proppant				Slurry Volume		Injection Rate (bbls/min)	Time		Remarks
		Stage (gals.)	Stage (bbls)	Cum (bbls)	Conc. (lbm/gal)	Size	Stage (lbm)	Cum (lbm)	Stage (bbls)	Cum (bbls)		Stage (min)	Cum (min)	
1	Treated Water	13,000	309.5	309.5	0.00		0	0	309.5	309.5	15	20.6	20.6	Pad
2	Treated Water	3,000	71.4	381.0	0.25	20/40 Sand	750	750	72.2	381.8	15	4.8	25.5	Prop
3	Treated Water	3,000	71.4	452.4	0.50	20/40 Sand	1500	2250	73.0	454.8	15	4.9	30.3	Prop
4	Treated Water	3,000	71.4	523.8	0.75	20/40 Sand	2250	4500	73.9	528.7	15	4.9	35.2	Prop
5	Treated Water	4,000	95.2	619.0	0.00		0	4500	95.2	623.9	15	6.3	41.6	Sweep
6	Treated Water	3,000	71.4	690.5	0.50	20/40 Sand	1500	6000	73.0	696.9	15	4.9	46.5	Prop
7	Treated Water	3,000	71.4	761.9	0.75	20/40 Sand	2250	8250	73.9	770.8	15	4.9	51.4	Prop
8	Treated Water	3,000	71.4	833.3	1.00	20/40 Sand	3000	11250	74.7	845.5	15	5.0	56.4	Prop
9	Treated Water	3,000	71.4	904.8	1.25	20/40 Sand	3750	15000	75.5	920.9	15	5.0	61.4	Prop
10	Treated Water	4,000	95.2	1000.0	0.00		0	15000	95.2	1016.2	15	6.3	67.7	Sweep
11	Treated Water	3,000	71.4	1071.4	0.50	20/40 Sand	1500	16500	73.0	1089.2	15	4.9	72.6	Prop
12	Treated Water	3,000	71.4	1142.9	0.75	20/40 Sand	2250	18750	73.9	1163.1	15	4.9	77.5	Prop
13	Treated Water	3,000	71.4	1214.3	1.00	20/40 Sand	3000	21750	74.7	1237.7	15	5.0	82.5	Prop
14	Treated Water	3,000	71.4	1285.7	1.25	20/40 Sand	3750	25500	75.5	1313.2	15	5.0	87.5	Prop
15	Treated Water	1,640	39.0	1324.8	0.00		0	25500	39.0	1352.2	15	2.6	90.1	Flush

	(bbls)	(gals)
Fluid 1 Treated Water	1,324.8	55,640
Fluid 2	0.0	0
Fluid 3	0.0	0
Total Fluid Volume	1,324.8	55,640

	(SG)	No. Bags	(lbm)
Sand 1 20/40 Sand	2.65	9.6	25,500
Sand 2	2.65		0
Sand 3			0
Total Sand			25,500

### 10. APPENDIX 4 – MAIN TREATMENT ADDITIVES SCHEDULE (DESIGNED)

ADDITIVES SCHEDULE

Fluid	Additives	Conc	UoM	Total	UoM
Fluid 1: Treated Water	Sodium Hypochlorite 12.5%	0.50	gpt	27.82	gal
	Acetic Acid	0.50	gpt	27.82	gal
Fluid 2:					

Client	Arrow
Well No	M219FR
Zone No	2
Location	QLD
Date	07-Jun-11
Treatment Type	Fracture Stimulation
Fluid Type	Treated Water
Sand Type	20/40
Supervisor	Clayton James
Engineer	Robin Kim
Client Rep	Jeff Dzeryk

Stage	Fluid	Prop. Conc.	Blender Unit (Liquid Chemicals)									Blender Unit (Dry Chemicals)					
			Acetic Acid >98%			Sodium Hypochlorite 12.5%											
			Conc. gpt	Rate gpm	Total gal	Conc. gpt	Rate gpm	Total gal	Conc. gpt	Rate gpm	Total gal	Conc. ppt	Rate ppm	Total lbs			
1	Treated Water	0.00	0.50	0.32	6.50	0.50	0.32	6.50									
2	Treated Water	0.25	0.50	0.32	1.50	0.50	0.32	1.50									
3	Treated Water	0.50	0.50	0.32	1.50	0.50	0.32	1.50									
4	Treated Water	0.75	0.50	0.32	1.50	0.50	0.32	1.50									
5	Treated Water	0.00	0.50	0.32	2.00	0.50	0.32	2.00									
6	Treated Water	0.50	0.50	0.32	1.50	0.50	0.32	1.50									
7	Treated Water	0.75	0.50	0.32	1.50	0.50	0.32	1.50									
8	Treated Water	1.00	0.50	0.32	1.50	0.50	0.32	1.50									
9	Treated Water	1.25	0.50	0.32	1.50	0.50	0.32	1.50									
10	Treated Water	0.00	0.50	0.32	2.00	0.50	0.32	2.00									
11	Treated Water	0.50	0.50	0.32	1.50	0.50	0.32	1.50									
12	Treated Water	0.75	0.50	0.32	1.50	0.50	0.32	1.50									
13	Treated Water	1.00	0.50	0.32	1.50	0.50	0.32	1.50									
14	Treated Water	1.25	0.50	0.32	1.50	0.50	0.32	1.50									
15	Treated Water	0.00	0.50	0.32	0.82	0.50	0.32	0.82									
					27.82			27.82			0.00			0.00			0.00



## 11. APPENDIX 5 – PRE FRACTURE PRODUCT COMPOSITION

Pre Fracture Product Composition Report

Well No: M219FR

Zone: 2

DESIGN

Additive Name	Density (SG)	Density (ppg)	BJ Component Use	Totals	UoM	Volume (L)	Mass (lbs)	Mass (kgs)	Product to Total Injected Volume (% vl)	Wt. Fraction of Product to Total Injected Mass (% wt)	Product Conc. In Total Injected Water (mg/l)	Proportion of Product to Total Injected Mass (ppm)
Acetic Acid >98%	1.07	8.924	pH Buffer	27.82	gal	105.31	248.26	112.61	0.05%	0.05%	534.65	506.82
Sodium Hypochlorite 12.5%	1.22	10.175	Bacteriacide	27.82	gal	105.31	283.06	128.40	0.05%	0.0577%	609.61	577.87
				0.00								
				0.00								
				0.00								
				0.00								
20/40 Sand	2.65	22.115	Proppant	25,500.00	lb	4,367.89	25,500.00	11,566.62	2.03%	5.20%	54,917	52,058
Water	1.00	8.345	Water	55,640.00	gal	210,620.32	464,339.73	210,621.25	97.87%	94.69%	1,000,005	947,942
									100.00%	100.00%		
Total Combined Mass of Water and Sand Injected							489,840	222,188				
Total Combined Mass of Product							531	241				
Total Mass of Water, Sand, and Products							490,371	222,429				

AdditiveName	CAS of Hazardous Compnents	Hazardous Component Chemical Name
Sodium Hypochlorite 12.5%	7681-52-9	Sodium hypochlorite
	1310-73-2	Sodium hydroxide
Acetic Acid >98%	64-19-7	Glacial acetic acid

