

# Mine Water Disinfection

# Why Disinfect ?

- Faecal Contamination
  - Pathogens
  - Cholera
  - Hepatitis
- Productivity of workforce
- Clarification does not remove microorganisms

# Methods Applied

- Mechanical (Ultraviolet)
- Chemical (Oxidising)
  - Ozone
  - Chlorine based
    - HTH
    - Chlorine gas
    - Sodium Hypo (jik)

# Methods Continued

- Chlorine / Bromine

- Hypo plus bromine
- BCH



- Pathogens negatively charged

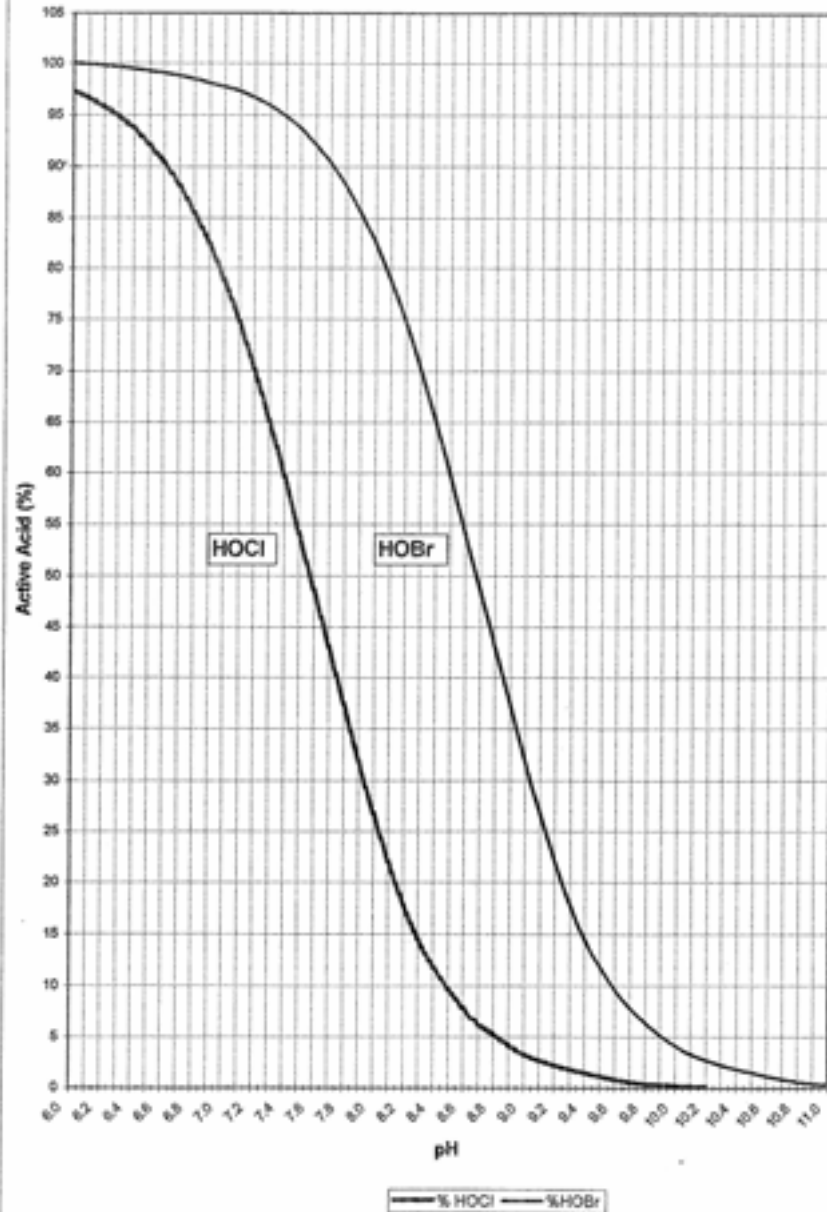
# Diagrams

pH Dependency

Control limits

### Dissociation Curves of Hypobromous and Hypochlorous Acids

pH	% HOCl	% HOBr
6.0	97.39	100.00
6.1	96.70	99.95
6.2	95.85	99.85
6.3	94.90	99.70
6.4	93.65	99.50
6.5	92.15	99.30
6.6	90.35	99.10
6.7	88.15	98.85
6.8	85.50	98.50
6.9	82.40	98.10
7.0	78.85	97.75
7.1	74.80	97.30
7.2	70.25	96.70
7.3	65.20	95.90
7.4	59.70	94.90
7.5	54.15	93.75
7.6	48.65	92.15
7.7	43.10	90.35
7.8	37.45	88.15
7.9	31.90	85.50
8.0	26.80	82.40
8.1	22.10	78.85
8.2	17.85	74.80
8.3	14.50	70.25
8.4	11.85	65.20
8.5	9.65	59.70
8.6	7.85	54.15
8.7	6.25	48.65
8.8	5.30	43.10
8.9	4.20	37.45
9.0	3.39	31.90
9.1	2.70	26.80
9.2	2.25	22.10
9.3	1.85	17.85
9.4	1.50	14.50
9.5	1.15	11.85
9.6	0.85	9.65
9.7	0.60	7.85
9.8	0.40	6.40
9.9	0.35	5.15
10.0	0.25	4.10
10.1	0.20	3.30
10.2	0.15	2.70
10.3		2.25
10.4		1.85
10.5		1.50
10.6		1.15
10.7		0.85
10.8		0.60
10.9		0.40
11.0		0.30



