Audit of procedures for monitoring the quality of water used in the preparation of dialysis fluid in adult haemodialysis units in Scotland – 2015

Dr Robert Mactier, Consultant Nephrologist, Glasgow Renal & Transplant Unit, Western Infirmary, NHS Greater Glasgow & Clyde

Mr John Wright, Technical Service Manager (Renal) University Hospital Crosshouse, NHS Ayrshire & Arran

On behalf of the Scottish Renal Registry

Introduction

Quality assurance of the water used in the preparation of dialysis fluid is of great importance as haemodialysis (HD) exposes the blood of the patient to more than 300 litres of water per week through a non-selective dialyser membrane compared with an average of 12 litres per week through a highly selective membrane (intestinal tract) in healthy individuals. Intact dialyser membranes are known to be permeable to bacterial contaminants as well as permitting backdiffusion and backfiltration of chemical contaminants from the dialysate.

Table 1 summarises the quality standards for testing for chemical and microbiological contaminants in water used in the preparation of dialysis fluid, which have been endorsed by the Association of Renal Technologists and UK Renal Association: http://www.renal.org/Clinical/GuidelinesSection/Haemodialysis.aspx

Achieving these standards of water purity usually requires a combination of softening, carbon filtration and reverse osmosis along with an effective disinfection programme for all pipework between the treatment plant and dialysis machines. Patient safety on HD is dependent on maintaining a supply of treated water which achieves the above standards at all times. In addition to quality assurance of treated water by regular monitoring for chemical and microbiological contaminants in the renal unit good clinical governance requires ongoing vigilance within the hospital to ensure that there is no inadvertent contamination of the water supply to the renal unit with aluminium, fluoride, chlorine (or chloramine) or hydrogen peroxide by hospital or external contractors.

This audit was performed in 2015 to assess if all HD units were following the above guidance on quality assurance of water used for HD after an earlier audit performed in 2010 had shown that a minority of units were not complying with some of the recommendations.

Methods

This audit of monitoring of product water quality in the 9 hub haemodialysis units in Scotland (and their satellite units) is based on a questionnaire using the standards on preparation of water for use for haemodialysis recommended by the Renal Association and Association of Renal Technologists (Appendix). The questionnaire was sent to the renal technicians covering each of the renal units in Scotland in 2010 and the units were informed of the analysis of the data returned from each unit. The audit cycle was repeated in February 2015 using the same questionnaire.

Results

Analysis of the 2010 audit showed that all of the procedures for monitoring the quality of water used in the preparation of dialysis fluid were followed by the 9 hub and 23 satellite HD sites except:

- 3 hub sites and their satellite units and 1 satellite unit in the Glasgow network did not meet the recommended minimum frequency for testing for endotoxin (monthly)
- 3 hub sites and their satellite sites did not meet the minimum frequency of testing for viable bacteria (monthly)
- 2 hub sites and their satellite units did not meet minimum frequency for testing for chemical contaminants (3 monthly)
- 1 hub site and its satellites and 3 satellites in the Glasgow network did not meet the minimum recommended frequency of testing for chlorine (weekly)

This data from 2010 was reported back to the renal units and the SRR and the same format of questionnaire and analysis was used when the audit cycle was repeated in 2015.

a) water treatment facilities for HD in Scotland in 2015

The number of hub renal units in 2015 was the same but the number of satellite units has increased and data was available from 24 satellite units (Table 2). The 2015 audit identified 789 serviced HD stations including stations in the workshops as well as treatment areas (Table 2). The HD stations within the paediatric renal unit based in the Royal Hospital for Sick Children, Glasgow are not included in this audit as the paediatric renal unit was about to transfer to a new HD water treatment plant at the South Glasgow University Hospital.

All sites apart from 3 small satellite units supported by the hub in Aberdeen units have centralised reverse osmosis. The water treatment plant facilities in all of the units fulfil the criteria required for producing water used for HD (Table 2). HDF is performed in most hub and satellite units but HDF is usually not performed in patients' homes. One unit (Crosshouse) performs HDF at home installations using individual reverse osmosis units capable of heat disinfection and machines fitted with in line filtration. Test results show that meeting the standards quoted in Table 1 for TVC and EU levels is easily achievable i.e. <100 colony forming units/ml and <0.25 EU/ml. With this quality of treated water and the use of in line filtration HDF can be used for home dialysis as well as hospital dialysis. Due to the environment and incorrect sampling points proving that ultrapure water is delivered consistently from the home based reverse osmosis units is difficult.