## 12. APPENDIX 6 – POST FRACTURE PRODUCT COMPOSITION

Post Fracture Product Composition Report

Well No: M219FR

Zone: 2

ACTUAL

Additive Name	Density (SG)	Density (ppg)	BJ Component Use	Totals	UoM	Volume (L)	Mass (lbs)	Mass (kgs)	Product to Total Injected Volume (% vl)	Wt. Fraction of Product to Total Injected Mass (% wt)	Product Conc. In Total Injected Water (mg/l)	Proportion of Product to Total Injected Mass (ppm)
Acetic Acid >98%	1.07	8.924	pH Buffer	37.00	gal	140.06	330	150	0.05%	0.05%	519	498
Sodium Hypochlorite 12.5%	1.22	10.175	Bacteriacide	29.00	gal	109.78	295	134	0.04%	0.04%	464	445
20/40 Sand	2.65	22.115	Proppant	26,450.00	lb	4,530.62	26,450.00	11,997.53	1.54%	3.99%	41,579	39,919
Water	1.00	8.345	Water	76,225.80	gal	288,546.06	636,137.08	288,547.33	98.37%	95.92%	1,000,005	960,081
									100.00%	100.00%		
Total Combined Mass of Water and Sand Injected							662,587	300,545				
Total Combined Mass of Product							625	284				
Total Mass of Water, Sand, and Products							663,212	300,828				

AdditiveName	CAS of Hazardous Compnents	Hazardous Component Chemical Name
Sodium Hypochlorite 12.5%	7681-52-9	Sodium hypochlorite
	1310-73-2	Sodium hydroxide
Acetic Acid >98%	64-19-7	Glacial acetic acid

### 13. APPENDIX 7 – MAIN TREATMENT PUMP SCHEDULE (ACTUAL)

#### SURFACE TREATMENT SCHEDULE PUMPED

Stage No.	Avg Slurry Rate (bpm)	Liquid Volume (bbl)	Slurry Volume (bbl)	Total Slurry Volume (bbl)	Total Time (min)	Fluid Type	Prop Type	Conc. (lbm/gal)	From Conc. (lbm/gal)	To Prop. Stage Mass (lbm)
1	12.597	37.005	37.005	37.005	3.725	Treated Water		0	0	0
2	0.0014403	0.00010464	0.00010464	37.005	3.7976			0	0	0
3	18.598	216.04	216.04	253.05	15.414	Treated Water		6.1442e-06	6.1442e-06	0.055751
4	20.472	119.47	120.8	373.85	21.315	Treated Water	20/40	0.24673	0.24673	1238
5	20.41	10.552	10.763	384.61	21.842	Treated Water	20/40	0.44195	0.44195	195.86
6	20.422	28.629	28.629	413.24	23.244	Treated Water		7.9963e-05	7.9963e-05	0.096149
7	20.421	98.609	100.82	514.06	28.181	Treated Water	20/40	0.49502	0.49502	2050.2
8	20.427	14.865	15.357	529.41	28.933	Treated Water	20/40	0.73221	0.73221	457.13
9	20.487	40.879	40.891	570.31	30.929	Treated Water		0.0062236	0.0062236	10.686
10	20.458	77.443	80.058	650.36	34.842	Treated Water	20/40	0.74626	0.74626	2427.3
11	20.457	10.748	11.185	661.55	35.389	Treated Water	20/40	0.89847	0.89847	405.59
12	20.566	219.24	219.24	880.79	46.049	Treated Water		5.7775e-05	5.7775e-05	0.53199
13	20.45	78.599	80.352	961.14	49.979	Treated Water	20/40	0.49296	0.49296	1627.3
14	20.47	117.05	121.02	1082.2	55.891	Treated Water	20/40	0.74923	0.74923	3683.4
15	20.482	67.022	70.011	1152.2	59.309	Treated Water	20/40	0.98527	0.98527	2773.5
16	20.591	169.52	169.52	1321.7	67.542	Treated Water		1.201e-05	1.201e-05	0.085511
17	20.522	30.773	31.796	1353.5	69.091	Treated Water	20/40	0.73411	0.73411	948.82
18	20.474	137.84	144.02	1497.5	76.126	Treated Water	20/40	0.99045	0.99045	5734.1
19	20.509	80.482	80.484	1578	80.05	Treated Water		0.0003852	0.0003852	1.3021
20	20.488	21.535	21.978	1600	81.123	Treated Water	20/40	0.45425	0.45425	410.87
21	20.482	59.482	59.482	1659.5	84.027	Treated Water		4.3185e-05	4.3185e-05	0.10789
22	20.444	54.552	56.368	1715.8	86.784	Treated Water	20/40	0.73569	0.73569	1685.6
23	20.457	34.268	35.817	1751.6	88.535	Treated Water	20/40	0.99859	0.99859	1437.2
24	20.512	21.124	22.32	1774	89.623	Treated Water	20/40	1.2507	1.2507	1109.6
25	20.61	27.491	29.285	1803.2	91.044	Treated Water	20/40	1.4422	1.4422	1665.2
26	2.3198	41.676	41.676	1844.9	109.01	Treated Water		8.6452e-08	8.6452e-08	0.00015132
Total Slurry Volume				1844.9		(bbl)				
Total Liquid Volume				1814.9		(bbl)				
Total Proppant Mass				27863		(lbm)				

**BOTTOMHOLE TREATMENT SCHEDULE PUMPED**

Stage No.	Avg Slurry Rate (bpm)	Liquid Volume (bbl)	Slurry Volume (bbl)	Total Slurry Volume (bbl)	Total Time (min)	Fluid Type	Prop Type	Conc. (lbm/gal)	From Conc. (lbm/gal)	To Prop. Stage Mass (lbm)
Well	9.9288	42.68	42.68	42.68	5.0861	Treated Water		0	0	0
1	19.151	37.005	37.005	79.684	7.0184	Treated Water		0	0	0
2	20.618	0.00010464	0.00010464	79.684	7.0184			0	0	0
3	20.628	216.04	216.04	295.73	17.492	Treated Water		6.1442e-06	6.1442e-06	0.055751
4	20.431	119.47	120.8	416.53	23.404	Treated Water	20/40	0.24673	0.24673	1238
5	20.489	10.552	10.763	427.29	23.929	Treated Water	20/40	0.44195	0.44195	195.86
6	20.403	28.629	28.629	455.92	25.333	Treated Water		7.9963e-05	7.9963e-05	0.096149
7	20.426	98.609	100.82	556.74	30.268	Treated Water	20/40	0.49502	0.49502	2050.2
8	20.528	14.865	15.357	572.09	31.017	Treated Water	20/40	0.73221	0.73221	457.13
9	20.476	40.879	40.891	612.99	33.014	Treated Water		0.0062236	0.0062236	10.686
10	20.455	77.443	80.058	693.04	36.928	Treated Water	20/40	0.74626	0.74626	2427.3
11	20.556	10.748	11.185	704.23	37.472	Treated Water	20/40	0.89847	0.89847	405.59
12	20.561	219.24	219.24	923.47	48.135	Treated Water		5.7775e-05	5.7775e-05	0.53199
13	20.44	78.599	80.352	1003.8	52.066	Treated Water	20/40	0.49296	0.49296	1627.3
14	20.479	117.05	121.02	1124.8	57.975	Treated Water	20/40	0.74923	0.74923	3683.4
15	20.499	67.022	70.011	1194.9	61.391	Treated Water	20/40	0.98527	0.98527	2773.5
16	20.593	169.52	169.52	1364.4	69.623	Treated Water		1.201e-05	1.201e-05	0.085511
17	20.476	30.773	31.796	1396.2	71.175	Treated Water	20/40	0.73411	0.73411	948.82
18	20.47	137.84	144.02	1540.2	78.211	Treated Water	20/40	0.99045	0.99045	5734.1
19	20.501	80.482	80.484	1620.7	82.137	Treated Water		0.0003852	0.0003852	1.3021
20	20.494	21.535	21.978	1642.7	83.209	Treated Water	20/40	0.45425	0.45425	410.87
21	20.485	59.482	59.482	1702.1	86.113	Treated Water		4.3185e-05	4.3185e-05	0.10789
22	20.443	54.552	56.368	1758.5	88.87	Treated Water	20/40	0.73569	0.73569	1685.6
23	20.576	34.268	35.817	1794.3	90.611	Treated Water	20/40	0.99859	0.99859	1437.2
24	20.497	21.124	22.32	1816.6	91.7	Treated Water	20/40	1.2507	1.2507	1109.6
25	1.6339	26.489	28.281	1844.9	109.01	Treated Water	20/40	1.4957	1.4957	1664