# How much ?

- What do we want to achieve?
  - Pathogen free water in the stope
- Residual required
  - ppm Free Chlorine
  - Depends on system
  - Adhere to safe limits
  - Test for indicators
  - Balance with economics

# Free available chlorine (Residual)

FREE AVAILABLE CHLORINE (mg/l)	DRINKING		FOOD PREPARATION	BATHING	LAUNDRY
	(Health)	(Aesthetic)			
<0,05	 Serious risk of infection if raw water source microbiologically contaminated	 No effects	 Serious risk of infection if raw water source microbiologically contaminated	 Risk of infection if raw water source microbiologically contaminated	 No effects
0,05-0,1	Disinfection may be compromised	No effects	Disinfection may be compromised	Slight risk of infection	No effects
0,1-0,2	Slight risk of infection	No effects	Slight risk of infection	Insignificant risk of infection	No effects
0,2-0,3	Insignificant risk of infection, disinfection adequate	Slight odour	Insignificant risk of infection, disinfection adequate	No health risks	No effects
0,3-0,6	Disinfection good	Slight odour and taste	Disinfection good	No health risks	No effects
0,6-0,8	Disinfection good; insignificant risk of health effects	Marked odour and disinfectant taste	Disinfection good; insignificant risk of health effects	No health effects, marked odour	Insignificant effects
0,8-1,0	Slight risk of mucous membrane irritation	Unpleasant odour and taste	Slight risk of mucous membrane irritation	Unpleasant odour	Insignificant effects
1,0-1,5	May cause nausea and mucous membrane irritation	Unpleasant odour and taste	May cause nausea and mucous membrane irritation	May cause skin rashes; unpleasant odour	Bleaching action on some dyes
> 1,5	Danger of toxic effects, nausea and vomiting	Repulsive odour and taste	Danger of toxic effects, nausea and vomiting at high concentrations	Danger of toxic effects and severe skin irritation	Bleaching action on coloured clothing at high concentrations






■ Blue - Ideal   
 ■ Green - Good   
 ■ Yellow - Marginal   
 ■ Red\* - Poor   
 ■ Purple\* - Completely unacceptable

\*Not to be used without treatment

# Indicator Organisms

- Total Bacterial Count (TBC)
  - Organisms per ml ( $<100$ )
- Total Coliforms
  - Organisms per 100 ml ( $<10$ )
- E-Coli or Faecal Coliforms
  - Organisms per 100 ml (zero)

# Total coliforms guideline

TOTAL COLIFORMS RANGE (Counts/100 m.)	DRINKING		FOOD PREPARATION	BATHING	LAUNDRY
	(Health)	(Aesthetic)			
0	 No detectable chance of infection	 No effects	 No detectable chance of infection	 No effects	 No effects
0-10	Insignificant chance of infection	No effects	Insignificant chance of infection	Insignificant effects	Insignificant effects
10-100	Clinical infections unlikely in healthy adults, but may occur in some sensitive groups	No effects	Clinical infections unlikely in healthy adults, but may occur in some sensitive groups	Insignificant effects	Insignificant effects
100-1000	Clinical infections common, even with good off consumption	No effects	Clinical infections common, even with good off consumption	Slight risk	Slight risk
>1000	Serious health effects common in all users	No effects	Serious health effects common in all users	Possibility of infection	Possibility of infection

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# Faecal coliforms guideline

FAECAL COLIFORMS RANGE (Counts/100 ml)	DRINKING		FOOD PREPARATION	BATHING	LAUNDRY
	(Health)	(Aesthetic)			
					
0	No detectable chance of infection	No effects	No effects	No effects	No effects
0-1	Insignificant chance of infection	No effects	Insignificant chance of infection	Insignificant effects	Insignificant effects
1-10	Clinical infections unlikely in healthy adults, but may occur in some sensitive groups	No effects	Clinical infections unlikely in healthy adults, but may occur in some sensitive groups	Insignificant effects	Insignificant effects
10-100	Clinical infections common, even with once-off consumption	No effects	Clinical infections common, even with once-off consumption	Slight risk	Slight risk
>100	Serious health effects common in all users	No effects	Serious health effects common in all users	Possibility of infection	Possibility of infection

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# Factors affecting results

- System hygiene
  - Toilets / gestures
- Suspended solids
- Oil and organics
- Contaminants
  - Nitrite
  - Iron