Chlorine levels in water supplied to Dialysis Installations

Following the report from New Cross Hospital (Artery Newsletter 47 p9) on the events surrounding the patients’ exposure to chlorine Dr. Paul Rylance invited comments or solutions. The ART committee thought it would be appropriate to provide a response in this matter.

For the purposes of this document chlorine is used to indicate the use of chlorine, chloramine or chlorine dioxide.

It seemed that, with all the work already carried out regarding chlorine, that this would be a simple matter of pulling all the information together and providing a best-practice set of guidelines. This has not been the case.

The task was broken down into several main areas of importance

1. Water supply provider and their responsibilities.
2. Design of Water Treatment systems for Dialysis
3. Dialysis Clinic responsibilities
4. Frequency of measurement and methods used

As we looked further into these areas they, in turn, were sub-divided into further areas of importance.

Water supply providers and their responsibilities.

There are more than 20 Water Supply companies in England and Wales. Each Water supply company is reported to have a person dedicated to customers with extra needs, such as Home HD patients and Dialysis Clinics. The Water Supplier has a responsibility to maintain water quality according to legislation which includes

- Water Industry Act 1991
- Water Supply (Water Quality) Regulations 2000
- Water Act 2003

Under these legislative documents the Water Companies have a requirement to liaise with the Health Protection Agencies (HPA) in the event of a particulate incident where the health of the public might be exposed to levels of water contamination outwith the levels set in these documents.

The Water Supply companies do NOT have a legislative requirement to contact individuals, though many have a register of special requirement customers. However, any communication set up with such customers is done on an informal agreement and should not be relied on.

The Water Suppliers DO have a legislative requirement to liaise with the HPA and it is the local HPA that must then distribute warnings to the appropriate interested parties, such as Dialysis Clinics and their Home HD patients.

Conclusion As Renal Technologists providing technical service to Dialysis Clinics we cannot afford to rely on the informal arrangement with our local Water Supplier, however diligent they may be, as this arrangement does not meet a robust standard if a major water incident were to occur. Consequently we must:-
• Put a communication pathway in place between the local HPA of all the Dialysis sites under our responsibility.
• Obtain information regarding the action levels at which point the local HPA is contacted regarding incidents.
• Encourage and continue, but not rely solely on, the informal arrangements that we may already have in place with our water suppliers.
• Regularly update the Water Supply companies of the locations and status of our HD sites, both clinics and Home HD locations.

**Design of Water Treatment systems for Dialysis**

There is a vast collection of literature available regarding the design of Dialysis Clinic Water Systems and this should be called upon when designing water treatment for a new clinic or Home HD installation. With regard to Chlorine, and its’ alternatives, it is critical that the Carbon filtration is adequate to remove the worse case dosing of incoming water at the highest flow rate. Please refer to the Renal Association current guidelines regarding acceptable chlorine, and chlorine alternatives, levels. The worst case dosing levels can be obtained by contacting the Water Supplier for the HD site. They will supply the measured levels, maximum and minimum records levels, for the previous 12 months. The technologist should also satisfy themselves that the dosing levels are acceptable by testing vigorously over a period of several months to ensure that levels do not exceed those reported by the Water Treatment companies.

The capacity of the carbon filtration to remove chlorine depends on a number of criteria:

• Maximum Level of chlorine in incoming water (preferably measured daily over a period of no less than 2 months)
• Maximum flow rates, typically during membrane flushing cycles, through the Carbon filtration.
• In The US the FDA require a minimum empty bed contact time of 6 minutes for removal of chlorine and 10 minutes for removal of chloramines. This should be taken as a starting point for calculation and sizing of carbon filtration, confirmed by testing and sampling.