Several of the Glasgow satellites required further measures to be taken after installation to ensure the facilities met the criteria set down in ISO 13959 and ISO 23500 indicating that such testing should be performed before handover to renal services.

b) monitoring of chemical contaminants in water used for HD

All hub and satellite HD units met the criteria for testing of chemical contaminants other than chlorine and all apart from two units sent the samples for testing to the Scottish Trace Element unit in Glasgow (Table 3). Two of the units do not monitor chlorine levels at least weekly, one because of limitations to access to the PFI water treatment plant. In contrast one unit wished that monitoring of chlorine levels should be recommended daily instead of weekly and another unit monitors chlorine levels continuously electronically. Point of care testing remains standard practice for chlorine testing although the specific methodology used varies widely (5 testing methods were in use in 2010 and 7 methods in 2015).

c) monitoring of microbiological contaminants in water used for HD

All hub and satellite HD units met the criteria for testing for total viable bacteria and for endotoxin at least monthly (Table 4). Most units use national NHS testing facilities for endotoxin whilst 6 units use local facilities testing for total viable bacterial counts (3 use NHS laboratories and 3 use commercially operated laboratories). All units have an action plan if the monitoring tests exceed 50% of the maximum acceptable levels for endotoxin and/or total viable counts. Quality assurance of water used for HD in the smaller satellite units usually employed the same procedures for monitoring water quality as their hub units (Tables 3 & 4).

d) clinical governance

All of the units have standard operational policies in place (Table 5). Reporting clinical governance procedures differ among the renal units and the responsible officer for water quality is:

- a senior renal consultant in 8 units
- a senior renal nurse in 1 unit

Some units perform more than the minimum recommended testing: two units expressed the wish that testing for water hardness should be included in the standard recommendations and one unit (Dumfries) recommended that chlorine be tested daily to provide better patient safety and clinical governance (Tables 3 & 5).

Maintenance of the water treatment plant and monitoring of water quality was the responsibility of the NHS in the majority of sites but the PFI sponsor and/or supplier of the water treatment plant were responsible at 7 sites and a combination of NHS and supplier of the water treatment facility at 5 sites making communication and lines of responsibility for clinical governance less easy to achieve and maintain.

Conclusion

The recent audit in 2015 demonstrates a significant improvement in adherence to national guidelines on quality assurance of water quality used for HD in Scotland since the previous audit in 2010 using the same methodology. Only a few satellite units do not perform all forms of routine monitoring for chemical and microbiological contaminants as frequently as recommended. These two satellite units perform all forms of monitoring routinely but still monitor chlorine levels less frequently than recommended. Almost all hub and satellite units can now perform HDF as well as high-flux HD.

 Table 1: Maximum allowable concentrations of chemical and microbiological contaminants in dialysis

 water (reproduced from ISO 13959: 2009)

Contaminant	Maximum recommended concentration	Recommended minimum frequency of testing
Aluminium	0.01 mg/l	Every 3 months
Calcium	2 mg/l (0.05mmol/l)	Every 3 months
Total chlorine	0.1 mg/l	Weekly
Copper	0.1 mg/l	Every 3 months
Fluoride	0.2 mg/l	Every 3 months
Magnesium	4 mg/l (0.15 mmol/l)	Every 3 months
Nitrate (as N)	2 (equates to 9 mg/l NO ₃)	Every 3 months
Potassium	8 mg/l (0.2 mmol/l)	Every 3 months
Sodium	70 mg/l (3.0 mmol/l)	Every 3 months
Total viable microbial count	less than 100 CFU/ml	Monthly
Endotoxin concentration	less than 0.25 EU/ml	Monthly

A programme of corrective measures should be commenced immediately if routine monitoring demonstrates chemical contaminant levels in excess of the maximum permitted levels <u>or</u> microbiological contaminants in excess of 50% maximum permitted levels.

Table 2: Water treatment plant facilities in Scottish renal networks in February 2015

