Quantum
Filtration Medium

2014 USERS GUIDE – PERFORMANCE SPECIFICATIONS AND MSDS

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DMI-65

9/16/2014

DMI-65 Product Specification and Performance Guide

DMI-65 is the most powerful Advanced Oxidation Catalytic Material for Removing Manganese, Iron, Arsenic and other Heavy Metals from water sources. Easy to Use and Operate, DMI-65 is the lowest cost and most environmentally sustainable heavy metals removal technology available – lasting up to 10 years. DMI-65 has greater load capacities than other medias making DMI-65 filter run times longer and reduced spent backwash water. Providing a means for World Health Organization Standards of Drinking Water Quality and Strategic Bio Fouling Protection for Reverse Osmosis and Micro and Nano Filtration Technologies.

2014 USERS GUIDE – Performance Specifications and msds

REMOVING IRON VIA CONTINUOUS INJECTION OF SODIUM HYPOCHLORITE THROUGH DMI-65

The reaction of ferrous bicarbonate and sodium hypochlorite is instantaneous. When the reaction takes place, the crystalline structure of ferric hydroxide [Fe $(OH)_3$] is not in the form of [□–FeOOH] with its continuous auto catalytic action.

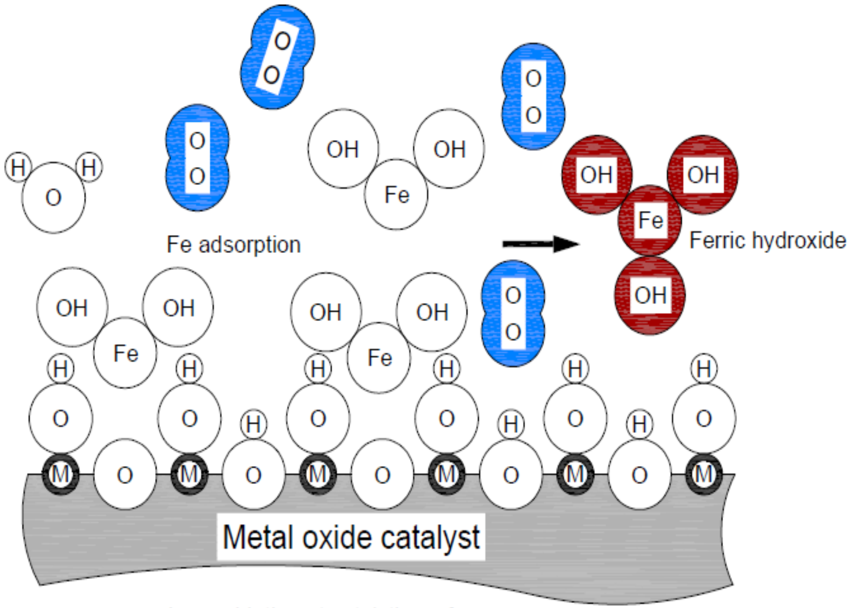
(a) $Z - [MnO.Mn_2O_7] + 4Fe(HCO_3)_2 + 5H_2O$

$\rightarrow Z - [MnO(OH)_2]_3 +^1 [Fe(OH)_3]_4 + 8CO_2$

(b) $2Fe(HCO_3)_2 + NaOCl + H_2O$

$\rightarrow 2Fe(OH)_2 \downarrow + 2CO_2 + NaCl$ (Where Z is the DMI-65)

Both reactions (a) and (b) take place as depicted, but the greater part of iron is removed by reaction (b). The ferric hydroxide is thus removed in the surface layers of the DMI-65 with sodium hypochlorite as the catalyst.



Iron oxidation at catalytic surface.

- M: Generic metal ion in the catalytic surface lattice (M^{n+}); n=1,2......
- O: Oxygen atom or ion (O^-) Fe: iron atom or ion (Fe^{2+}, Fe^{3+})
- H: Hydrogen atom or ion H^+ OH: Hydroxide or hydroxyl anion (OH^-)
- H_2O: Water molecule shown as tangent circles $Fe(OH)_2$: Ferrous Hydroxide is shown as tangent circles
- $Fe(OH)_3$: Ferric Hydroxide shown as tangent circles red color O_2: Oxygen molecule, atoms shown at covalent bonding distance, blue color

REMOVING MANGANESE VIA CONTINUOUS INJECTION OF SODIUM HYPOCHLORITE THROUGH DMI-65

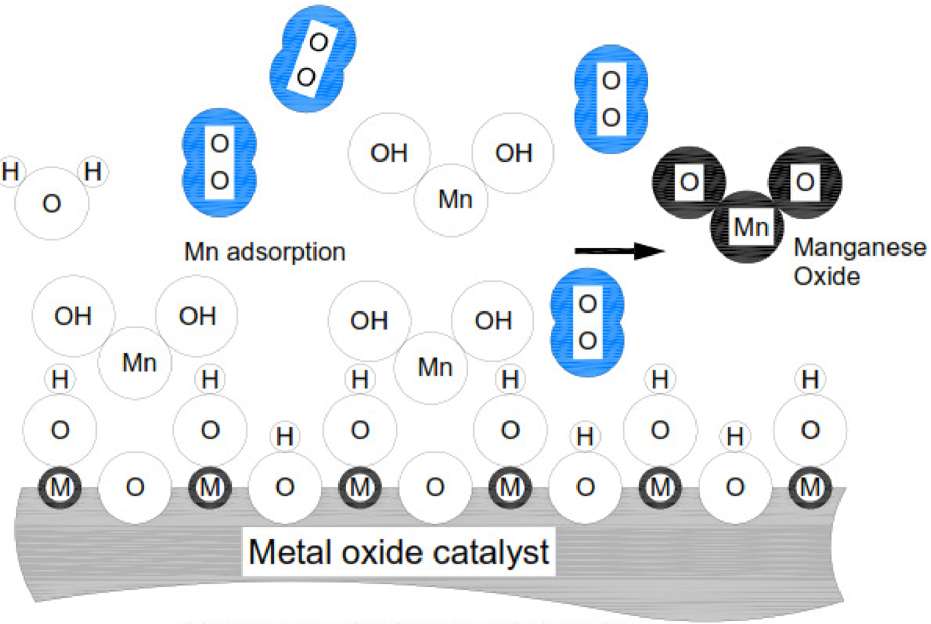
Like iron, manganese exists in bore water as bicarbonate. Manganese, however, oxidises less readily than iron. Natural oxidation of iron occurs at a pH of 6.7 or greater, while for manganese the pH must be 8 or greater. To oxidise and remove manganese at a pH of around 7 calls for DMI-65 as an oxidation catalyst, and an oxidant such as sodium hypochlorite.