Total Slurry Volume	1844.9	(bbl)
Total Liquid Volume	1814.9	(bbl)
Total Proppant Mass	27861	(lbm)

## 14. APPENDIX 8 – MSDS



# CONSOLIDATED CHEMICAL CO.

ABN 34 527 060 773 ACN 005 056 502

52-62 Waterview Close, DANDENONG SOUTH, 3175  
P.O. BOX 4415, DANDENONG SOUTH, 3164, VIC, AUSTRALIA.  
PHONE (03) 9799 7555 FAX (03) 9799 7666  
E-mail: sales@conchem.com.au  
Website: www.conchem.com.au

## ACETIC ACID GLACIAL

Hazard Alert Code:  
EXTREME

Chemwatch Material Safety Data Sheet

Revision No: 7

Chemwatch 2789-3

Issue Date: 17-Mar-2009

CD 2009/1

### Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

**PRODUCT NAME**  
ACETIC ACID GLACIAL

**SYNONYMS**

C2-H4-O2, CH3COOH, ROA30, "glacial acetic acid", "acetic acid > 80%", "acetic acid vapour", "methane carboxylic acid", "vinegar acid", "ethanoic acid", "ethylic acid", "anhydrous acetic acid", "pyroligneous acid", Ashland, J.T.Baker, Chem-Supply, "Fisher Scientific"

**PROPER SHIPPING NAME**

ACETIC ACID, GLACIAL or ACETIC ACID SOLUTION

**PRODUCT NUMBERS**

10,11521,10304,10582,2871

**PRODUCT USE**

Manufacturer of various acetates, acetyl compounds, acetate rayon, plastics and rubber; in tanning, printing calico and dyeing silk. As an acidulant and preservative in foods. Solvent for many organic substances; also dissolves phosphorus, sulphur and halogen acids. Widely used in commercial organic syntheses.

**SUPPLIER**

Company: CONSOLIDATED CHEMICAL CO

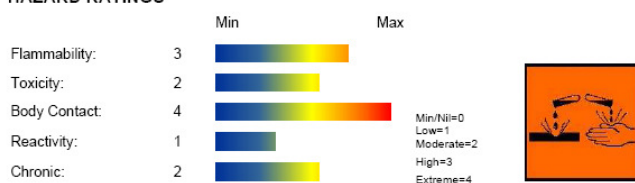
Address:

52-62 Waterview Close  
DANDENONG SOUTH  
3175

Telephone: 03/9799 7555

Fax: 03/9799 7666

**HAZARD RATINGS**



### Section 2 - HAZARDS IDENTIFICATION

**STATEMENT OF HAZARDOUS NATURE**

**HAZARDOUS SUBSTANCE, DANGEROUS GOODS.** According to the Criteria of NOHSC, and the ADG Code.

**POISONS SCHEDULE**

S6

**RISK**

- » Flammable.
- » Harmful in contact with skin.
- » Causes severe burns.
- » Risk of serious damage to eyes.
- » Ingestion may produce health damage\*.
- » Cumulative effects may result following exposure\*.

\* (limited evidence).

**SAFETY**

- » Keep locked up.
- » Do not breathe gas/ fumes/ vapour/ spray.
- » Avoid contact with eyes.
- » Wear suitable protective clothing.
- » To clean the floor and all objects contaminated by this material use water.
- » Take off immediately all contaminated clothing.
- » In case of accident or if you feel unwell IMMEDIATELY contact Doctor or Poisons Information Centre (show label if possible).
- » This material and its container must be disposed of as hazardous waste.

### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
------	--------	---

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acetic acid glacial

64-19-7

>98

### Section 4 - FIRST AID MEASURES

#### SWALLOWED

- » For advice, contact a Poisons Information Centre or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Transport to hospital or doctor without delay.

#### EYE

- » If this product comes in contact with the eyes:
- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

#### SKIN

- » If skin or hair contact occurs:
- Immediately flush body and clothes with large amounts of water, using safety shower if available.
- Quickly remove all contaminated clothing, including footwear.
- Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
- Transport to hospital, or doctor.

#### INHALED

- »
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

#### NOTES TO PHYSICIAN

- » For acute or short term repeated exposures to strong acids:
- Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
- Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

#### INGESTION:

- Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
- DO NOT attempt to neutralise the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

#### SKIN:

- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

#### EYE:

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. DO NOT use neutralising agents or any other additives. Several litres of saline are required.
  - Cycloplegic drops. (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
  - Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.
- [Ellenhorn and Barceloux: Medical Toxicology].

### Section 5 - FIRE FIGHTING MEASURES

#### EXTINGUISHING MEDIA

- »
- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

#### FIRE FIGHTING

- »
- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water courses.
- Consider evacuation (or protect in place).
- Use water delivered as a fine spray to control fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

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### FIRE/EXPLOSION HAZARD

»

- Flammable.
- Moderate fire and explosion hazard when exposed to heat or flame.
- Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- May emit corrosive fumes.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), other pyrolysis products typical of burning organic material.

May emit corrosive fumes.

### FIRE INCOMPATIBILITY

»

- Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

### HAZCHEM

\*2P

## Section 6 - ACCIDENTAL RELEASE MEASURES

### EMERGENCY PROCEDURES

#### MINOR SPILLS

»

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

#### MAJOR SPILLS

» Chemical Class: acidic compounds, organic

For release onto land, recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
<b>LAND SPILL - SMALL</b>				
wood fiber - pillow	1	throw	pitchfork	R, P, DGC, RT
cross-linked polymer - particulate	1	shovel	shovel	R, W, SS
cross-linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
sorbent clay - particulate	2	shovel	shovel	R, I, P
foamed glass - pillow	2	throw	pitchfork	R, P, DGC, RT
wood fiber - particulate	3	shovel	shovel	R, W, P, DGC
<b>LAND SPILL - MEDIUM</b>				
cross-linked polymer - particulate	1	blower	skiploader	R, W, SS
polypropylene - particulate	2	blower	skiploader	W, SS, DGC
sorbent clay - particulate	2	blower	skiploader	R, I, P
cross-linked polymer - pillow	3	throw	skiploader	R, DGC, RT
polypropylene - mat	3	throw	skiploader	W, SS, DGC
expanded mineral - particulate	3	blower	skiploader	R, I, W, P, DGC

#### Legend

DGC: Not effective where ground cover is dense

R: Not reusable

I: Not incinerable

P: Effectiveness reduced when rainy

RT: Not effective where terrain is rugged

SS: Not for use within environmentally sensitive sites

W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;

R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988

- DO NOT touch the spill material
- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapour.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

### PROTECTIVE ACTIONS FOR SPILL

From IERG (Canada/Australia)

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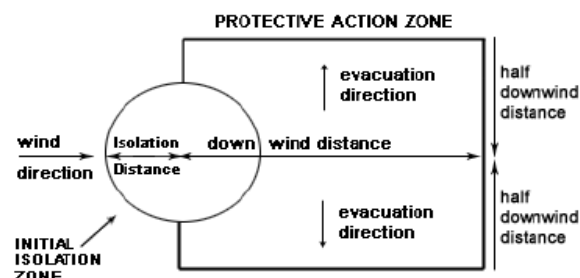
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Isolation Distance 25 metres  
Downwind Protection Distance 250 metres  
IERG Number 19

## FOOTNOTES

- 1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
- 2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
- 3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
- 4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
- 5 Guide 132 is taken from the US DOT emergency response guide book.
- 6 IERG information is derived from CANUTEC - Transport Canada.

## EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:

acetic acid glacial 250ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

acetic acid glacial 35ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:

acetic acid glacial 5ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according exceed the following cutoffs

Very Toxic (T+)	>= 0.1%	Toxic (T)	>= 3.0%
R50	>= 0.25%	Corrosive (C)	>= 5.0%
R51	>= 2.5%		
else	>= 10%		

where percentage is percentage of ingredient found in the mixture

## SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together

O: May be stored together with specific precautions

+: May be stored together

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

## Section 7 - HANDLING AND STORAGE

### PROCEDURE FOR HANDLING

- » DO NOT allow clothing wet with material to stay in contact with skin
- WARNING: Contact with water generates heat.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before re-use.



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- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
- Containers, even those that have been emptied, may contain explosive vapours.
- Do NOT cut, drill, grind, weld or perform similar operations on or near containers.

### SUITABLE CONTAINER

- » Lined metal can, Lined metal drum, Lined metal safety cans.
- Packing as supplied and/or recommended by manufacturer
- Plastic lining or containers may only be used if approved for flammable liquid (non-polar type).

- Check that containers are clearly labelled and free from leaks.
- DO NOT use aluminium or galvanised containers

For low viscosity materials

- Drums and jerrycans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.

For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):

- Removable head packaging;
- Cans with friction closures and
- low pressure tubes and cartridges may be used.

Where combination packages are used, and the inner packages are of glass, porcelain or stoneware, there must be sufficient inert cushioning material in contact with inner and outer packages unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.

- Check regularly for spills and leaks
- Glass container is suitable for laboratory quantities
- DO NOT use mild steel or galvanised containers

In accordance with ADG Code 5.9.8, Bulk transport by Road Tankers complying with construction standards RT1 or RT7

### STORAGE INCOMPATIBILITY

- » Reacts with mild steel, galvanised steel / zinc producing hydrogen gas which may form an explosive mixture with air.

Acetic acid:

- vapours forms explosive mixtures with air (above 39 C.)
- reacts violently with bases such as carbonates and hydroxides (giving off large quantities of heat), oxidisers, organic amines, acetaldehyde, potassium tert-butoxide
- reacts (sometimes violently), with strong acids, aliphatic amines, alkanolamines, alkylene oxides, epichlorohydrin, acetic anhydride, 2-aminoethanol, ammonia, ammonium nitrate, bromine pentafluoride, chlorosulfonic acid, chromic acid, chromium trioxide, ethylenediamine, ethyleneimine, hydrogen peroxide, isocyanates, oleum, perchloric acid, permanganates, phosphorus isocyanate, phosphorus trichloride, sodium peroxide, xylene
- attacks cast iron, stainless steel and other metals forming flammable hydrogen gas
- attacks many forms of rubber, plastics and coatings
- Avoid strong bases.
- Segregate from alkalies, oxidising agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

### STORAGE REQUIREMENTS

- » Store in approved flammable liquid storage area.
- No smoking, naked lights/ignition sources.
- Keep containers securely sealed.
- Store away from incompatible materials in a cool, dry, well-ventilated area.
- Protect containers against physical damage and check regularly for leaks.
- Storage areas should be clearly identified, well illuminated, clear of obstruction and accessible only to trained and authorised personnel - adequate security must be provided so that unauthorised personnel do not have access.
- Store in grounded, properly designed and approved vessels and away from incompatible materials
- Store according to applicable regulations for flammable materials for storage tanks, containers, piping, buildings, rooms, cabinets, allowable quantities and minimum storage distances.
- Use non-sparking ventilation systems, approved explosion proof equipment and intrinsically safe electrical systems.
- Have appropriate extinguishing capability in storage area (e.g. portable fire extinguishers - dry chemical, foam or carbon dioxide) and flammable gas detectors.
- Keep adsorbents for leaks and spills readily available
- For bulk storages, consider use of floating roof or nitrogen blanketed vessels; where venting to atmosphere is possible, equip storage tank vents with flame arrestors; inspect tank vents during winter conditions for vapour/ice build-up; storage tanks should be above ground and diked to hold entire contents
- Observe manufacturer's storing and handling recommendations.

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC
Australia Exposure Standards	acetic acid glacial (Acetic acid)	10	25	15	37			

### EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m <sup>3</sup> )	Revised IDLH Value (ppm)
acetic acid glacial		50

### MATERIAL DATA

» for acetic acid:

NOTE: Detector tubes for acetic acid, measuring in excess of 1 ppm, are commercially available.

Exposure at or below the TLV-TWA and TLV-STEL is thought to protect the worker against conjunctival, nose and respiratory tract irritation.

Odour Safety Factor(OSF)

OSF=21 ("ACETIC ACID, GLACIAL").

### PERSONAL PROTECTION

## ACETIC ACID GLACIAL

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### EYE

- » Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure.
- Chemical goggles, whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted.
- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59]

### HANDS/FEET

- » Elbow length PVC gloves
  - When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
- Suitability and durability of glove type is dependent on usage. Factors such as:
- frequency and duration of contact,
  - chemical resistance of glove material,
  - glove thickness and
  - dexterity,
- are important in the selection of gloves.
- Neoprene rubber gloves
- Do not use polyethylene gloves.

### OTHER

- » Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.

### GLOVE SELECTION INDEX

» Glove selection is based on a modified presentation of the:

"Forsberg Clothing Performance Index".

The effect(s) of the following substance(s) are taken into account in the computer-generated selection: acetic acid glacial

» Protective Material CPI:

BUTYL	A
NEOPRENE	A
NITRILE+PVC	A
FE	A
SARANEX-23	A
TEFLON	A
FE/EVALIFE	A
PVC	A
NATURAL RUBBER	B
NITRILE	B
BUTYL/NEOPRENE	B
NATURAL+NEOPRENE	B
NAT+NEOPR+NITRILE	C

» \* CPI - Chemwatch Performance Index

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

\* Where the glove is to be used on a short-term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

### RESPIRATOR

» Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	AB-AJS	-
1000	50	-	AD-AUG
5000	50	Airline *	-

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5000	100	-	AB-2
10000	100	-	AD-3
	100+		Airline**

\* - Continuous Flow \*\* - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

### ENGINEERING CONTROLS

» Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.

An approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:

Air Speed:

solvent, vapours, degreasing etc., evaporating from tank (in still air). 0.25-0.5 m/s (50-100 f/min.)

aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation) 0.5-1 m/s (100-200 f/min.)

direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion) 1-2.5 m/s (200-500 f/min.)

grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion). 2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

Upper end of the range

1: Room air currents minimal or favourable to capture 1: Disturbing room air currents

2: Contaminants of low toxicity or of nuisance value only. 2: Contaminants of high toxicity

3: Intermittent, low production. 3: High production, heavy use

4: Large hood or large air mass in motion 4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

### APPEARANCE

Clear colourless mobile flammable corrosive liquid (&gt; 18 deg.C), or clear crystalline solid (in cold weather) with a characteristic sharp, pungent, vinegar-like odour. Mixes with water, alcohol, glycerol, ether and most organic solvents.

### PHYSICAL PROPERTIES

Liquid.

Mixes with water.

Corrosive.

Acid.