HD units in 9 Renal networksRO"In Service" stationsBS ISO 13959 and ISO 2300Ultrapure WaterPerf HIAberdeenY39YYYInverurieY8YYYElginY10YYYPeterheadY8YYYShetlandN6NYYOrkneyN5NYYShetlandN4NYYOrkney & Shetland62	Hub and satellite	Central	Number of	Compliance with		Can
networksstationsand ISO 23500WaterHIAberdeenY39YYYInvervirieY8YYYElginY10YYYPeterheadY8YYYBanffN6NYYOrkneyN5NYYShetlandN4NYYOrkneyShetlandN4NYYOrkneyShetlandOrkneyShetlandOrkneyShetlandOrkneyShetlandOrkneyShetlandMIS Ayrshire &62MIS Ayrshire &30Glasgow WesternY50YYY-Glasgow WesternY50YYYale of LevenY9YYMoklands, NHSY22NYMusclagow & ForthMoklands, NHSY75YYY-Musclagow & ForthMusclagow & Forth <td< td=""><td>HD units in 9 Renal</td><td>RO</td><td>"In Service"</td><td></td><td>Ultrapure</td><td>perform</td></td<>	HD units in 9 Renal	RO	"In Service"		Ultrapure	perform
Aberdeen Y 39 Y Y Y Inverurie Y 8 Y Y N Elgin Y 10 Y Y N Peterhead Y 8 Y Y N Banff N 6 N Y N Orkney N 5 N Y N Shetland N 4 N Y N Orkney & Shetland		_		and ISO 23500	-	HDF?
Inverurie Y 8 Y Y Y Elgin Y 10 Y Y Y Peterhead Y 8 Y Y Y Banff N 6 N Y Y Orkney N 5 N Y Y Shedand N 4 N Y Y Orkney & Shetland N 4 N Y Y Orkney & Shetland - - - - - Orkney & Shetland - - - - - Orkney & Shetland - - - - - Orkney & Shetland - - - - - - Orkney & Shetland -		Y				Y
Elgin Y 10 Y Y Y Peterhead Y 8 Y Y Y Banff N 6 N Y Y Banff N 6 N Y Y Orkney N 5 N Y Y Shetland N 4 N Y Y Orkney Shetland						Y
Peterhead Y 8 Y Y Y Banff N 6 N Y N Orkney N 5 N Y N Shetland N 4 N Y N NHS Grampian, 80						Y
BanffN6NYYOrkneyN5NYYShetlandN4NYYNHS Grampian, Orkney & Shetland80YYOrkney & ShetlandN47YYYCrosshouseY47YYYYAyrY15YYYYMHS Ayrshire & Arran62						Y
OrkneyN5NYYShetlandN4NYYNHS Grampian, Orkney & Shetland80 $ -$ Orkney & Shetland-YYYAyrY15YYYAyrY15YYYNHS Ayrshire & Arran62DumfriesY21YYYStranraerY5YYYNHS Dumfries & Galloway30Glasgow WesternY50YYYNHS StobhillY35NYYVictoriaY35NYYGlasgow RoyalY25YYYForth ValleyY38YYYNHS Greater212Monklands, NHSY75YYYArbroathY9YYYNHS Tayside85RaigmoreY18NYYYNHS Highland29Vestern GeneralY11YYYNHS GraderNinewellsY62YYYNHS Lophade85RelfordY7NYYSt JohnsY13 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>Y</td>						Y
ShetlandN4NYYNHS Grampian, Orkney & Shetland80						Y
NHS Grampian, Orkney & Shetland80						Y
Orkney & ShetlandImage: scalar display="block">V47YYCrosshouseY47YYYAyrY15YYYNHS Ayrshire &62Image: scalar display="block">V15YYYNHS Ayrshire &62Image: scalar display="block">V21YYYStranraerY5YYYYStranraerY5YYYYNHS Dumfries &30Image: scalar display="block">VYYYStanraerY50YYYYGlasgow WesternY50YYYYStobhillY33NYYYVale of LevenY9YYYYVale of LevenY9YYYYPorth ValleyY38YYYYNine wellsY62YYYYMonklands, NHSY75YYYYPerthY14YYYYNHS Tayside85Image: scalar display="block">SImage: scalar display="block">SMine wellsY73YYYNHS Highland29Image: scalar display="block">SImage: scalar display="block">SIdinburgh RoyalY73YYYNHS Lothian &115<	NHS Grampian,		80			
Crosshouse Y 47 Y Y Y Ayr Y 15 Y Y Y NHS Ayrshire & 62 Y Y Y Y Arran						
NHS Ayrshire & Arran62 \cdot DumfriesY21YYStranraerY5YYStranraerY5YYKirkcubrightY4YYNHS Dumfries & Galloway30 \cdot \cdot Glasgow WesternY50YYNStobhillY33NYYStobhillY33NYYVictoriaY35NYYVale of LevenY9YYYInverclydeY22NYYPorth ValleyY38YYYNHS Greater Ualey212101010NinewellsY62YYYNinewellsY62YYYNinewellsY9YYYNHS Tayside8510RaigmoreY18NYYYBelfordY73YYYSt JohnsY13YYYNHS Lothian & Borders115Western GeneralY18YYYNHS Lothian & Borders115Ween MargaretY33YYYNHS Lothian & Hospital115		Y	47	Y	Y	Y
NHS Ayrshire & Arran62DumfriesY21YYDumfriesY21YYStranraerY5YYYKirkcubrightY4YYYNHS Dumfries & Galloway30GallowayGallowayGallowayGlasgow WesternY50YYNStobhillY33NYYVictoriaY35NYYVale of LevenY9YYYInverclydeY22NYYForth ValleyY38YYYNHS Greater Ualey212YYYMonklands, NHSY75YYYNinewellsY62YYYNinewellsY99YYYNinewellsY99YYYNHS Tayside85RaigmoreY18NYYYBelfordY73YYYSt JohnsY13YYYNHS Lothian & Borders115Western GeneralY18YYYNHS Lothian & Borders115Weixel GeneralY33YYYNHS Lothian & Hospital115 <td>Ayr</td> <td>Y</td> <td>15</td> <td>Y</td> <td>Y</td> <td>Y</td>	Ayr	Y	15	Y	Y	Y