(a) $Z - [MnO.Mn_2\,O_2] + 2Mn(HCO_3)_2 + 3H_2O$
$\rightarrow Z - [MnO(OH)_2]_5 + 4CO_2$

(b) $Z - [MnO(OH)_2] + Mn(HCO_3)_2 + NaOCl$

$\rightarrow Z - [MnO(OH)_2]_2 + 2CO_2 + NaCl$ (Where Z is DMI-65)

Reaction (a) only occurs at the outset. Once $[MnO.Mn_2O_7]$ has been converted entirely to $[MnO(OH)_2]$ reaction (b) causes the manganese to be removed. In other words, just as in the removal of iron using DMI-65, $[MnO(OH)_2]$ draws on continuous auto catalytic action.



Manganese oxidation at catalytic surface.

- M: Generic metal ion in the catalytic surface lattice (M^{n+}); n=1, 2......
  - O: Oxygen atom or ion (O^-)
  - Mn: Manganese atom or ion (Mn^{+})
  - H: Hydrogen atom or ion (H^{+})
  - OH: Hydroxide or hydroxyl anion (OH^-)
  - H_2O: Water molecule shown as tangent circles
  - $Mn(OH)_2$: Manganese Hydroxide is shown as tangent circles
  - MnO_2 : Manganese Oxide (or higher valence) shown as tangent circles black color
  - O_2 : Oxygen molecule, atoms shown at covalent bonding distance, blue color

REMOVING ARSENIC VIA FERRIC CHLORIDE DOSING AND CONTINUOUS INJECTION OF SODIUM HYPOCHLORITE THROUGH DMI-65

In the case of drinking water treatment where the requirement is to reduce arsenic to a few parts per billion, the applicable technologies are limited. This letter mentions briefly the aqueous inorganic chemistry of arsenic and the common method that has been successfully applied commercially in the water treatment industry. Low cost removal of arsenic from drinking water is likely to be confined to precipitation and adsorption, and then where the Quantum material DMI-65 is used as the catalytic material to filter the arsenic precipitates.

PRECIPITATION OF ARSENIC

The most common methods of removing arsenic from aqueous process streams are by precipitation as ferric arsenate. Arsenic (V) can also be precipitated from process solutions below about pH=2 with iron(III) to form ferric arsenate, $FeAsO_4.2H_2O$, which is white to very pale green in colour. Iron (II) arsenates are less soluble and more stable in the neutral pH region than ferric arsenate. Iron(II) arsenate is of particular interest as a low solubility material and this compound has recently been the basis of a process developed and successfully demonstrated in a variety of applications. The Fe(II)-Fe(III) hydroxy sulfate (known as "green rust")
has been shown to incorporate arsenic into the structure at pH<7.

ADSORPTION OF ARSENIC ON FERRIHYDRATE

Over many years there has been much attention directed to the removal of arsenic from hydrometallurgical process solutions and waste waters by precipitation and co-precipitation with iron(III). Various complexes are formed in the adsorption of As(V) on ferrihydrite; at pH>7. Arsenic(V) is adsorbed to ferrihydrite as a strongly bonded innersphere complex. However the optimal adsorption of arsenic(III) on ferrihydrite occurs at pH 8-9.

DMI-65 CATALYTIC FILTER MEDIA REMOVES ARSENIC THROUGH CHEMICAL COMPLEX WITH IRON

So it is understood by introducing a flocculating agent such as ferric chloride solution at concentration ratios of up to 50 parts ferric chloride as iron to one part arsenic will overwhelm the arsenic and causing the arsenic and iron to form a complex. We use $FeCl_3$ to for a bond and with Arsenic, and as DMI-65 has a high efficiency of iron removal, it is possible to remove the arsenic through the retention of precipitated arsenic that has formed a complex with iron introduced from the ferric chloride.
Overall, Quantum's knowledge based on results from the attached two attached reports indicate that the DMI-65 is very successful in removing arsenic and possible to undetectable limits. Note performance increases with the increase in iron content in pre-treated water and decreased with the increase in flow rate.

ACTIVATION OF DMI-65 FILTER, INITIAL ADJUSTMENT – SETUP GUIDE

Sodium hypochlorite is used to activate DMI-65 filtration medium. The following method is typically used.

DMI-65 is poured into the filter unit. Clean water is added to fill the filtration unit. A solution of 12% sodium hypochlorite is then introduced into the unit in a ratio of 10 kg of sodium hypochlorite to 1m^3 of DMI-65. The mixture is then lightly agitated and the wash valve opened to drain off the water until the water is at the level of the surface of the filtration medium. The wash valve is then closed. The DMI-65 is then soaked for at least 3 hours. The longer the soaking, the better.

The wash valve is then opened and all the water is drained from the system. The medium is then backwashed. Sodium hypochlorite or chlorine in double the ratio used above is continuously injected while backwashing. This process should continue until the manganese concentration falls to 0.3 ppm or less. The time taken for this to occur is usually between 20 and 40 minutes.

Once the manganese concentration has fallen to 0.3 ppm or less, the injection of hypochlorite or chlorine is adjusted to bring the level of residual chlorine to between 0.1 and 0.3 ppm in the filtrate. The use of a reducing agent such as sodium thiosulphate may be necessary to neutralise high levels of residual chlorine when draining of the backwash water is not possible.

Hypochlorite and chlorine are in a chemical equilibrium in water; the position of the equilibrium is pH dependent and low pH (acidic) favors chlorine.

Cl2 + H20 n H+ + Cl + HClO.

Therefore the 12.5% solution of chlorine, at a ratio 10kg per 1m3 of DMI-65, which is used to condition the DMI-65 will naturally be at a low pH.

