

# WRc-NSF

---

**DRYDEN AQUA LTD**

## **LABORATORY LEACHING TESTS ON AFM**

**DWI reference 56.4.382**

**WRc-NSF Ref.: SOS/LAB 152A**

**October 2005**

WRc-NSF Ltd, 30 Fern Close, Pen-y-Fan Industrial Estate, Oakdale,  
Gwent, NP11 3EH, UK  
Tel: +44 (0) 1495 236260 Fax: +44 (0) 1495 249234  
WRc-NSF Ltd, Registered in England No. 3754780.  
Registered Office: Frankland Road, Blagrove, Swindon, Wiltshire SN5 8YF England.



The contents of this document are subject to copyright and all rights are reserved. No part of this document may be reproduced, stored in a retrieval system or transmitted, in any form or by any means electronic, mechanical, photocopying, recording or otherwise, without the prior written consent of the copyright owner.

This document has been produced by WRc-NSF Ltd.

---

## CONTENTS

SUMMARY	1
1. INTRODUCTION	2
2. TESTS	3
2.1 Test sample	3
2.2 Hydrofluoric acid digestion	3
2.3 Water extractable	3
3. ANALYSIS	5
3.1 Hydrofluoric acid digestion	5
3.2 Water extractable	5
4. RESULTS	7
4.1 Hydrofluoric acid digestion	7
4.2 Water extractable	7
5. DISCUSSION	8
5.1 General	8
5.2 Hydrofluoric acid digest	8
5.3 Water extractable	8
6. CONCLUSIONS	9

## LIST OF TABLES

Table 2.1 Test events for Water extractable test	4
Table 3.1 Analysis dates and reference codes for metals analysis	5
Table 3.2 Metals analysed by LSM	6
Table 4.1 Metal concentration after hydrofluoric acid digestion	7
Table 4.2 Metal concentration after water extraction test	7

## **EXECUTIVE SUMMARY**

Dryden Aqua requested WRc-NSF to perform laboratory leaching tests on AFM; an advanced filtration media based on a recycled glass material for use in contact with public drinking water supplies. The aim was to provide leaching data to investigate the product's potential effects on water quality, to support an application for approval of this product for use in contact with potable water under Regulation 31 of the Water Supply (Water Quality) Regulations 2000.

The product was analysed to determine the metal content after hydrofluoric acid digest and the metals leaching after the water extractable substances test according to BS EN 12902.

## 1. INTRODUCTION

Dryden Aqua requested WRc-NSF to carry out laboratory leaching tests on AFM, an advanced filtration media based on a recycled glass material for use in contact with public drinking water supplies.

The aim was to provide the leaching data requested by the Committee and Processes for Use in Public Water Supply (CPP) on AFM in support of the application by Dryden Aqua for approval of this product for use in contact with potable water under Regulation 31 (4) (a) of the Water Supply (Water Quality) Regulations 2000.

The leaching tests and analyses of the leachates were performed in accordance with the requirements communicated to WRc-NSF in the E-mail from DWI dated 7<sup>th</sup> February and 4<sup>th</sup> March 2005, Ref. DWI 56.4.382.

The tests specified were analysis of metals following hydrofluoric acid digestion and metals analysis on an aqueous extraction performed in accordance with BS EN 12902:2004, Products used for treatment of water intended for human consumption–Inorganic supporting and filtering materials–Methods of test, Section 6.3 Water–extractable substances, 6.3.4 Granular materials.

Five metals of the determined metals were detected in hydrofluoric acid digest above the limit of detection, aluminium, barium, chromium, cobalt and lead.

No significant leaching of the determined metals was detected in the water extractable leachate.

## 2. TESTS

### 2.1 Test sample

The AFM, a green granular powder, was supplied by Dryden Aqua and received by WRc-NSF 20<sup>th</sup> April 2005.

### 2.2 Hydrofluoric acid digestion

A sub-sample of the AFM was submitted to the analytical laboratories of London and Scandinavian Metallurgical Co Ltd (LSM).

1. A 500 mg portion of AFM was digested with hydrofluoric acid in a sealed PTFE vessel in a microwave. This procedure ensures complete dissolution and prevents the loss of any volatile fluorides during the digestion procedure.
2. The digest was then analysed by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES).

### 2.3 Water extractable

The test was performed at the WRc-NSF laboratories Oakdale and the metals analysis at the Medmenham laboratory in accordance with BS EN 12902:2004, Products used for treatment of water intended for human consumption–Inorganic supporting and filtering materials–Methods of test, Section 6.3 Water–extractable substances, 6.3.4 Granular materials.

The test procedure was,

1. A bed volume of test water was added to a suitable glass column and left for about 30 minutes, after which time the water was collected for analysis. This sample constituted the blank.
2. A know mass of AFM was placed in the same column to give a bed depth of at least 30 cm. One bed volume of tap water was added and left for about 15 hours.
3. The bed was then backwashed with tap water at a flow rate to give a bed expansion of 25% for about 30 minutes.
4. The water was then drained to the top of the bed and the column rinsed twice with test water, each rinse taking about 10 minutes.
5. A further bed volume of test water was added and allowed to stand for 30 minutes after which time the water was drained and collected in suitable containers for metals analysis.

The table of events and test sample details is given in Table 2.1.