Molecular Weight: 60.06

Boiling Range (°C): 118

Melting Range (°C): 18.6

Specific Gravity (water=1): 1.05

Solubility in water (g/L): Miscible

pH (as supplied): Not available

pH (1% solution): 2.9 approx.

Vapour Pressure (kPa): 1.5 @ 20 deg C

Volatile Component (%vol): 100

Evaporation Rate: 0.99 BuAc=1

Relative Vapour Density (air=1): 2.07

Flash Point (°C): 43-44.5 TCC

Lower Explosive Limit (%): 5

Upper Explosive Limit (%): 18

Autoignition Temp (°C): 483

Decomposition Temp (°C): Not available

State: Liquid

Viscosity: Not Available

## Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

### CONDITIONS CONTRIBUTING TO INSTABILITY

»

- Contact with alkaline material liberates heat

## Section 11 - TOXICOLOGICAL INFORMATION

### POTENTIAL HEALTH EFFECTS

#### ACUTE HEALTH EFFECTS

##### SWALLOWED

» Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. Swelling of the epiglottis may make it difficult to breathe which may result in asphyxiation. More severe exposure may result in vomiting blood and thick mucus, shock, abnormally low blood pressure, fluctuating pulse, shallow respiration and clammy skin, inflammation of stomach wall, and rupture of oesophageal tissue. Untreated shock may eventually result in kidney failure. Severe cases may result in perforation of the stomach and abdominal cavity with consequent infection, rigidity and fever. There may be severe narrowing of the oesophageal or pyloric sphincters; this may occur immediately or after a delay of weeks to years. There may be coma and convulsions, followed by death due to infection of the abdominal cavity, kidneys or lungs.

Accidental ingestion of the material may be damaging to the health of the individual.

Ingestion of low-molecular organic acid solutions may produce spontaneous haemorrhaging, production of blood clots, gastrointestinal damage and narrowing of the oesophagus and stomach entry.

Ingestion of acetic acid may cause delayed gastro-intestinal and oesophageal perforation, and in severe cases death. Ingestion of as little as 1 ml. of glacial acid has resulted in oesophageal perforation.

## ACETIC ACID GLACIAL

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### EYE

» If applied to the eyes, this material causes severe eye damage. Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns. Mild burns of the epithelia generally recover rapidly and completely. Severe burns produce long-lasting and possibly irreversible damage. The appearance of the burn may not be apparent for several weeks after the initial contact. The cornea may ultimately become deeply opaque resulting in blindness. Solutions of low-molecular weight organic acids cause pain and injury to the eyes. Acetic acid produces conjunctival irritation at concentrations below 10 ppm.

### SKIN

» Skin contact with the material may be harmful; systemic effects may result following absorption. The material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterised by redness, swelling and blistering. Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue. Action of acetic acid on the skin may be delayed and insidious. Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

### INHALED

» The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Swelling of the lungs can occur, either immediately or after a delay; symptoms of this include chest tightness, shortness of breath, frothy phlegm and cyanosis. Lack of oxygen can cause death hours after onset. Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary oedema. Minor acetic acid exposures may cause transient loss of voice. A severe acute vapour exposure may cause pulmonary oedema. Exposure at 800-1200 ppm cannot be tolerated for longer than 3 minutes.

### CHRONIC HEALTH EFFECTS

» Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs. Chronic exposure may inflame the skin or conjunctiva. Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Repeated minor oral exposure to acetic acid can cause blackening of the skin and teeth, erosion of the teeth, vomiting, diarrhoea, nausea. Repeated minor vapour exposure may cause chronic respiratory inflammation and bronchitis. It is reported that workers exposed for 7 to 12 years at concentrations of 60 ppm acetic acid, plus one hour daily at 100-260 ppm had no injury except slight irritation of the respiratory tract, stomach, and skin although this report is equivocal as in another study different researchers found conjunctivitis, bronchitis, pharyngitis and erosion of exposed teeth apparently in the same workers. Occupational exposures for 7-12 years to concentrations of 80-200 ppm, at peaks, caused blackening and hyperkeratosis of the skin and hands, conjunctivitis (but no corneal damage), bronchitis and pharyngitis and erosion of the exposed teeth (incisors and canines). Digestive disorders with heartburn and constipation have been reported at unspecified prolonged exposures.

### TOXICITY AND IRRITATION

» unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

#### TOXICITY

Oral (human) TDLo: 1.47 mg/kg  
Unreport (man) LDLo: 308 mg/kg  
Oral (rat) LD50: 3310 mg/kg  
Inhalation (human) TClO: 818 ppm/3 min  
Inhalation (rat) LCLo: 16000 ppm/4 hr  
Dermal (rabbit) LD50: 1080 mg/kg

#### IRRITATION

Skin (human): 50mg/24hr - Mild  
Skin (rabbit): 525mg (open)-SEVERE  
Eye (rabbit): 0.05mg (open)-SEVERE

» Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

NOAELs following repeated exposure to acetic acid and its salts range from 210 mg/kg bw/day (2-4 month acetic acid drinking water study; systemic toxicity) to 3600 mg/kg bw/day (acetic acid, sodium salt, 4 week dietary study; no effects reported). Signs of irritation/corrosion at the site of contact as well as systemic toxicity have been reported. Prolonged inhalation exposure to acetic acid results in muscle imbalance, increase in blood cholinesterase activity, decreases in albumins and decreased growth at concentrations greater than 0.01 mg/m<sup>3</sup>/day.

Groups of 20 mice/sex were given 0.025% sodium acetate in drinking water (about 60 mg/kg bw/day) for 1 week before breeding during a 9-day breeding period and (females only) throughout pregnancy, lactation and until the offspring were weaned at 3 weeks of age. No effects on fertility were observed. The male offspring were given the same solution until they were 5-7 weeks old and were then examined in a 24-hour activity test. Examination of the litters revealed no overt deformities and normal pup weights at day 1 and day 21. The activity of offspring of the treated group was lower than that of controls during the first 12 hours but was similar during the second 12 hours. It is unknown if the decreased activity observed in the sodium acetate treated group to was a result of exposure in utero and/or post-weaning, since the pups were exposed during both time periods. Acetic acid had no effects on implantation or on maternal or fetal survival in rats, mice or rabbits dosed via gavage during gestation days 6-19 at doses up to 1600 mg/kg/day. The number of abnormalities seen in either soft or skeletal tissues of the test groups did not differ from the number occurring in the controls. Sodium acetate had no effect on pregnant mice or offspring when mice were administered 1000 mg/kg bw. by gavage on days 8-12 of gestation.

## Section 12 - ECOLOGICAL INFORMATION

» Fish LC50 (96hr.) (mg/l):	88, 92
» Daphnia magna EC50 (48hr.) (mg/l):	37
» Algae IC50 (72hr.) (mg/l):	90
» log Kow (Prager 1995):	- 0.31
» log Kow (Sangster 1997):	- 0.17
» log Pow (Verschuieren 1983):	1.8E+0
» Acetic acid and its salts (the acetates) can be grouped together because of their close structural relationships, their natural occurrence in plants and	

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animals, and their fundamental role in cell metabolism, particularly in the tricarboxylic acid cycle (also known as the citric acid or Krebs's cycle), which is where humans get their energy.