This still leaves the dialysis clinic exposed to an increase in dosing by the water companies in the event of a pathogen or bacterial outbreak in the water supply; the chlorine dosage will be increased to manage such an outbreak and, though the HPA will be informed of the bacterial event they will not necessarily be informed of the increase in dosage of chlorine or to what extent. Additionally, if the clinic is within hospital grounds and the water is supplied for a central water source maintained by the hospital works department it seems that there are no regulations regarding chlorine other than its’ purpose to inhibit bacterial activity.

**Conclusion**

While the design criteria for carbon filtration is well documented, the regulation of levels of chlorine seem to be dependant on local policies within the water companies and hospital works departments. As a group ART should lobby the appropriate authorities to tighten up the regulation and reporting of all chemical events that are performed on the water supply to the dialysis installations.
Dialysis Clinic responsibilities

While ultimately the responsibility for the suitability of water used for Dialysis lies with the lead Nephrologists, they in turn rely on the lead Nurse and Renal Technologist for their input.

As Renal Technologists providing technical service to Dialysis Clinics we must accept the responsibility of providing enough unbiased information to the Multi-Disciplinary Team (MDT) to allow them to make an informed decision when required, and to provide a QA service regarding Water Quality throughout the lifetime of the dialysis clinic setting at other times.

Frequency of measurement and methods used

The frequency of testing water currently is dependant on the local policy of the technical/nursing service. The Renal Association (RA) Guidelines 4th Edition 2007 recommends no less than weekly testing. However, this gives us a snapshot of the chlorine levels and, if performed weekly, does not provide any kind of surveillance that might pick up a temporary high dosing event.

The options for testing are :-

- Testing once per week, manually, as per RA Guidelines
- Test daily at the start of each working day, manually
- Test at the start of each dialysis session, manually
- Continually monitor with an automatic tester with remote alarm

Each of these options has its’ merits and drawbacks and would be best discussed at the ART National Meeting in a workshop setting.

Type of manual testing is also an issue as this will impact on the frequency. The different type of test equipment available range from test strips (easiest but least accurate) to electronic electrode type tester which leaves least interpretation to the user, but will come at a higher cost. What must also be taken into account is the competence level of the user and this may range from Home HD patient/carer through HCA to technologist. Again, this would be best discussed at the ART National Meeting in a workshop setting.
Water Companies in Great Britain

1. **Albion Water**  
   Head Office Address: 71 Clarence Road Teddington Middlesex TW11 0BN  
   Telephone: +44 (0)20 8977 3055 Fax: +44 (0)20 8977 3185  
   http://www.albionwater.co.uk  
   Email: info@albionwater.co.uk

2. **Anglian Water**  
   Head Office Address: Anglian House, Ambury Road, Huntingdon PE29 3NZ  
   Tel: +44 (0) 1480 323 000 Fax : +44 (0) 1480 323 115  
   www.anglianwater.co.uk

3. **Bournemouth & West Hampshire Water**  
   Head Office Address: George Jessel House Francis Avenue Bournemouth BH11 8NX  
   Telephone: +44 (0)1202 591 111 (business line) Telephone: +44 (0)1202 590 059 (customer contact centre) Fax:  
   +44 (0)1202 597 022 http://www.bwhwater.co.uk Email: customerservice@bwhwater.co.uk

4. **Bristol Water**  
   Head Office Address: PO Box 218 Bridgwater Road Bristol BS99 7AU  
   Telephone: +44 (0)117 966 5881 Fax: +44 (0)117 963 4576  
   http://www.bristolwater.co.uk

5. **Cambridge Water**  
   Head Office Address: 90 Fulbourn Road Cambridge, CB1 9JN  
   Telephone: +44 (0) 1223 403 000 Fax: +44 (0) 1223 214 052  
   http://www.cambridge-water.co.uk

6. **Cholderton & District Water Company Ltd**  
   Head Office Address: Estate Office Cholderton Salisbury Wiltshire SP4 0DR  
   Telephone: +44 (0)1980 629 203 Fax: +44 (0)1980 629 307  
   http://www.choldertonwater.co.uk/