DumfriesY21YYYStranraerY5YYYKirkcubrightY4YYYNHS Dumfries & Galloway3030YYGlasgow WesternY50YYYStobhillY33NYYVictoriaY35NYYGlasgow RoyalY25YYYOlasgow RoyalY25YYYStobhillY25YYYInverclydeY22NYYForth ValleyY38YYYNHS Greater212YYGlasgow & Forth Valley212YYMonklands, NHS ValleyY75YYYNinewellsY62YYYYPerthY14YYYYNHS Tayside85SRaigmoreY18NYYYYBelfordY73YYYYSt JohnsY13YYYYNHS Lothian & Borders115Wictoria, KirkcaldyY57YYYYNHS Lothian & Hospital115			62			
StranraerY5YYYKirkcubrightY4YYYNHS Dumfries & Galloway3030	Arran					
KirkcubrightY4YYYNHS Dumfries & Galloway3030Glasgow WesternY50YYNStobhillY33NYYStobhillY35NYYVictoriaY25YYYOlasgow RoyalY25YYYVictoriaY25YYYVale of LevenY9YYYForth ValleyY38YYYNHS Greater2120YYGlasgow & Forth ValleyY75YYYMonklands, NHS ValeoY62YYYNinewellsY62YYYYArbroathY9YYYYNHS Tayside85	Dumfries	Y	21	Y	Y	Y
NHS Dumfries & Galloway301Glasgow WesternY50YYNStobhillY33NYYStobhillY35NYYVictoriaY35NYYGlasgow RoyalY25YYYGlasgow RoyalY25YYYStobhillY22NYYInverclydeY22NYYForth ValleyY38YYYNHS Greater212Glasgow & Forth ValleyMonklands, NHS LanarkshireY62YYYNinewellsY62YYYPerthY14YYYNHS Tayside85RaigmoreY18NYYBelfordY73YYYSt JohnsY13YYYSt JohnsY13YYYMHS Lothian & Borders115Western GeneralY33YYYNHS Lothian & Hospital115Witcoria, KirkcaldyY57YYY	Stranraer		5		Y	Y
GallowayY50YYNGlasgow WesternY50YYNStobhillY33NYYVictoriaY35NYYGlasgow RoyalY25YYYVale of LevenY9YYYInverclydeY22NYYForth ValleyY38YYYStobhillY38YYYMust Greater212NYYGlasgow & ForthY75YYValleyMonklands, NHSY62YYYNinewellsY62YYYPerthY14YYYMust Tayside85RaigmoreY18NYYBelfordY73YYYSt JohnsY13YYYSt JohnsY13YYYMHS Lothian & Borders115Victoria, KirkcaldyY57YYYVueen MargaretY33YYY	Kirkcubright	Y	4	Y	Y	Y
Glasgow WesternY50YYNStobhillY33NYYStobhillY35NYYVictoriaY25YYYGlasgow RoyalY25YYYVale of LevenY9YYYInverclydeY22NYYInverclydeY22NYYStothY38YYYNHS Greater212Glasgow & Forth ValleyY75YYYNinewellsY62YYYNinewellsY62YYYPerthY14YYYNHS Tayside85RaigmoreY18NYYBelfordY73YYYWestern GeneralY13YYYSt JohnsY13YYYSt JohnsY13YYYWestern GeneralY18YYYSt JohnsY13YYYMHS Lothian & Borders115Western KerkeldyY57YYYNHS Lothian & Hospital133YYY	NHS Dumfries &		30			
StobhillY33NYYVictoriaY35NYYGlasgow RoyalY25YYYVale of LevenY9YYYInverclydeY22NYYForth ValleyY38YYYNHS Greater212YYGlasgow & Forth212YMonklands, NHSY75YYYLanarkshireYYNinewellsY62YYYYPerthY14YYYYNHS Tayside85YYRaigmoreY18NYYYEdinburgh RoyalY73YYYSt JohnsY13YYYSt JohnsY18YYYNHS Lothian & Borders115Victoria, KirkcaldyY57YYYVuen MargaretY33YYY	Galloway					
VictoriaY35NYYGlasgow RoyalY25YYYVale of LevenY9YYYInverclydeY22NYYForth ValleyY38YYYNHS Greater21210YYGlasgow & Forth2121010ValleyY75YYYMonklands, NHSY62YYYLanarkshire14YYYNinewellsY62YYYPerthY14YYYNHS Tayside8511YYRaigmoreY18NYYBelfordY73YYYWestern GeneralY11YYYSt JohnsY13YYYNHS Lothian &115115115YQueen MargaretY33YYYVictoria, KirkcaldyY57YYY	Glasgow Western		50	Y	Y	Ν
Glasgow RoyalY25YYYVale of LevenY9YYYInverclydeY22NYYForth ValleyY38YYYNHS Greater212101010Glasgow & Forth212101010Valley75YYY10Monklands, NHSY62YYYLanarkshire14YYYNinewellsY62YYYPerthY14YYYNHS Tayside85101010RaigmoreY18NYYBelfordY73YYYSt JohnsY13YYYSt JohnsY13YYYNHS Lothian &11511510Borders11511YYVictoria, KirkcaldyY57YYY33YYYY	Stobhill	Y	33	Ν	Y	Y
Vale of LevenY9YYYInverclydeY22NYYForth ValleyY38YYYForth ValleyY38YYYNHS Greater212 212 122 122 Glasgow & ForthY75YYYValleyY75YYYMonklands, NHSY62YYYLanarkshireY62YYYNinewellsY62YYYPerthY14YYYPerthY18NYYRaigmoreY18NYYBelfordY73YYYWestern GeneralY11YYYSt JohnsY13YYYNHS Lothian &115 115 115 1000 Borders 115 115 1000 115 Victoria, KirkcaldyY57YYYNegital 133 YYY	Victoria	Y	35	Ν	Y	Y
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Glasgow Royal		25		Y	Y
Forth ValleyY38YYYNHS Greater Glasgow & Forth Valley212	Vale of Leven		9	Y		Y