- Acetic acid is degraded photochemically in the atmosphere to produce hydroxyl radicals (estimated typical half-life of 22 days). Physical removal of acetates on atmospheric particulates may occur via wet or dry deposition.
  - Natural water will neutralise dilute solutions of acetic acid.
  - Spills of acetic acid on soil will readily biodegrade - the biodegradation rate for acetic acid after 14 days under aerobic conditions is 74 days.
  - In invertebrates the toxicity of acetic acid (EC50 = 50-450 mg/L, depending on test species) -under static conditions, the 48 hour EC50 value for acetic acid is 85 mg/L for aquatic invertebrates (the test media was not neutralised). When the test solutions are neutralised, the static 48 hour EC50 for acetic acid is 6000 mg/L. In renewal systems with aquatic invertebrates, 48 hour EC50s for acetic acid are 100 mg/L and 180 mg/L.
  - Fish LC50 (96 h): 75-89 mg/l.
  - Acetic acid is not expected to bioconcentrate in the aquatic system.
  - Low concentrations of acetic acid are harmful to fish.
  - Drinking water standards: none available.
  - Soil Guidelines: none available.
  - Air Quality Standards: none available.
- » Prevent, by any means available, spillage from entering drains or water courses.  
» DO NOT discharge into sewer or waterways.

### Section 13 - DISPOSAL CONSIDERATIONS

- »
- Containers may still present a chemical hazard/ danger when empty.
  - Return to supplier for reuse/ recycling if possible.
- Otherwise:
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
  - Where possible retain label warnings and MSDS and observe all notices pertaining to the product.
- Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
- A Hierarchy of Controls seems to be common - the user should investigate:
- Reduction,
  - Reuse
  - Recycling
  - Disposal (if all else fails)
- This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
- DO NOT allow wash water from cleaning or process equipment to enter drains.
  - It may be necessary to collect all wash water for treatment before disposal.
  - In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
  - Where in doubt contact the responsible authority.
  - Recycle wherever possible.
  - Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
  - Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: Burial in a licenced land-fill or Incineration in a licenced apparatus
  - Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

### Section 14 - TRANSPORTATION INFORMATION



Labels Required: CORROSIVE, FLAMMABLE LIQUID

HAZCHEM: 2P (ADG6)

Land Transport UNDG:

Class or division:	8	Subsidiary risk:	3
UN No.:	2789	UN packing group:	II

Shipping Name: ACETIC ACID, GLACIAL or ACETIC ACID SOLUTION more than 80% acid, by mass

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	3
UN/ID Number:	2789	Packing Group:	II

Special provisions: None

Shipping Name: ACETIC ACID, GLACIAL

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	3
UN Number:	2789	Packing Group:	II
EMS Number:	F-E,S-C	Special provisions:	None

Limited Quantities: 1 L

Shipping Name: ACETIC ACID, GLACIAL or ACETIC ACID SOLUTION, more than 80% acid, by mass

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### Section 15 - REGULATORY INFORMATION

#### POISONS SCHEDULE

S6

#### REGULATIONS

acetic acid glacial (CAS: 64- 10- 7) is found on the following regulatory lists:

Australia Exposure Standards

Australia Hazardous Substances

Australia High Volume Industrial Chemical List (HVICL)

Australia Illicit Drug Reagents/Essential Chemicals - Category III

Australia Inventory of Chemical Substances (AICS)

Australia National Pollutant Inventory

Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix E (Part 2)

Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Appendix F (Part 3)

Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 2

Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 5

Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 6

CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP

GESAMP/EHS Composite List of Hazard Profiles - Hazard evaluation of substances transported by ships

IMO IBC Code Chapter 17: Summary of minimum requirements

IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk

IMO Provisional Categorization of Liquid Substances - List 1: Pure or technically pure products

International Council of Chemical Associations (ICCA) - High Production Volume List

OECD Representative List of High Production Volume (HPV) Chemicals

### Section 16 - OTHER INFORMATION

» Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:

[www.chemwatch.net/references](http://www.chemwatch.net/references).

» The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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TEL (+61 3) 9572 4700.*

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## CONSOLIDATED CHEMICAL CO.

ABN 34 627 060 773 ACN 005 056 602

52-62 Waterview Close, DANDENONG SOUTH, 3175  
P.O. BOX 4415, DANDENONG SOUTH, 3164, VIC, AUSTRALIA.  
PHONE (03) 9799 7555 FAX (03) 9799 7666  
24 hours emergency response : 1800 839 984  
E-mail: sales@conchem.com.au  
Website: www.conchem.com.au

### sodium hypochlorite

Chemwatch Material Safety Data Sheet  
Issue Date: 14-May-2010  
XC93-175C

Hazard Alert Code: **EXTREME**

CHEMWATCH 3508  
Version No.8  
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#### Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

**PRODUCT NAME**  
sodium hypochlorite

**PROPER SHIPPING NAME**  
HYPOCHLORITE SOLUTION

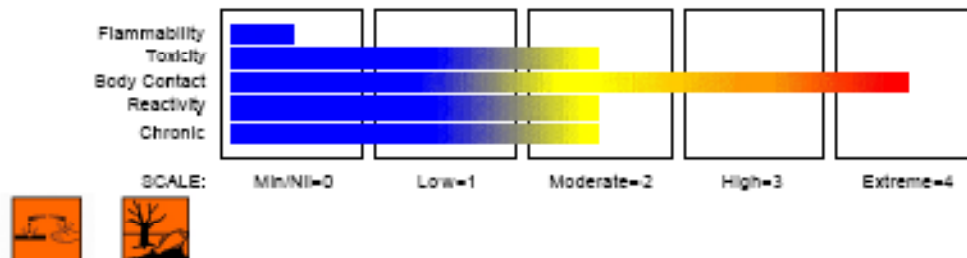
**PRODUCT USE**  
Used in the bleaching of paper pulp and textiles, for the purification of water, in medicine, as a swimming pool disinfectant and laundering agent and as a fungicide and germicide. Also used in the manufacture of organic chemicals and as a chemical intermediate.  
Intermediate

**SUPPLIER**  
Company: CONSOLIDATED CHEMICAL CO  
Address:  
52- 62 Waterview Close  
DANDENONG SOUTH  
3175  
Australia  
Telephone: 03/9799 7555  
Emergency Tel: 1800 839 984  
Fax: 03/9799 7666

#### Section 2 - HAZARDS IDENTIFICATION

**STATEMENT OF HAZARDOUS NATURE**  
HAZARDOUS SUBSTANCE, DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



continued...

sodium hypochlorite

Chemwatch Material Safety Data Sheet  
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XC88178C

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Section 2 - HAZARDS IDENTIFICATION

**RISK**

- Contact with acids liberates toxic gas.
- Causes burns.
- Risk of serious damage to eyes.
- Very toxic to aquatic organisms.

**SAFETY**

- \* Keep locked up.
- \* Keep away from combustible material.
- \* Do not breathe dust.
- \* Avoid contact with eyes.
- \* Wear suitable protective clothing.
- \* To clean the floor and all objects contaminated by this material, use water.
- \* This material and its container must be disposed of in a safe way.
- \* Take off immediately all contaminated clothing.
- \* In case of accident or if you feel unwell IMMEDIATELY contact Doctor or Poisons Information Centre (show label if possible).
- \* Use appropriate container to avoid environmental contamination.
- \* Avoid release to the environment. Refer to special Instructions/Safety data sheets.
- \* This material and its container must be disposed of as hazardous waste.

**Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS**

NAME	CAS RN	%
sodium hypochlorite	7681-52-9	>98
marketed as sodium hypochlorite solution containing more than 5% available chlorine		

**Section 4 - FIRST AID MEASURES**

**SWALLOWED**

- \* For advice, contact a Poisons Information Centre or a doctor at once.
- \* Urgent hospital treatment is likely to be needed.
- \* If swallowed do NOT induce vomiting.
- \* If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

**EYE**

- If this product comes in contact with the eyes:
- \* Immediately hold eyelids apart and flush the eye continuously with running water.
- \* Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- \* Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- \* Transport to hospital or doctor without delay.