7. **Dee Valley Water**  
   Head Office Address: Packsaddle Wrexham Road Rhostyllen Wrexham Clwyd North Wales LL14 4EH  
   Telephone: +44 (0)1978 846 946 Fax: +44 (0)1978 846 888  
   http://www.deevalleygroup.com/DVW/DVW.htm

8. **Dwr Cymru/Welsh Water**  
   Head Office Address: Pentwyn Road, Nelson, Treharris, Mid Glamorgan, CF46 6LY Tel: +44 (0)1443 452 300 Fax: +44 (0)1443 452 323  
   www.dwrcymru.co.uk

9. **Essex & Suffolk Water**  
   Now part of Northumbrian Water Ltd Hall Street Chelmsford Essex CM2 0HH  
   Telephone: +44 (0)1245 491 234 Fax: +44 (0)1245 212 345  
   http://www.eswater.co.uk

10. **Hartlepool Water Plc**  
    Hartlepool Water 3 Lancaster Road Hartlepool Teesside TS24 8LW  
    http://www.anglianwater.co.uk/index.php?sectionid=175&parentid=175
11. **Independent Water Networks**  
   Ocean Park House East Tyndall Street Cardiff CF24 5GT Call us on: 0845 051 1650 Fax us on: 0871 429 0589 Email us at: enquires@iwnl.co.uk

12. **Northumbrian Water**  
   Head Office Address: Abbey Road, Pity Me, Durham DH1 5FJ Tel: +44 (0)8706 084820 Fax: +44 (0)191 384 1920 www.nwl.co.uk

13. **Portsmouth Water**  
   Head Office Address: PO Box 8 West Street Havant Hants PO9 1LG  
   Telephone: +44 (0)23 9249 9888 Fax: +44 (0)23 9245 3632  
   www.portsmouthwater.co.uk

14. **Scottish Water**  
   Head Office Address : Scottish Water, PO Box 8855, Edinburgh, EH10 6YQ  
   Telephone : 0845 601 8855 http://www.water-guide.org.uk/scottish-water.html

15. **Severn Trent Water**  
   Head Office Address: 2297 Coventry Road, Sheldon, Birmingham B26 3PU  
   Tel: +44 (0)121 722 4000 Fax: +44 (0)121 722 4800  
   www.stwater.co.uk

16. **South East Water**  
   Head Office Address: Rocfort Road Snodland Kent ME6 5AE  
   Telephone: +44 (0)845 8 60 60 60 Fax: +44 (0) 1444 413 200  
   www.southeastwater.co.uk

17. **South Staffordshire Water**  
   Head Office Address: Green Lane Walsall West Midlands WS2 7PD  
   Telephone: +44 (0)1922 638 282 Fax: +44 (0)1922 723 631  
   http://www.south-staffs-water.co.uk

18. **South West Water**  
   Head Office Address: Peninsula House, Rydon Lane, Exeter EX2 7HR  
   Tel: +44 (0)1392 446 688 Fax: +44 (0)1392 434 966  
   www.southwestwater.co.uk

19. **Southern Water**  
   Head Office Address: Southern House, Yeoman Road, Worthing, Sussex BN13 3NX  
   Tel: +44 (0)1903 264 444 Fax: +44 (0)1903 262 185  
   www.southernwater.co.uk

20. **Sutton & East Surrey Water**  
   Head Office Address: London Road Redhill Surrey RH1 1LJ  
   Telephone: +44 (0)1737 772 000 Fax: +44 (0)1737 766 807  
   http://www.waterplc.com

21. **Thames Water**  
   Head Office Address: Clearwater Court, Vastern Road, Reading RG1 8DB  
   Tel: +44 (0)118 373 8000 Fax: +44 (0)1793 424 291  
   www.thameswater.co.uk
22. United Utilities Water
   Head Office Address: Howeswater House, Lingley Mere Business Park, Lingley Mere Avenue, Great Sankey, Warrington WA5 3LW Tel: +44 (0)1925 237 000 www.unitedutilities.com