Residual Chlorine in the wastewater from conditioning and soaking in chlorine and also the initial backwash water is at several hundred ppm and highly acidic and low pH. When draining is possible of this wastewater is possible, a reducing agent such as sodium thiosulphate should be used to neutralize the chlorine. When there is a high concentration of ammonia in the raw water another method such as the continuous injection of caustic soda may be required.

Addition of chlorine to water gives both hydrochloric acid (HCl) and hypochlorous acid and inevitably will lower pH. Cl_2 +

H_2O HClO + HCl.

Because the pH scale is logarithmic, pH 6 is 10 times more acidic than neutral pH 7. And pH 5 is 100 times more acidic than neutral. This means during the soaking and conditioning procedure when 10 liters of chlorine (12.5%) per 1m3 of DMI-65 is lowering pH to less than pH 3, we can estimate the solution is more than 10000 times more acidic than neutral.

However during service mode, a volume of say 10 liters of chlorine (12.5%) per 1m3 of DMI-65, highly acidic to lower the pH to less than pH 5.8, will never occur with programmed chemical dosing pumps collaborated and fitted to maintain a continuous injection of chlorine and pH range control. It's definitely wise to have monitoring system and alarm in place to keep the chlorine residual levels at 0.1 -0.1 mg/L and a neutral pH.

As long as the pH is not abnormally lower than pH 5.8 for long period of service, It will not damage the DMI-65.

The DMI-65 is primed in water after it is poured (approx. 10 minutes). It is then backwashed (approx. 30 minutes). After backwashing, at least 10 ppm over the theoretically required volume of sodium hypochlorite is introduced while washing and draining, until the manganese concentration falls to 0.3 ppm. The time it takes for the DMI-65 to be activated will differ substantially according to either the water quality of the raw water, or the amount of chlorine introduced.

STEP BY STEP PROCEDURE FOR CONDITIONING AND ACTIVATING DMI-65

1. Fill the filter vessel half of its height or internal volume, or a little more, with clean water and add a minimum of 10 liters of a sodium hypochlorite, 12.5% NaClO per cubic meter of DMI-65. This is about the same as 10 fl oz of chlorine (12.5%) per cubic foot of DMI-65.
   See the supplied calculator named "Initial Chlorine Required for Soaking DMI-65 at Set up Stage"

2. Pour the DMI-65 into the upper hole of filter. Bed depth has to be according to filter bed design depth (minimum 600 mm or 24") plus approximately 5%. Usually, 40% free board above the DMI-65 is needed for bed expansion during backwash. If water level is not well above the DMI bed add more clean water.
   See the supplied calculator named "LV-SV Calculator" to calculate volume and bed depth required.

3. Let the DMI-65 filter bed soak in the chlorine solution for 3 hours or more. The longer the DMI-65 is left to soak the better. The DMI-65 may be left to soak overnight or even perhaps over the weekend.

4. The initial water and chlorine solution used for soaking and conditioning the DMI-65 is at several hundred ppm. When draining is not possible, a reducing agent such as sodium thiosulphate should be used to neutralize the chlorine before discarding to waste.

5. Backwash the DMI-65 while continually injecting chlorine solution. The backwash velocity should be about 30 to 40 m3 / m2 / hour depending on the bed depth. This is about 12 – 15 gpm / square foot. Ensure that the residual chlorine level in the backwash water is minimum 0.2 ppm and not higher than maximum intended concentration for treated water. Keep backwashing the DMI-65 until the residual manganese (Mn) in the backwash water is less than 3 times the Maximum Contaminant Limit (MCL) of your region. For example, in the USA the MCL for Mn is 0.05 mg/L. Therefore the DMI-65 needs to be backwashed until the residual Mn reads less than 0.15 ppm (0.05 x 3 = 0.15 mg/L).

6. Ensure that the back wash velocity is sufficient enough to expand and raise the DMI-65 so that the very fine material is removed from the bed. During the early stages of the backwash there will be many fine black particles removed and the backwash water will be of a dark colour. During the later stages of the backwash, the water will become clearer, depending on the volume of DMI-65, the time this takes can be some number of hours. Monitor the residual Mn level until it has fallen below, "three times the MCL".

7. Turn the filter to Rinse Mode. This water must be discharged to waster until the residual Mn levels fall below the MCL. This limit may vary from country to country.

8. Once the residual Mn level of water has fallen below the local MCL in the Rinse Mode turn the filter to Service Mode. Start the Service Mode while at the same time continually injecting chlorine. Total free chlorine may be reduced if needed. However, ensure that there is always free chlorine residual in the treated water. Running with residual free chlorine of less than 0.1 ppm is not recommended. Service flow rate will be about 5 m3 – 20 m3 / m2 / hour or 2 – 8 gpm per square foot. This depends on filter bed depth and water quality.

9. Checking Water Quality

In case Iron (Fe) and Manganese (Mn) is found to be contained in the effluent water, at greater than MCL, please check the following:

- Is there dissolved oxygen present?
- Is the pH abnormally low?
- Is the DMI-65 filter bed being backwashed adequately?
- Is the DMI-65 old?
- Is there been an equipment failure such as chemical dosing system?

10. Please check to make sure that the following elements below are not in high concentrations in the raw water. If these elements are high in concentrations please contact Quantum or your local DMI-65 agent.

- Salt
- Ammonia
- Silica
- Calcium and Magnesium (excessive hardness)

EXCERCISING CARE WITH WATER QUALITY

The DMI-65 consists of a resin of manganese dioxide and silica sand which have been alternately reacted with Fe^{++} and NaOH to form a film infused on the under surface of the resin. The DMI-65 film will therefore may degenerate if the water has low pH or there is no dissolved oxygen present. The filter medium is maintained in a state of permanent activation by catalysis of Fe^{++} with NaOH.

The diameter of particles trapped by typical DMI-65 is between 6□□ and 10□. Care must therefore be exercised when the pH of the raw water is abnormally low. Substantial amounts of particles of diameter 2□ or less are capable of passing through the DMI-65.

DMI-65 is used as a catalytic filter medium when the raw water contains manganese.

Care must be exercised in the use of DMI-65, given that manganese itself has a higher tendency than iron to ionise. When there is no oxidant in the water, manganese is exchanged for iron in the water and the DMI-65 steadily loses its ability to remove manganese.