**SKIN**

- If skin or hair contact occurs:
- \* Immediately flush body and clothes with large amounts of water, using safety shower if available.
- \* Quickly remove all contaminated clothing, including footwear.
- \* Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
- \* Transport to hospital, or doctor.

**INHALED**

- \* If fumes or combustion products are inhaled remove from contaminated area.
- \* Lay patient down. Keep warm and rested.
- \* Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- \* Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- \* Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema.

continued...



## sodium hypochlorite

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**Section 4 - FIRST AID MEASURES**

- Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs).
- As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested.
- Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered.

### NOTES TO PHYSICIAN

■ Excellent warning properties force rapid escape of personnel from chlorine vapour thus most inhalations are mild to moderate. If escape is not possible, exposure to high concentrations for a very short time can result in dyspnea, haemoptysis and cyanosis with later complications being tracheobroncho-pneumonitis and pulmonary oedema.  
for corrosives:

### BASIC TREATMENT

- Establish a patent airway with suction where necessary.
  - Watch for signs of respiratory insufficiency and assist ventilation as necessary.
  - Administer oxygen by non-rebreather mask at 10 to 15 l/min.
  - Monitor and treat, where necessary, for pulmonary oedema.
- For acute or repeated exposures to hypochlorite solutions:
- Release of small amounts of hypochlorous acid and acid gases from the stomach following ingestion, is usually too low to cause damage but may be irritating to mucous membranes. Buffering with antacid may be helpful if discomfort is evident.
  - Evaluate as potential caustic exposure.
  - Decontaminate skin and eyes with copious saline irrigation. Check exposed eyes for corneal abrasions with fluorescein staining.
  - Emesis or lavage and catharsis may be indicated for mild caustic exposure.
- Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not manifest until a few hours have passed and they are aggravated by physical effort.

### **Section 5 - FIRE FIGHTING MEASURES**

#### EXTINGUISHING MEDIA

- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).

#### FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use fire fighting procedures suitable for surrounding area.

#### FIRE/EXPLOSION HAZARD

- Non combustible.
  - Not considered a significant fire risk, however containers may burn.
- Decomposition may produce toxic fumes of hydrogen chloride, metal oxides.  
May emit corrosive fumes.

#### FIRE INCOMPATIBILITY

- None known.

#### HAZCHEM

2X

#### Personal Protective Equipment

Breathing apparatus.  
Gas tight chemical resistant suit.  
Limit exposure duration to 1 BA set 30 mins.

continued...

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### Section 6 - ACCIDENTAL RELEASE MEASURES

#### MINOR SPILLS

- \* Remove all ignition sources.
  - \* Clean up all spills immediately.
  - \* Avoid contact with skin and eyes.
  - \* Control personal contact by using protective equipment.
  - \* Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
  - \* Check regularly for spills and leaks.
- Neutralise with sodium metabisulfite or sodium thiosulfate.

#### MAJOR SPILLS

- \* Clear area of personnel and move upwind.
  - \* Alert Fire Brigade and tell them location and nature of hazard.
  - \* Wear full body protective clothing with breathing apparatus.
  - \* Prevent, by any means available, spillage from entering drains or water course.
- Neutralise with sodium metabisulfite or sodium thiosulfate.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

### Section 7 - HANDLING AND STORAGE

#### PROCEDURE FOR HANDLING

- \* Avoid all personal contact, including inhalation.
- \* Wear protective clothing when risk of exposure occurs.
- \* Use in a well-ventilated area.
- \* **WARNING:** To avoid violent reaction, ALWAYS add material to water and NEVER water to material.

#### SUITABLE CONTAINER

- \* Liquid inorganic hypochlorites shall not be transported in unlined metal drums. Inner packagings shall be fitted with vented closures and plastic drums and carboys shall have vented closures or be performance tested to a minimum of 250 kPa.
  - \* Glass container is suitable for laboratory quantities.
  - \* Lined metal can, lined metal pail/ can.
  - \* Plastic pail.
  - \* Polyliner drum.
  - \* Packing as recommended by manufacturer.
- For low viscosity materials
- \* Drums and jerrycans must be of the non-removable head type.
  - \* Where a can is to be used as an inner package, the can must have a screwed enclosure. <<->

#### STORAGE INCOMPATIBILITY

- \* Contact with acids produces toxic fumes.
- \* Metals and their oxides or salts may react violently with chlorine trifluoride and bromine trifluoride.
- \* These trifluorides are hypergolic oxidisers. They ignite on contact (without external source of heat or ignition) with recognised fuels - contact with these materials, following an ambient or slightly elevated temperature, is often violent and may produce ignition.
- \* The state of subdivision may affect the results.
- \* Presence of rust (iron oxide) or other metal oxides catalyses decomposition of inorganic hypochlorites.
- \* Contact with water can cause heating and decomposition giving off chlorine and oxygen gases. Solid hypochlorites in contact with water or moisture may generate sufficient heat to ignite combustible materials. Thermal decomposition can be sustained in the absence of oxygen.
- \* Contact with acids produces toxic fumes of chlorine.
- \* Bottles of strong sodium hypochlorite solution (10-14% available chlorine) burst in storage due to failure of the cap designed to vent oxygen slowly during storage. A hot summer may have exacerbated the situation. Vent caps should be checked regularly (using full personal protection) and hypochlorites should not be stored in direct sunlight or at temperatures exceeding 18 deg. C.
- \* Contact with acids produces toxic fumes of chlorine.
- \* Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.

#### PACKAGING MATERIAL INCOMPATIBILITIES

Chemical Name	Container Type
Sodium Hypochlorite (100%)	" 304 stainless steel" , " 316 stainless steel" , " Acetal (Delrin)"

continued...

sodium hypochlorite

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Section 7 - HANDLING AND STORAGE

, Aluminum, Brass, " Buna N (Nitrile)", " Carbon Steel", " Carpenter  
20", " Cast Iron", Epoxy, Hytrel, Kel- Fr, " Natural rubber",  
Neoprene, Nylon, Polypropylene, Polyurethane, " PPS (Ryton)"

**STORAGE REQUIREMENTS**

- Store in an upright position.
- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.

**Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**

**EXPOSURE CONTROLS**

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC	Notes
Australia Exposure Standards	sodium hypochlorite (Chlorine)					1	3		

**PERSONAL PROTECTION**



**RESPIRATOR**

- type h-p filter of sufficient capacity.

**EYE**

- safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; goggles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure
- Chemical goggles whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted
- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.

**HAND/FEET**

- Elbow length PVC gloves.

**NOTE:**

- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.
- Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
  - frequency and duration of contact,
  - chemical resistance of glove material,
  - glove thickness and
  - dexterity.

**OTHER**

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.

**ENGINEERING CONTROLS**

- Local exhaust ventilation usually required, if risk of overexposure exists, wear approved respirator.
- CARE:** Use of a quantity of this material in confined space or poorly ventilated area, where rapid build up of concentrated

continued..

sodium hypochlorite

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**Section 8 - EXPOSURE CONTROL & PERSONAL PROTECTION**

atmosphere may occur, could require increased ventilation and/or protective gear.

**Section 9 - PHYSICAL AND CHEMICAL PROPERTIES**

**APPEARANCE**

White crystals with disagreeable odour; soluble in cold water, decomposed by hot water. Strong oxidising agent. Highly unstable in air unless mixed with sodium hydroxide. Usually stored and used in solution. Packaging Group III is used for solutions containing more than 5% but less than 16% available chlorine.

**PHYSICAL PROPERTIES**

Solid.  
Mixes with water.  
Corrosive.  
Contact with acids liberates toxic gas.