NHS Greater Glasgow & Forth Valley212212Monklands, NHS LanarkshireY75YYMonklands, NHS LanarkshireY62YYNinewellsY62YYYArbroathY9YYYPerthY14YYYNHS Tayside85RaigmoreY18NYYBelfordY7NYYCaithnessY4NNNNHS Highland29Edinburgh RoyalY73YYYSt JohnsY13YYYSt JohnsY13YYYNHS Lothian & Borders115Victoria, KirkcaldyY57YYYNuen MargaretY33YYY	Inverclyde		22	Ν		Y
Glasgow & Forth ValleyY75YYMonklands, NHS LanarkshireY75YYYNinewellsY62YYYArbroathY9YYYPerthY14YYYNHS Tayside85	Forth Valley	Y	38	Y	Y	Y
ValleyImage: state of the system	NHS Greater		212			
Monklands, NHS LanarkshireY75YYYNinewellsY62YYYArbroathY9YYYPerthY14YYYNHS Tayside85YRaigmoreY18NYYBelfordY7NYYCaithnessY4NNNNHS Highland29YYSt JohnsY13YYYBorders GeneralY18YYYVictoria, KirkcaldyY57YYYQueen MargaretY33YYY	8					
LanarkshireImage: Constraint of the systemNinewellsY62YYYArbroathY9YYYPerthY14YYYNHS Tayside85Image: Constraint of the systemYYRaigmoreY18NYYBelfordY7NYYCaithnessY4NNMNHS Highland29Image: Constraint of the systemYYEdinburgh RoyalY73YYYSt JohnsY13YYYBorders GeneralY18YYYNHS Lothian &115Image: Constraint of the systemImage: Constraint of the systemYVictoria, KirkcaldyY57YYYQueen MargaretY33YYY	, i i i i i i i i i i i i i i i i i i i					
NinewellsY62YYYArbroathY9YYYPerthY14YYYPerthY14YYYNHS Tayside85RaigmoreY18NYYBelfordY7NYYCaithnessY4NNNNHS Highland29Edinburgh RoyalY73YYYSt JohnsY11YYYSt JohnsY13YYYNHS Lothian & Borders115Victoria, KirkcaldyY57YYYMusel115 </td <td></td> <td>Y</td> <td>75</td> <td>Y</td> <td>Y</td> <td>Y</td>		Y	75	Y	Y	Y
ArbroathY9YYYPerthY14YYYNHS Tayside85RaigmoreY18NYYBelfordY7NYYBelfordY7NYYCaithnessY4NNNNHS Highland29Edinburgh RoyalY73YYYSt JohnsY11YYYSt JohnsY13YYYNHS Lothian &115Victoria, KirkcaldyY57YYYQueen MargaretY33YYY						
PerthY14YYYNHS Tayside85RaigmoreY18NYYBelfordY7NYYCaithnessY4NNNNHS Highland29Edinburgh RoyalY73YYWestern GeneralY11YYSt JohnsY13YYBorders GeneralY18YYVictoria, KirkcaldyY57YYVictoria, KirkcaldyY33YYHospital33YY						Y
NHS Tayside85RaigmoreY18NYYBelfordY7NYYCaithnessY4NNNNHS Highland29YEdinburgh RoyalY73YYWestern GeneralY11YYSt JohnsY13YYBorders GeneralY18YYNHS Lothian &115YVictoria, KirkcaldyY57YYYoteon MargaretY33YYHospitalYY			-			Y
RaigmoreY18NYYBelfordY7NYYCaithnessY4NNNNHS Highland29Edinburgh RoyalY73YYWestern GeneralY11YYSt JohnsY13YYBorders GeneralY18YYNHS Lothian &115Victoria, KirkcaldyY57YYY33YYY		Y		Y	Y	Y
BelfordY7NYYCaithnessY4NNNNHS Highland29Edinburgh RoyalY73YYWestern GeneralY11YYSt JohnsY13YYBorders GeneralY18YYNHS Lothian &115BordersY57YYVictoria, KirkcaldyY57YYYHospital33YYY						
CaithnessY4NNNNHS Highland29						Y
NHS Highland29Edinburgh RoyalY73YYWestern GeneralY11YYSt JohnsY13YYBorders GeneralY18YYNHS Lothian &115Borders125Victoria, KirkcaldyY57YYY33YYY						Y
Edinburgh RoyalY73YYWestern GeneralY11YYSt JohnsY13YYBorders GeneralY18YYNHS Lothian &115BordersYYVictoria, KirkcaldyY57YYQueen MargaretY33YY		Y		N	N	N
Western GeneralY11YYYSt JohnsY13YYYBorders GeneralY18YYNHS Lothian &115YYBordersVictoria, KirkcaldyY57YYQueen MargaretY33YYHospital		X 7		\$7	\$7	X 7
St JohnsY13YYYBorders GeneralY18YYYNHS Lothian & Borders115Victoria, KirkcaldyY57YYQueen MargaretY33YYYHospital </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>Y</td>						Y
Borders GeneralY18YYYNHS Lothian & Borders115IBorders777Victoria, KirkcaldyY57YYQueen MargaretY33YYHospital1111						Y
NHS Lothian & Borders115Victoria, KirkcaldyY57YYQueen MargaretY33YYYHospital </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>Y</td>						Y
BordersVictoria, KirkcaldyY57YYQueen MargaretY33YYYHospital </td <td></td> <td>Y</td> <td></td> <td>Ŷ</td> <td>Ŷ</td> <td>Y</td>		Y		Ŷ	Ŷ	Y
Victoria, KirkcaldyY57YYQueen MargaretY33YYHospitalYYY			115			
Queen Margaret HospitalY33YY		v	57	V	V	v
Hospital						Y Y
		Y	33	ľ	х Г	Y
StAndrows V 11 N N		V	11	NT	NT	NT
St Andrews Y 11 N N N NHS Fife 101 <th< th=""> <!--</td--><td></td><td>ľ</td><td></td><td>IN</td><td>1N</td><td>N</td></th<>		ľ		IN	1N	N