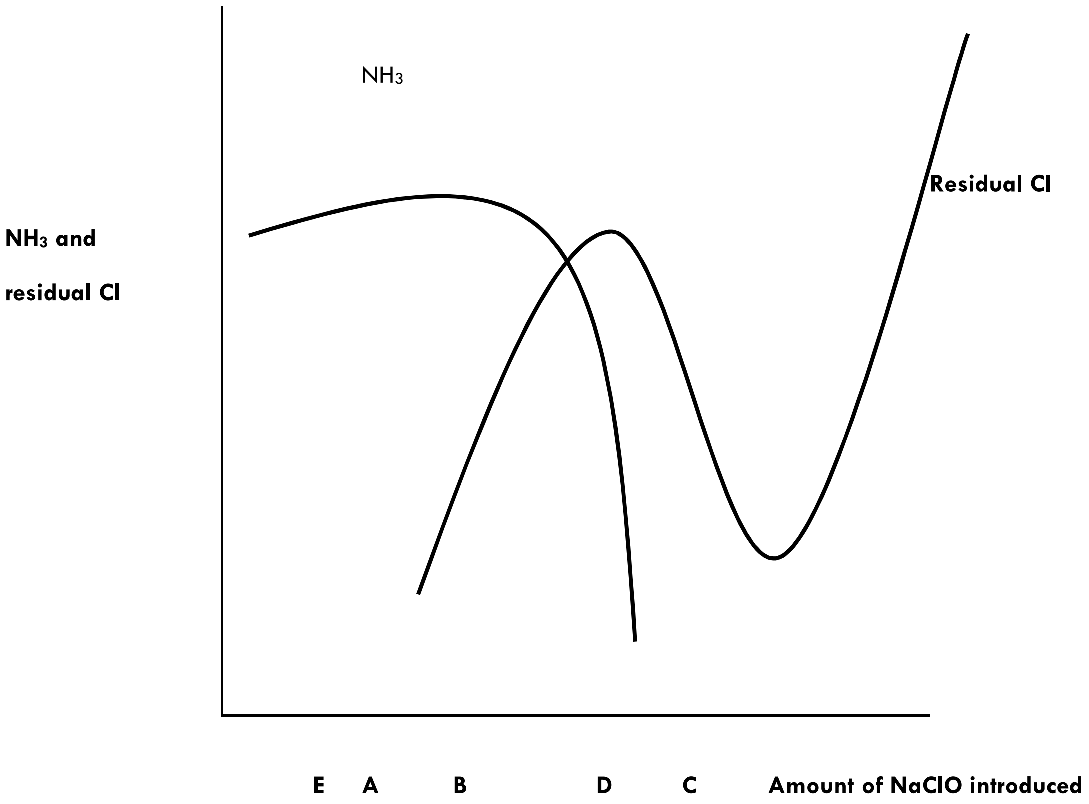
When removing manganese using sodium hypochlorite, if the raw water contains ammonia, the following reactions will occur.

$$NH_3 + NaCL \rightarrow NH_2CL + NaOH$$

$$NH_3 + 2NaCLO \rightarrow NHCL_2 + 2NaOH$$

The reactions generate chloramine, which reduces oxidisation capability and wipes out the ability to remove manganese. When it occurs, the phenomenon must be addressed with discontinuous treatment and an injection of chlorine some ten times the volume of ammonia nitrogen.

Nor will the above method remove manganese in the presence of chemical agents that form strong chelates. Manganese cannot therefore be removed without the treatment method being adjusted to suit the water quality, such as adjusting the amount or type of chemical agent introduced. Hypo-oxidation proceeds in the order of, iron, ammonia, and finally manganese, which means that the amount introduced must be increased until sufficient oxidation of ammonia has occurred. If the amount introduced is insufficient, the chloramine generated will react to ortho-tolidine, and the residual chlorine will follow the relationship to ammonia shown in the graph, over the page.



AMMONIA Vs RESIDUAL CHLORINE

As depicted in the graph, residual chlorine has the same value at both points A and C, but at point A it is bonded, which means that it manifests as chloramine. Chloramine is unable to oxidise manganese.

The residual chlorine at point C is free chlorine, and is effective against manganese.

At point B at which residual chlorine is a maximum, ammonia is still present and the residual chlorine is chloramine.

At point D ammonia is zero and residual chlorine has also decreased.

Manganese is removed by free chlorine generated beyond this point.

At point E there is sufficient hypochlorite to oxidise iron, and chloramine has not yet been generated.

The difference between chloramine and free chlorine can be determined by the presence of residual ammonia in the treatment water. Fortunately, there are also slight differences in the speed at which the reaction of ortho-tolidine proceeds. Bonded chlorine will react in two or three seconds, causing colour to darken, while free chlorine causes colour change in less than a second.

REFERENCE EXAMPLES

SAINT JOHN OF GOD & FMG CLOUDBREAK MINE

EXAMPLE 1- SAINT JOHN OF GOD HEALTH CAMPUS

3 x 48" DIAMETER TOWER METHOD OF REMOVING IRON AND MANGANESE

(Continuous injection of sodium hypochlorite)

	IRON (ppm)	MANGANESE (ppm)	pH
RAW WATER	11.4	0.49	6.4
TREATMENT WATER	0.001	0.008	6.4

METHOD

FILTRATE MEDIUM	DMI-65 Media - bed depth of 1000mm and volume of 6.85m3 Approximately 10,000kg of media.
FILTERING SPEED	LV 8.49 m3 / m2/ hr
BACKWASH SPEED	LV 30 m3 / m2 / hr
BACKWASH CYCLE	10 minute period, once every 24 – 48 hours.