State	Divided solid	Molecular Weight	74.77
Melting Range (°C)	Decomposes.	Viscosity	Not Available
Boiling Range (°C)	Decomposes.	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not applicable	pH (1% solution)	Not available
Decomposition Temp (°C)	Not available	pH (as supplied)	Not applicable
Autoignition Temp (°C)	Not available	Vapour Pressure (kPa)	Not available
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not applicable	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not available	Evaporation Rate	Not available

**Section 10 - STABILITY AND REACTIVITY**

**CONDITIONS CONTRIBUTING TO INSTABILITY**

- Presence of incompatible materials.
  - Product is considered stable.
  - Hazardous polymerisation will not occur.
- For incompatible materials - refer to Section 7 - Handling and Storage.

**Section 11 - TOXICOLOGICAL INFORMATION**

**POTENTIAL HEALTH EFFECTS**

**ACUTE HEALTH EFFECTS**

- Causes burns.
- Risk of serious damage to eyes.
- Ingestion may produce health damage\*.
- \* (limited evidence).

**CHRONIC HEALTH EFFECTS**

- Possible skin sensitiser\*.
- Limited evidence of a carcinogenic effect\*.
- Cumulative effects may result following exposure\*.
- \* (limited evidence).

**TOXICITY AND IRRITATION**

■ Asthma like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non allergic condition known as reactive airways dysfunction syndrome (RAD6) which can occur following exposure to high levels of highly irritating compound.

Hypochlorite salts are classified by IARC as Group 3: NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to infants may produce conjunctivitis.

Hypochlorite salts are extremely corrosive and can cause severe damage to the eyes and skin.

A number of fibrosarcomas and squamous cell carcinomas were observed in mice treated dermally with repeated subcarcinogenic doses of 4-nitroquinoline-1-oxide, followed by dermal treatment with sodium hypochlorite.

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**Section 12 - ECOLOGICAL INFORMATION**

Very toxic to aquatic organisms.  
This material and its container must be disposed of as hazardous waste.  
Avoid release to the environment.  
Refer to special instructions/ safety data sheets.

Ecotoxicity Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
sodium hypochlorite	No Data Available	No Data Available		

**GESAMPIEH8 COMPOSITE LIST - GESAMP Hazard Profiles**

Name / Cas No / RTECS No	EHS	TRN	A1a	A1b	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3
Sodium hypochlorite solutions	1256	2785	Ino	0	0	Ino	(4)	(1)	0	0	1	3	3	8		D	3

contain  
g 20% and  
less but  
more than  
2% NaOCl  
/  
CAS.7681-  
52-9/

**Legend:**  
EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships) NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation, B1=Acute aquatic toxicity LC/EC/CSO (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg), C2=Acute mammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion, D2=Eye irritation & corrosion, D3=Long-term health effects E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference with coastal amenities.  
For column A2: R=Readily biodegradable, NR=Not readily biodegradable.  
For column D3: C=Carcinogen, M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lung injury, N=Neurotoxic, I=Immunotoxic.  
For column E1: NT=Not tainting (tested), T=Tainting test positive.  
For column E2: Fp=Persistent floater, F=Floater, S=Sinking substances.  
The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard.  
(GESAMP/EHS Composite List of Hazard Profiles - Hazard evaluation of substances transported by ships)

**Section 13 - DISPOSAL CONSIDERATIONS**

- Containers may still present a chemical hazard/ danger when empty.
  - Return to supplier for reuse/ recycling if possible.
  - Otherwise:
    - If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
    - Where possible retain label warnings and MSDS and observe all notices pertaining to the product.
- Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.  
A Hierarchy of Controls seems to be common - the user should investigate:
- Reduction.
  - DO NOT allow wash water from cleaning or process equipment to enter drains.
  - It may be necessary to collect all wash water for treatment before disposal.
  - In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.

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Section 13 - DISPOSAL CONSIDERATIONS

- \* Where in doubt contact the responsible authority.
- \* Recycle wherever possible.
- \* Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- \* Treat and neutralise at an approved treatment plant. Treatment should involve: Mixing or slurring in water; Neutralisation followed by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or incineration in a licenced apparatus (after admixture with suitable combustible material)
- \* Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

**Section 14 - TRANSPORTATION INFORMATION**



Labels Required: CORROSIVE

HAZCHEM:  
2X (ADG7)

**Land Transport UNDG:**

Class or division:	8	Subsidiary risk:	None
UN No.:	1791	UN packing group:	II
Shipping Name:HYPOCHLORITE SOLUTION			

**Air Transport IATA:**

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UNID Number:	1791	Packing Group:	II
Special provisions:	A3		
Cargo Only			
Packing Instructions:	30 L	Maximum Qty/Pack:	855
Passenger and Cargo			
Packing Instructions:	1 L	Maximum Qty/Pack:	851
Passenger and Cargo Limited Quantity			
Packing Instructions:	0.5 L	Maximum Qty/Pack:	Y840

Shipping Name: HYPOCHLORITE SOLUTION † 1791

**Maritime Transport IMDG:**

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	1791	Packing Group:	II
EMS Number:	F-A, S-B	Special provisions:	None
Limited Quantities:	1 L	Marine Pollutant:	Yes
Shipping Name: HYPOCHLORITE SOLUTION			

GESAMP hazard profiles for this material can be found in section 12 of the MSDS.

**Section 15 - REGULATORY INFORMATION**

POISONS SCHEDULE 66

**REGULATIONS**

sodium hypochlorite (CAS: 7881-62-8,10022-70-5) is found on the following regulatory lists:  
 "Australia Hazardous Substances", "Australia High Volume Industrial Chemical List (HVICL)", "Australia Inventory of Chemical Substances (AICS)", "China (Hong Kong) Fire Service Department - List of Dangerous Goods", "China Classification and Labelling of Dangerous Chemical Substances", "China Dangerous Chemicals Names List", "China Hygienic Standards for Uses of Food Additives (GB 2760-1996) - List of Processing Assistants Recommended for Use in Food Industry", "China Inventory of Existing Chemical Substances", "GESAMP/IEHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "International Council of Chemical Associations (ICCA) - High Production Volume List", "Japan Chemical Substances Control Law - Existing/New Chemical Substances", "Japan Explosives Control Law (Japanese)", "Japan Food Sanitation Law - Designated Additives",

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Section 16 - REGULATORY INFORMATION

"Japan Industrial Safety and Health Law (ISHL) - Corrosive Liquid (English)", "Japan Marine Pollution and Disasters", "Japan Poisonous and Deleterious Substances Control Law - Cabinet Order (Article 2) Deleterious Substances (Japanese)", "Japan Port Regulations Law (Japanese) - Chemical Liquid Waste", "Korea (South) Existing Chemicals List (KECL)", "New Zealand Hazardous Substances and New Organisms (HSNO) Act - Chemicals (single components)", "New Zealand Hazardous Substances and New Organisms (HSNO) Act - Classification of Chemicals", "New Zealand Hazardous Substances and New Organisms (HSNO) Act - Classification of Chemicals - Classification Data", "New Zealand Inventory of Chemicals (NZIoC)", "OECD Representative List of High Production Volume (HPV) Chemicals", "Philippines Inventory of Chemicals and Chemical Substances (PICCS)", "Taiwan Scope and Application Standards of Food Additives - Sanitizing Agents", "Thailand Harmful Chemicals - List I"

Section 18 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
sodium hypochlorite	7681-52-9, 10022-70-5

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references. A list of reference resources used to assist the committee may be found at: [www.chemwatch.net/references](http://www.chemwatch.net/references).

The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

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This is the end of the (M)SDS.