"in service" stations includes all dialysis bays currently in use plus workshop and treatment stations

Table 3: Monitoring of chemical	contominants in water us	cad for propa	ring dialysis fluid
Table 5. Monitoring of chemical	Containinants in water us	seu ioi prepa	i ng ulaiysis nulu

	Turner	C 1		T = = 4	A
Hub and satellite HD units	Trace	Samples	Chlorine	Test	Action if
HD units	elements at	sent to	at least	method	results reach 100% of
	least every 3		weekly		
A h	months Y	STE	Y	<u>C</u> 1.1	maximum Y
Aberdeen,	Ŷ	SIE	Ŷ	Chlorosense	Ŷ
Inverurie, Elgin,					
Peterhead, Banff,					
Orkney , Shetland Crosshouse	V	A 10 0 m 4 m 0 1	V	Chlanssonse	V
	Y Y	Alcontrol Alcontrol	Y Y	Chlorosense Chlorosense	Y Y
Ayr Dumfries	Y Y				Y Y
Dumiries	Ĭ	Alcontrol	Y- wish daily testing	Palintest,	ľ
			of chlorine	Chlorosense,	
<u> </u>	N 7	<u> </u>		Ultrasense	N/
Stranraer	Y	Alcontrol	Y	Alcontrol	Y
Kirkcudbright	Y	Alcontrol	Y	Alcontrol	Y
Glasgow	Y	STE	Y	Serin	Y
Western				Guardian	
Infirmary				Hisense	
Stobhill	Y	STE	Y	HACH	Y
				colourimeter	
Victoria	Y	STE	Ν	Serin	Y
			(monthly	Guardian	
			access)	Hisense	
GRI	Y	STE	Y	HACH	Y
				colourimeter	
Vale of Leven	Y	STE	Y	Test strips	Y
Inverclyde	Y	STE	Y	Palintest	Y
Forth Valley	Y	STE	N monthly		Y
Monklands	Y	STE	Y	Palintest	Y
Ninewells,	Y	STE	Y	Palintest	Y
Arbroath, Perth					
Raigmore	Y	STE	Y	Continuous	Y
				electronic	
Belford	Y	STE	Y	Test strip	Y
Caithness	Y	STE	Y	Test strip	Y
Edinburgh	Y	STE	Y	Hach	Y
Royal, Western				colourimeter	
General, St Johns,					
Borders General					
Kirkcaldy.	Y	STE	Y	Hach digital	Y
Queen Margaret				pocket	
Hospital, St				colourimeter	
Andrews.					