EXAMPLE 2 – FORTESCUE METALS GROUP CLOUDBREAK

SINGLE TOWER METHOD OF REMOVING IRON AND MANGANESE

(Continuous injection of sodium hypochlorite)

	IRON (ppm)	MANGANESE (ppm)	pH
RAW WATER	1.8	0.939	7.1
TREATMENT WATER	0.001	0.02	7.1

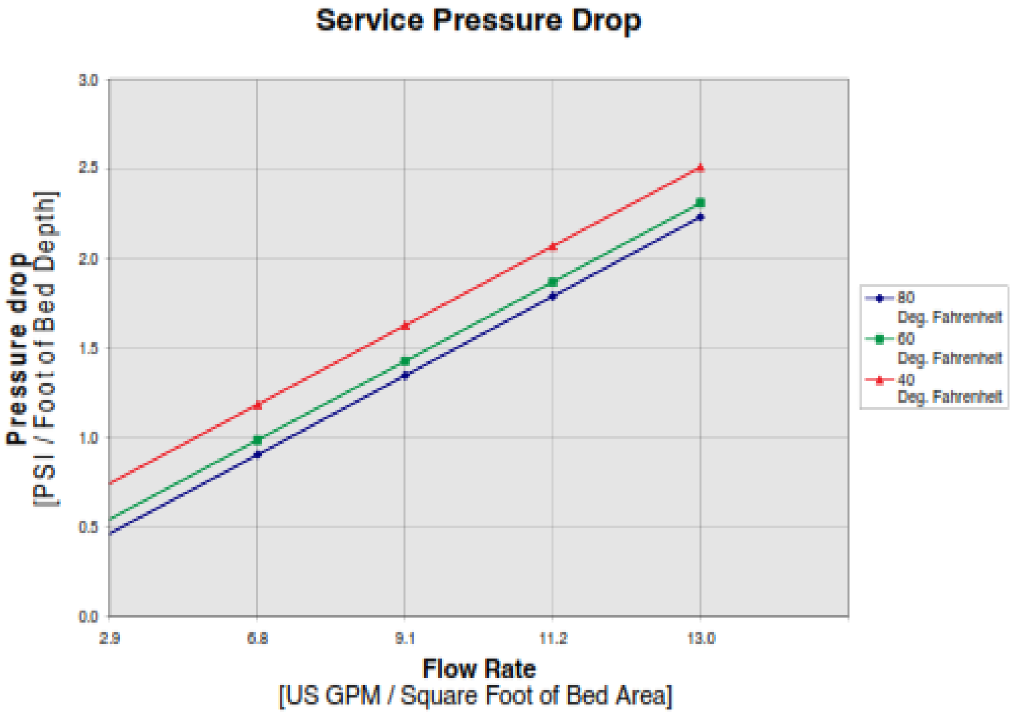
METHOD

FILTRATE MEDIUM	DMI-65 Media – Approximately 2,000kgs and bed depth of 900mm
FILTERING SPEED	LV 9 m3 / m2 / hour
BACKWASH SPEED	LV 27 m3 / m2 hour
BACKWASH CYCLE	Automated to backwash after a pressure drop in head pressure of 50kpa or for 10minutes once every 24 – 48 hours.

DMI-65 PRODUCT SPECIFICATIONS

DMI-65 ADVANCED OXIDATION PROCESS CATALYTIC MEDIA

CERTIFIED: *NSF ANSI-61* WATER QUALITY ASSOCIATION OF THE USA. *FOR SAFTEY AND HEALTH EFFECTS FOR DRINKING WATER COMPONENTS*	
CERTIFIED: DRINKING WATER INSPECTORATE OF THE UNITED KINGDOM: *REGULATION 31- WATER QUALITY – DRINKING WATER - APPROVED*	
COLOUR	Brown to Black, Golden Sheen under Microscope
INFUSION TECHNOLOGY	Catalytic layers are infused into the substrate matrix material – not just a coating, like other medias, DMI-65 unique infusion technology lasts longer
POWERFUL LOAD CAPCITY	18,000 grains of oxidised Fe and Mn per square foot of DMI-65, at LV 10m3/m2/hour, allows for 50% greater filter run times.
OXIDATION BOOSTER	Catalytic Surface is the strongest oxidizing booster that is the most efficient material in the world to remove Mn to undetectable levels.
Specific Gravity	2.69
Effective Size	0.35 - .65mm
Uniform Coefficient	1.4 to 1.7
Mesh size	20 - 40
Attrition Loss per annum less than	2%
Water pH range	5.8 – 8.6
Optimum pH Performance	7.0 – 8.0
Maximum water T	60 degrees C
Freeboard	40% of bed depth (min)
Regeneration	**No regeneration required**
Service flow rate	5 – 20 m^3/m^2 hr
Backwash flow rate	Between 25 – 40 m^3/m^2 hr
Backwash bed expansion	Between 15 – 50%
Expected Life Span	Up to 10 years continuous use.


Service Pressure Drop
Pressure drop
[PSI / Foot of Bed Depth]
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2.9
6.8
9.1
11.2
13.0
Flow Rate
[US GPM / Square Foot of Bed Area]
80 Deg. Fahrenheit
60 Deg. Fahrenheit
40 Deg. Fahrenheit


Backwash Bed Expansion
Backwash Bed Expansion
[Percent of Bed Depth]
70%
60%
50%
40%
30%
20%
10%
0%
0
5
10
15
20
Flow Rate
[US GPM / Square Foot of Bed Area]
80 Deg. Fahrenheit
60 Deg. Fahrenheit
40 Deg. Fahrenheit

RECOMMENDATIONS FOR WATER TREATMENT PLANTS USING DMI-65

Flow, Pressure, Water Velocity

The characteristics of DMI 65 filter media are such that the DMI 65 is easy to use and provides flexibility when upgrading old water treatment systems. DMI 65 can be used in existing systems typically by just replacing the ordinary sand or similar materials used for mechanical filtration or for removal of iron and manganese through catalytic oxidation.
The filters using DMI 65 filter media have three modes of operation, the same as ordinary sand filters: Filtration mode,

Backwash mode and Rinse mode.
We relate the pressure drop to velocity of the water through the cross sectional area of the filter because its usefulness and simplicity of relating the data to flow rate. The flow rat "Q" in **cubic meters per hour** can be calculated by multiplying the velocity 'v" in **meters per hour** by the filter area "*A*" in **square meters.**

Q = *v* x *A*
Water temperature during test for the data in the charts was **24° C.**

1) Filtration mode
Pressure drop for initial clean filter depends on the depth of the filter media bed and water velocity. The chart below shows the pressure drop for 1 meter bed depth. For other bed depth the pressure drop can be considered linearly dependent on bed depth. Thus, to find out the pressure drop for 0.6 m bed depth we multiply the value for pressure drop found in the chart by 0.6.