23. Veolia Water Central Ltd (formerly Three Valleys Water)
   Head Office Address: PO Box 48 Bishops Rise Hatfield Hertfordshire AL10 9HL Telephone: +44 (0)1707 268 111 Fax: +44 (0)1707 277 333 http://www.3valleys.co.uk

24. Veolia Water East Ltd (formerly Tendring Hundred)
   Head Office Address: Mill Hill Manningtree Essex CO11 2AZ Telephone: +44 (0)1206 399 200 Fax: +44 (0)1206 399 210 http://www.thws.co.uk

25. Veolia Water SouthEast Ltd (formerly Folkstone and Dover Water)
   Head Office Address: Cherry Garden Lane Folkestone Kent CT19 4QB Telephone: +44 (0)1303 298 800 Fax: +44 (0)1303 276 712 http://www.fdws.co.uk

26. Dŵr Cymru Welsh Water
   Head Office Address: Pentwyn Road, Nelson, Treharris, Mid Glamorgan, CF46 6LY Tel: +44 (0)1443 452 300 Fax: +44 (0)1443 452 323 www.dwrcymru.co.uk

27. Wessex Water
   Head Office Address: Claverton Down Road, Claverton Down, Bath BA2 7WW Tel: +44 (0)1225 526 000 Fax: +44 (0)1225 528 000 www.wessexwater.co.uk

28. Yorkshire Water
   Head Office Address: Western House, Western Way, Bradford BD6 2LZ Tel: +44 (0)1274 691 111 Fax: +44 (0)1274 604 764 www.yorkshirewater.com
Useful links

**Consumer Council for Water**

The Consumer Council for Water represents water and sewerage consumers in England and Wales.


**The Drinking Water Inspectorate**

DWI is responsible for assessing the quality of drinking water in England and Wales.


**Ofwat**

The economic regulator for the water and sewerage industry in England and Wales


**Defra**

Defra is the UK government department responsible for policy and regulations on the environment, food and rural affairs.


**Environment Agency**

The Environment Agency is an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs and an Assembly Sponsored Public Body responsible to the National Assembly for Wales, whose principal aims are to protect and improve the environment, and to promote sustainable development. They play a central role in delivering the environmental priorities of central government and the Welsh Assembly Government through their functions and roles.

What is Regulation 31

Regulation 31 of the Water Supply (Water Quality) Regulations 2000\(^1\) implements Article 10 of the Council of the European Union Drinking Water Directive (DWD) in England and Wales for all chemicals and construction products used by water undertakers, from the source of the water, up to the point of delivery to the consumer’s building. It sets out how approvals can be given to such construction products and materials that do not prejudice water quality and consumer safety.

Article 10 of the DWD states that:

Quality assurance of treatment, equipment and materials

*Member States shall take all measures necessary to ensure that no substances or materials for new installations used in the preparation or distribution of water intended for human consumption or impurities associated with such substances or materials for new installations remain in water intended for human consumption in concentrations higher than is necessary for the purpose of their use and do not, either directly or indirectly, reduce the protection of human health provided for in this Directive; the interpretative document and technical specifications pursuant to Article 3 and Article 4 (1) of Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products (1) shall respect the requirements of this Directive.*

The full text of the Water Supply (Water Quality) Regulations is available from the DWI website - [http://www.dwi.gov.uk/regs/si3184/3184.htm](http://www.dwi.gov.uk/regs/si3184/3184.htm).

Guidance on these Regulations is also available from the DWI website - [http://www.dwi.gov.uk/guidance/Guidance to WS(WQ) Regulations_October2008_FINAL.pdf](http://www.dwi.gov.uk/guidance/Guidance to WS(WQ) Regulations_October2008_FINAL.pdf)

Details of how to obtain approval for treatment chemicals, construction products and materials for use with drinking water is given in Advice Sheet No 1, together with an explanation of the approval arrangements elsewhere in the United Kingdom.