**Table 2.1 Test events for Water extractable test**

Event	Time	Date	Lapsed Time	Sample Code
Blank start	15:00	28/04/05		
Blank finish	15:30	28/04/05	30 min	SOS/LAB 905K
Initial soak start	17:00	28/04/05		
Initial soak finish	08:30	29/04/05	15.5 hours	
Back wash start	08:40	29/04/05		
Back wash finish	09:10	29/04/05	30 min	
Start rinse 1	09:15	29/04/05		
Finish rinse 1	09:25	29/04/05	10 min	
Start rinse 2	09:30	29/04/05		
Finish rinse 2	09:40	29/04/05	10 min	
Start stagnation	09:45	29/04/05		
Finish stagnation & sample leachate	10:15	29/04/05	30 min	SOS/LAB 152A

### 3. ANALYSIS

#### 3.1 Hydrofluoric acid digestion

The hydrofluoric acid digestion and analysis was conducted in the laboratories of the London and Scandinavian Metallurgical Co Ltd. UKAS accreditation number 1091

The digest was analysed using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES).

#### 3.2 Water extractable

The water extractable leachates were analysed at the WRc-NSF Medmenham laboratories using Inductively Coupled Plasma Mass Spectrometry (ICPMS) or Cold Vapour Atomic Absorption Spectrometry (CVAAS). WRc-NSF is UKAS accredited, 1550, for this analysis.

The sample analysis dates and WRc-NSF analysis reference codes are shown in Table 3.1.

The metals determined, limits of detection and the test methods are given in Table 3.2 for LMS and in Table 3.3 for WRc-NSF.

**Table 3.1 Analysis dates and reference codes for metals analysis**

Sample	Submission date	Analysis date	Ref.
AFM (HF digest)	15/04/05	10/05/05	N21683
SOS/LAB 152A (aqueous extract)	03/05/05	04/05/05	N21695
SOS/LAB 905K (aqueous blank)	03/05/05	04/05/05	N21695



**Table 3.2 Metals analysed by LSM**

<b>Metal</b>	<b>Test method</b>	<b>Limit of detection (<math>\mu\text{g l}^{-1}</math>)</b>
Aluminium	ICP-OES	5000
Antimony	ICP-OES	5000
Arsenic	ICP-OES	5000
Barium	ICP-OES	1000
Cadmium	ICP-OES	1000
Chromium	ICP-OES	1000
Cobalt	ICP-OES	1000
Lead	ICP-OES	5000
Mercury	ICP-OES	5000

**Table 3.3 Metals analysed by WRc-NSF**

<b>Metal</b>	<b>Test method</b>	<b>Limit of detection (<math>\mu\text{g l}^{-1}</math>)</b>
Antimony	ICPMS	0.5
Arsenic	ICPMS	1
Cadmium	ICPMS	0.5
Chromium	ICPMS	5
Lead	ICPMS	1
Mercury	CVAAS	0.1
Nickel	ICPMS	2
Selenium	ICPMS	1

ICPMS Inductively Coupled Plasma Mass Spectrometry

CVASS Cold Vapour Atomic Absorption Spectrometry

ICP-OES Inductively Coupled Plasma Optical Emission Spectrometry

## 4. RESULTS

### 4.1 Hydrofluoric acid digestion

The concentrations of metals found in the sample of AFM are given in Table 4.1.

**Table 4.1 Metal concentration after hydrofluoric acid digestion**

Metal	Metal concentration %	Concentration mg g <sup>-1</sup>
Aluminium	0.76	7.6
Antimony	<0.001	<0.01
Arsenic	<0.0001	<0.001
Barium	0.02	0.2
Cadmium	<0.00001	<0.0001
Chromium	0.10	1.0
Cobalt	0.012	0.12
Lead	0.011	0.11
Mercury	<0.0005	<0.005

### 4.2 Water extractable

The concentrations of the metals detected in the water extractable leachates are reported in Table 4.2.

**Table 4.2 Metal concentration after water extraction test**

Metal	Metal concentration µg l <sup>-1</sup>			WS(WQ)R 2000 µg l <sup>-1</sup> #
	Blank	Test sample	Water extractable metals (X <sub>3</sub> )	
Antimony	1.7	1.4	<0.5	5.0
Arsenic	<1.0	<1.0	<1.0	10
Cadmium	2.6	<0.5	<0.5	5.0
Chromium	<5.0	<5.0	<5.0	50
Lead	<1.0	<1.0	<1.0	25 (10*)
Mercury	<0.1	<0.1	<0.1	1.0
Nickel	<2.0	<2.0	<2.0	20
Selenium	<1.0	<1.0	<1.0	10

X<sub>3</sub> Content of water extractable metals that were analysed

# Water Supply (Water Quality) Regulations 2000\* 25 µg l<sup>-1</sup> until 24/12/13, then 10 µg l<sup>-1</sup>

## 5. DISCUSSION

### 5.1 General

The tests of the effects of the product (AFM) on water quality were accomplished without significant problems.

### 5.2 Hydrofluoric acid digest

Five of the determined metals were detected above the limit of detection, aluminium, barium, chromium, cobalt and lead.

### 5.3 Water extractable

No significant leaching of the determined metals was detected in the water extractable leachate.

## 6. CONCLUSIONS

The leaching tests and analyses of the leachates were performed in accordance with the requirements communicated to WRc-NSF in the E-mail from DWI dated 7<sup>th</sup> February and 4<sup>th</sup> March 2005, Ref. DWI 56.4.382.

The tests specified were analysis of metals following hydrofluoric acid digestion and metals analysis on an aqueous extraction performed in accordance with BS EN 12902:2004, Products used for treatment of water intended for human consumption–Inorganic supporting and filtering materials–Methods of test, Section 6.3 Water-extractable substances, 6.3.4 Granular materials.

Five of the determined metals were detected in hydrofluoric acid digest above the limit of detection, aluminium, barium, chromium, cobalt and lead.

No significant leaching of the determined metals was detected in the water extractable leachate.