Filter media depth needed increases with the decrease in the amount of residual iron and manganese allowed in the filtered water. Maximum bed depth could be just over 1 meter and relates also to the flow capacity of the system and effective height of available filters.

Water velocity through the filter should be selected in accordance with the usage of the filtered water, size of water treatment plant, water quality and other factors.
Clean Filter - Pressure Drop for 3.3 feet bed depth

For large drinking water treatment plants the depth of the bed should be selected towards the maximum and the water velocity around 5 m/hr, in any case not more than 10 m/hr. This maximizes performance in removing iron and manganese, reduces the frequency of backwashing, reduces power consumption because average pressure drop is lower, and could provide redundancy in case one of the filters is out of order and higher flow rate has to be put through the remaining filters.

The upper limit of velocity, up to 30 m/hr should be used for small bed depth and larger allowed amount of residual iron and manganese in the filtered water.

2) Backwash mode
Total pressure drop through the filter before backwashing is recommended to be maximum 100 kPa. The granules of DMI 65 filter media are porous. The larger the pressure drop, the larger compaction forces are applied to the filter media. The interaction between filter media particles during alternated compaction under normal service and expansion of the bed during backwashing leads in time to deterioration of granules. Backwashing the filter when the pressure drop has increased by 50 kPa from the initial clean filter pressure drop is a good reference. Higher or lower values could be set depending on the application and how long the filter media has to last before changing it. Note that the filter media would not loose significantly the effectiveness in removing the iron and manganese but the pressure drop through clean filter bed will increase.

Water velocity for backwashing the filter is limited to 80 m/hr. This is the same as recommended for ordinary sand filtration. Although it is possible to use not filtered water for backwashing in general this is not a good idea unless the water is relatively clean and the system is set up with a rinse operating mode in addition to filtration and backwashing.
At low backwashing velocity longer backwashing time is needed. In general backwashing velocity should be twice the filtration velocity.

Backwashing time should be determined by using a site glass on the discharge backwash line or in some other way observe when the backwash water discharged is satisfactorily clean. Backwashing time could vary from a few minutes to 15 minutes.

3) Rinse mode
This mode follows backwashing to remove the contaminant solids that would exit the filter before the filter bed is compacted back and operates normally. This mode is not necessary to be implemented in all water treatment systems.
Rinse time should be around 30 seconds for small bed depth and 1 minute or a little more for upper limit of bed depth. Obviously the required time could be found by checking the presence of contamination in the filtered water when starting over normal filtration operation.

MATERIAL SAFETY DATA SHEET (MSDS)

IN EMERGENCY - CONTACT THE POISONS INFORMATION CENTRE

(Telephone Number: 131126)

Date issued: **18th September 2014**

GENERAL

Product name: **DMI-65**

Producer: **QUANTUM FILTRATION MEDIUM Pty Ltd**
Address: 5341 Mungalup Road, Collie WA, Australia 6225

Postal Address: PO BOX 409 Collie WA, Australia, 6225.

Telephone: +61 1300 303 281

Emergency Telephone: +618 97343 641

Email: info@dmi65.com

ACN: 099 362 026 ABN: 09 099 362 026

IDENTIFICATION

HS Code: 25 05 10

Other product names: **De Iron De Manganese water filtration media**
Synonyms **Silica Sand/Crystalline Quartz/ Quartz/ Silicon Dioxide**
Appearance: **Dark granules**
Uses **Water filtration sand media**
Manufacturers Code: **Not Applicable**
U.N. Number: **None Allocated**
Dangerous Goods Class: **None Allocated**
Subsidiary Risk: **None Allocated**
Hazchem Code: **None Allocated**
Poison Schedule **None Allocated**
Packaging Group **None Allocated**
EPG **None Allocated**
Sub-tert risk **None Allocated**

INGREDIENTS

CHEMICAL ENTITY	CAS NO.	PROPORTION
Quartz / Silicon Dioxide (SiO2)	**14808.60-7**	**> 90 %**
Microcline (KAlSiO3O8)	**Not available**	**< 9**
Bixbyite (Mn2O3)	**Not available**	**< 1**
Calcite (CaCO3)	**471.34-1**	**< 0.1**

PRECAUTIONS FOR USE

EXPOSURE STANDARDS:

Unless specified otherwise, limits are expressed as milligrams of substance per cubic metre of air (mg/m3). 8 hour time weighted averages (TWA). Limits for cristobalite & tridymite (other forms of crystalline silica) are equal to one-half of the limits for quartz.

Respirable crystalline silica (quartz):
ACGIH TLV, OSHA PEL, & MSHA – proposed PEL = O.1 mg/m³

Respirable dust:
MSHA = 10 mg/m³ (% respirable quartz + 2).

Total dust;
MSHA = 30 mg/m³ (% quartz +3).

Other particulates:

ACGIH TLV	**= 10 mg/m³ (total particulates, not otherwise classified)**
OSHA PEL	**= 5 mg/m³ (respirable dust, not otherwise regulated)**
	= 15 mg/m³ (total dust, not otherwise regulated)
MSHA	**= 10 mg/m³ (total “nuisance” dust)**
MSHA - proposed	**= 5 mg/m³ (respirable mine dust)**

At this point in time there is a discrepancy in the standards for respirable quartz levels, of either 0.1 mg/m³ or 0.2 mg/m³. The interim National Standard is currently 0.2 mg/m³.

ENGINEERING CONTROLS:

This product should not be used as an abrasive blasting medium.
It is currently illegal to use it, both in Wet and Dry Blasting in Western Australia.

Follow protective controls set forth in this MSDS when handling this product. Respirable quartz – containing dust may be generated during processing, handling, and storage.

VENTILATION:

Local exhaust or general ventilation adequate to maintain exposures below appropriate exposure limits.

PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT

PPE: **Personal Protective Equipment is normally required.**
When using large quantities or where heavy contamination is likely, wear dust proof goggles and PVC, rubber or cotton gloves.
Where an inhalation risk exists, wear a Class P1 (Particulate) respirator.
At high dust levels, wear a Powered Air Purifying Respirator (PAPR) with Class P 3 (Particulate) filter, an Air-line respirator or a Full-face Class P3 (Particulate) respirator.