Table 4: Monitoring of microbiological contaminants in water used for preparing dialysis fluid

TT 1 1		T 1	m / 1 · · · ·	T 1	
Hub and	Test for	Laboratory	Total viable	Laboratory	Action if
satellite HD	endotoxins	where	counts at	where	results reach
units	at least	samples are	least	samples are	50% of
	monthly	sent	monthly	sent	maximum*
Aberdeen	Y	Aberdeen	Y	Aberdeen Lab	Y
Inverurie	Y		Y		Y
Elgin	Y		Y		Y
Peterhead	Y		Y		Y
Banff	Y	Endosafe	Y		Y
Orkney	Y	Endosafe	Y		Y
Shetland	Y		Y		Y
Crosshouse	Y	Westfield	Y	Westfield	Y
		Caledonian		Caledonian	
		Ltd		Ltd	
Ayr	Y	SNBTS	Y Y	SNBTS	Y
Dumfries	Y	Alcontrol	Y	Alcontrol	Y
		Labs		Labs	
Stranraer	Y	Alcontrol	Y	Alcontrol	Y
		Labs		Labs	
Kirkcudbright	Y	Alcontrol	Y	Alcontrol	Y
		Labs		Labs	
Glasgow	Y	SNBTS	Y	SNBTS	Y
Western					
Stobhill	Y	SNBTS	Y	SNBTS	Y
Victoria	Y	SNBTS	Y	SNBTS	Y
GRI	Y	SNBTS	Y	SNBTS	Y
Vale of Leven	Y	SNBTS	Y	GRI lab	Y
Inverclyde	Y	SNBTS	Y	GRI lab	Y
Forth Valley	Y	SNBTS	Y	SNBTS	Y
Monklands	Y	SNBTS	Y	GRI lab	Y
Ninewells,	Y	SNBTS	Y	Alcontrol,	Y
Arbroath, Perth				Bellshill	
Raigmore	Y	SNBTS	Y	Scottish	Y
				Water,	
				Inverness	
Belford	Y	SNBTS	Y	Scottish	Y
				Water	
Caithness	Y	SNBTS	Y	Scottish	Y
				Water	
Edinburgh	Y	SNBTS	Y	SNBTS	Y
Royal,					
Western					
General, St					
Johns, Borders					
General					
Kirkcaldy,	Y	SNBTS	Y	Fife Lab	Y
Queen Margaret					
Hospital, St					
Andrews					