RESPIRATORY:

The following is a Respiratory Selection Guide as per Worksafe:

Quartz Level	**AS 1715 – 1991**
Under 0.1 mg/m^3	**Respirator optional**
0.5 mg/m^3	**Disposable type, Class P1**
1.0 mg/m^3	**Disposable or replaceable filter type**
10.0 mg/m^3	**Filter type, Class P3 or powered air purifying respirator with Class P3 particulate filter.**
Over 10.0 mg/m^3	**Airline respirator, positive pressure or self contained breathing apparatus, positive pressure.**

If respiratory protection is required, employees need to be trained in its safe use and maintenance.

OTHER CONTROL MEASURES:

Respirable dust levels should be monitored regularly.
Dust levels in excess of appropriate exposure limits should be reduced by all feasible engineering controls, including (but not limited to) wet suppression, ventilation, process enclosure, and enclosed work stations.

HEALTH HAZARD INFORMATION

HEALTH EFFECTS

Crystalline Silicon Dioxide has been classified as a Hazardous Substance by Worksafe and one for which health surveillance is required.

ACUTE:

Exposure to dust may irritate respiratory system, eyes, & skin. Use of natural sand and gravel for construction purposes is believed not to have caused acute toxic effects.
Repeated overexposures to respirable crystalline silica for periods as short as 6 months has caused acute silicosis. Symptoms of acute silicosis include (but are not limited to): shortness of breath, cough, fever, weight loss, & chest pain. Acute silicosis is a rapid progressive, incurable lung disease & is typically fatal.

CHRONIC:

Chronic exposure to respirable quartz-containing dust in excess of appropriate exposure limits has caused silicosis, a progressive pneumoconiosis (lung disease). Chronic tobacco smoking may further increase the risk of developing chronic lung problems.

SYMPTOMS OF SILICOSIS:

Not all individuals with silicosis will exhibit symptoms (signs) of the disease. However, silicosis is progressive, & symptoms can appear at any time, even years after exposure have ceased. Symptoms of silicosis may include (but are not limited to): Shortness of breath; difficulty breathing with or without exertion; coughing; diminished work capacity; diminished chest expansion; reduction of lung volume; right heart enlargement and/or failure. Persons with silicosis have an increased risk of pulmonary tuberculosis infection.

In late 1996, the IARC (International Agency for Research into Cancer) upgraded its previous classification of crystalline silica from "probably carcinogenic to humans (Group 2A)", to "Carcinogenic to humans (Group 1)".
This was changed on the basis of a relatively large number of epidemiological studies that together provided "sufficient evidence" in humans for the carcinogenicity of inhaled crystalline silica under the conditions specified.

HEALTH HAZARDS

Low irritant. Avoid dust generation. Adverse health effects, usually associated with long term exposure to high crystalline silica dust levels are not anticipated, given the granular nature of this product. Chronic exposure to dust may cause lung fibrosis (silicosis). Crystalline quartz is classified as carcinogenic to humans (1ARC Group 1)

SKIN:

Low irritant. Prolonged and repeated exposure to dust may result in irritation and dermatitis.
Wash dust-exposed skin with soap and water. Wash work clothes after each use.

EYE:

Low irritant. Exposure may result in irritation and lacrimation.
Safety glasses with side shields should be worn as minimum protection.
Dust goggles should be worn when excessively (visible) dusty conditions are present or are anticipated.

INGESTION:

Low toxicity. This product is biologically inert. However, ingestion may result in gastrointestinal irritation due to mechanical action.

PRECAUTIONS:

Flammability: **Not flammable under conditions of use. No fire or explosion hazard exists.**

Reactivity: **Incompatible with strong acids (eg Hydrofluoric acid).**

Ventilation: **Do not inhale dust/powder. Use with adequate natural ventilation. Where a dust inhalation hazard exists, mechanical extraction ventilation or dampening with water is recommended.**

FIRST AID

EYE: **(Dust exposure) Flush eyes gently with running water for 15 minutes. Seek medical attention if irritation persists or later develops.**

SKIN: **(Dust) Gently flush affected areas with soap and water. Seek medical attention if irritation develops.**

INHALATION: **Leave area of exposure. Dust in the throat and nasal passages should clear spontaneously. Seek medical attention if irritation persists or symptoms later develop.**

INGESTION: **Due to product form application, ingestion is considered highly unlikely.**

SAFE HANDLING INFORMATION

STORAGE:	**Store in a dry place. Keep container closed when not in use. Store away from oxidising agents and strong acids such as Hydrofluoric acid.**
TRANSPORT:	**Refer to the Australian Code for the Transport of Dangerous Goods by Road and Rail. If the quantity exceeds the limit permitted by the code then: Product should not be loaded in the same vehicle or packed in the same freight container with: Class 1 :Explosives Class 4.3 :Dangerous when wet substances Class 5.1 :Oxidising agents Class 5.2 :Organic peroxides Class 6 :Cyanides only Class 7 :Radioactive substances (Health Dept) Class 8 :All corrosive substances (acids and alkalies) Foodstuff and empty foodstuff containers DMI-65 has a Harmonization Code of 25 05 10 and is considered safe to Transport by Air in sample sized quantities less than 400kg If the amount is exceeds this quantity please refer to the Recommendations on the Transport of Dangerous Goods Model Regulations Volume 2 Sixteenth Edition of the United Nations 2009.**
SPILLAGE:	**Contain the spill. If spilt (bulk), wear dust-proof goggles. PVC/rubber gloves and a Class P(Particulate) respirator (where an inhalation risk exists). Persons involved in clearing should follow the precautions defined in this MSDS. Spilled materials, where dust can be generated, may overexpose clean up personnel to respirable quartz containing dust. Wetting of spilled material and/or use of respiratory protective gear may be necessary. Do not dry sweep spilled material. Avoid generating dust.**
DISPOSAL:	**Collect and place in sealable containers for disposal. Dispose of waste materials only in accordance with applicable federal, state, and local laws and regulations.**
ENVIRONMENT:	**The main component/s of this product occurs naturally in the earth's crust. It is not anticipated to cause any adverse effects to plants or animals.**
FIRE AND EXPLOSION:	**None known, not flammable. No fire or explosion hazard exists.**
EXTINQUISHING:	**Non flammable.**

PHYSICAL DESCRIPTION AND CHEMICAL PROPERTIES

INCOMPATIBILITY:	**(Materials to avoid) – Contact with powerful oxidising agents such as fluorine, chlorine trifluoride, manganese trifluoride, and oxygen difluoride may cause fire and/or explosions. Silica dissolves in hydrofluoric acid producing a corrosive gas – silicon tetrafluoride.**
Observed Odour:	**Odourless**
Flammability:	**Non flammable**
Flammability limits:	**Not applicable**
Flash point:	**None**
Upper Explosion Limit:	**Not relevant**
Lower Explosion Limit:	**Not relevant**
Boiling Point:	**2230 °C**
Vapour Pressure:	**Not available**
Evaporation Rate:	**Not available**
% Volatiles:	**Not available**
Exposure Standard (TWA)	**0.2 mg/m3 silica, crystalline-quartz**
pH:	**Not available**
Specific Gravity:	**2.61**
Melting point:	**1610 °C**
Solubility in water:	**Insoluble**

ADDITIONAL INFORMATION FOR MICROCLINE

Concentration in this product:	**< 9%**
Molecular Formula:	**KAlSiO3O8**
Molecular Weight:	**278.2**
Solubility in cold water:	**Insoluble**

EMERGENCY-ENVIRONMENT

Microcline is naturally occurring silicate (Feldspar) minerals.
They are not anticipated to have an adverse effect on the environment.

ADDITIONAL INFORMATION FOR BIXBYITE

Concentration in this product: **< 1%**
Molecular Formula: **Mn2O3**
Molecular Weight: **157.9**
Other name: **Manganese oxide – sesqui or Di Manganese Trioxide**
Solubility in cold water: **Insoluble**

EMERGENCY-ENVIRONMENT

Bixbyite is a naturally occurring mineral.
It is not anticipated to have an adverse effect on the environment.

ADDITIONAL INFORMATION FOR CALCITE

Concentration in this product: **< 0.1%**
Molecular Formula: **CaCO3**
Molecular Weight: **100**
Other name: **Limestone**
Solubility in water: **Slightly soluble (pH dependant)**

EMERGENCY-ENVIRONMENT

Calcite is a naturally occurring mineral.
It is not anticipated to have an adverse effect on the environment.

ADDITIONAL INFORMATION FOR SILICA, CRYSTALLINE-QUARTZ

General Comment: Silica is the most abundant compound in the earth's crust.

Concentration in this product: **> 90%**
Molecular Formula: **Si02**
Molecular Weight: **60.09**

HEALTH HAZARD – EYE
Direct contact may result in mechanical irritation.
Avoid rubbing the eyes as the surface may be scratched.

HEALTH HAZARDS – HEALTH HAZARD SUMMARY

Crystalline silica quartz is classified as a human carcinogen (1ARC Group 1)
It is also listed as a hazardous substance for which health surveillance is required according to the WorkSafe Australia Standard for the Control of Workplace Hazardous Substances.
The National Occupational Health and Safety Commission (NOHSC) recommends that where legislation exists that deals with the control of crystalline silica, and specifies lower exposure standard values for quartz, cristobalite and tridymite than those listed by NOHSC,
then compliance with those exposure standards must be maintained.
The ACGIH recommend a TLV of 0.1 mg/m^3.

HEALTH HAZARDS – INHALATION

Classified as carcinogenic to humans (1ARC group 1)
Smokers are likely to be more susceptible.
Chronic exposure to respirable silica dust may result in lung fibrosis (silicosis).
Symptoms include cough, wheezing and with progression, an increasing shortness of breath.

YWA: 0.2 mg/m³ (Silica Quartz).

TCLo (inhalation) : 16 000 000 particles / ft³ / 8 hours 17.9 years (human fibrosis).
LCLo (inhalation) : 300 µg/m³ / 10 years (human).

EMERGENCY – ENVIRONMENT

Silica occurs naturally as quartz, flint, distomite, agate, chaicedony, chart and tridymite.
It is not anticipated to have an adverse effect on the environment.

HEALTH HAZARDS TOXICITY DATA

LDLo (Intravenous) : 20 mg/kg (dog).
LDLo (Intratrachea) : 200 mg/kg (rat)

ADDITIONAL SAFE HANDLING INFORMATION

EXPOSURE STANDARDS – TIME WEIGHTED AVERAGES:

Exposure standards are established on the premises of an 8 hour work period of normal intensity, under normal climatic conditions and where a 16 hour break between shifts exists to enable the body to eliminate absorbed contaminants. In the following circumstances, exposure standards must be reduced; strenuous work conditions; hot, humid climates; high altitude conditions; extended shifts (which increase the exposure period and shorten the period of recuperation).

1ARC – GROUP 1 – PROVEN HUMAN CARCINOGEN:

This product contains an ingredient for which there is sufficient evidence to have been classified by the International Agency for Research into Cancer as a human carcinogen. The use of products known to be human carcinogens should be strictly monitored and controlled.

SILICA – MEDICAL CONSIDERATIONS:

Medical testing for those with frequent or potentially high exposure to silica (half the TWA or more) is recommended before beginning work and at regular intervals there after.
This should include: lung function tests – check x-rays every 1-3 years.
If abnormal chest x-ray develops, skin test for tuberculosis should be done. Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:

The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as method of application, working environment, quantity use, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

HEALTH EFFECTS FROM EXPOSURE:

It should be noted that the effects from exposure to this product will depend on several factors including: frequency and duration of use; quantity used, effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare an MSDS which would encompass all possible scenarios. It is anticipated that users will assess the risks and apply control methods where appropriate.

Quantum Filtration Medium Pty Ltd Disclaimer:

The information and recommendations contained herein are based upon data available and believed to be both accurate and reliable.

Quantum Filtration Medium Pty Ltd has made no effort to censor nor to conceal deleterious aspects of this product.

However, no guarantee or warranty of any kind, express or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by purchase, resale, use or exposure to our silica sand product. Customers-users of silica sand must comply with all applicable health and safety laws, regulations and orders, including the OSHA Hazardous Communication Standard.

If clarification or further information is needed to ensure that an appropriate risk assessment is made, the user should contact Quantum Filtration Medium Pty Ltd

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