* perform additional disinfection of membranes and/or distribution pipework

Hub and satellite HD	Standard Operating	Action if results	Water plant	Lead for
units	Procedures in place	reach 50% of	maintenance	Clinical
		maximum		Governance
Aberdeen	Y	Y	NHS	Consultant
Inverurie	Y	Y	NHS	
Elgin	Y	Y	NHS	
Peterhead	Y	Y	NHS	
Banff	Y	Y	NHS	
Orkney	Y	Y	NHS	
Shetland	Y	Y	NHS	
Crosshouse	Y	Y	NHS	Consultant
Ayr	Y	Y	NHS	
Dumfries	Y	Y – wish daily testing of chlorine	NHS	Lead Nurse
Stranraer	Y	Y	NHS	
Kirkcudbright	Y	Y	NHS	
Glasgow	*	*		
Glasgow Western	Y	Y	NHS	Consultant
Stobhill	Y	Y	NHS	Consultant
Victoria	Y	Y	NHS	
Glasgow Royal	Y	Y	NHS	
Vale of Leven	Y	Y	NHS	
Inverclyde	Y	Y	NHS	
Forth Valley	Y	Y	PFI	
Monklands	Y	Y	Supplier	Consultant
Ninewells	<u> </u>	Y	NHS	Consultant
Arbroath	1 Y	Y	NHS	Consultant
Perth	<u> </u>	Y	NHS	
	1 Y	Y		Consultant
Raigmore Belford		Y	Supplier	Consultant
	Y Y	Y Y	Supplier	
Caithness	Y Y		Supplier	Consultant
Edinburgh Royal	Ĭ	Y, wishes weekly	PFI +	Consultant
		water hardness + total chlorine < 0.1	Supplier	
Western General	Y	mg/L	NHS +	
WESTERN OCHERAL	1		Supplier	
St Johns	Y		NHS +	
St JOHII2	I		Supplier	
Borders General	Y		NHS +	
Doracio Ocherai	I		Supplier	
Victoria, Kirkcaldy	Y	Y, wishes weekly	PFI +	Consultant
, ievoriu, isiineuluy	Ĩ	water hardness +	Supplier	Consultant
		total chlorine < 0.1	Supplier	
		mg/L		
Queen Margaret	Y		NHS +	
Hospital	I		Supplier	
-	Y		NHS +	
St Andrews	Y			

Table 5: Clinical Governance in HD water plants in Scotland

Appendix: Quality assurance of dialysis water questionnaire used in 2010 and 2015

Name and address of your parent renal unit and its satellites:

(please include a separate report for any satellite unit supported by your parent unit <u>if</u> different procedures for monitoring water quality are followed in the satellite unit)

Who is responsible for water sampling in your unit?

Name: Employer: Line manager: Title:

Question 1 (based on RA Guideline 3.2, 3.6 & 3.7): Water treatment plant

1a. Do you have a centralised RO unit?

1b. How many stations does your RO supply?

1c. Was the current water treatment plant capable of meeting the requirements of BS ISO 13959 and ISO 23500 from the time of installation?

1d. Has the current water treatment plant been shown to produce ultrapure water reliably?

1e. Does your unit perform haemodiafiltration?

Question 2 (based on RA guideline 3.3: Chemical contaminants in water used for preparation of dialysis fluid)

2a. Do you monitor mandatory trace metals at least 3 monthly? If not, how frequently do you perform this? Please state where samples are sent and method if performed at point of care

2b. Do you monitor chlorine levels at least weekly? If not, how frequently do you perform this? Please state where samples are sent and method if performed at point of care

Question 3 (based on RA guideline 3.4: Microbiological contaminants in water used for preparation of dialysis fluid)

3a. Do you monitor endotoxin levels at least monthly?If not, how frequently do you perform this?Please state where samples are sent and method if performed at point of care

3b. Do you monitor total viable bacterial counts at least monthly? If not, how frequently do you perform this? Please state where samples are sent and method if performed at point of care

Question 4 (based on guideline 3.5 which recommends action of corrective measures if chemical or microbiological contaminants exceed 50% of maximum permitted level)

4a. Do you set in motion corrective measures and repeat testing if chemical contaminants exceed 50% of permitted maximum level?

4b. Do you set in motion corrective measures and repeat testing if total bacterial counts or endotoxin levels exceed 50% of permitted maximum level?

Question 5

5a. Do you have a written standard operating procedure for sampling, frequency and methods of monitoring, recording and reporting of continuing audit of dialysis water quality?

5b. Do you wish any changes to the circulated template for a standard operating procedure for monitoring of water quality in haemodialysis units?

5c. Who is responsible for planned preventive maintenance in your haemodialysis unit

5d. Who is responsible for clinical governance of your haemodialysis unit?

Thank you for completing this questionnaire.

We will collate the responses and circulate to all members of the group.