



guardians of drinking water quality

DRINKING WATER INSPECTORATE

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6 February 2001

Information Letter 3/2001

To: Board Level Contacts of Water and Sewerage Companies and Water Companies in England and Wales

Dear Sir/Madam

FURTHER GUIDANCE ON REQUIREMENTS TO MEET NEW LEAD STANDARDS

Purpose

1. The purpose of this letter, which has been prepared in consultation with the Lead Working Group, is to provide water companies with:
 - clarification of the advice contained in DWI Information Letter 12/2000 and the associated draft Framework for a Strategy for Plumbosolvency Control by Treatment; and
 - further advice on the requirements to meet the new lead standards.

Background

2. DWI Information Letter 12/2000 and the associated draft Plumbosolvency Strategy Framework provided comprehensive advice to water companies on the criteria to be adopted as the trigger values for the steps to be taken to meet the new tighter lead standards, including optimisation of existing, new and further plumbosolvency treatment and control measures. Since the issue of the letter, the Inspectorate has held meetings with most water companies to discuss their plumbosolvency treatment and control strategies and their programmes of work. The Inspectorate has also written to individual water companies commenting on their draft plumbosolvency strategies and clarifying and providing further advice on some issues. A number of issues were also discussed at a recent meeting of the Lead Working Group which included representatives from Water UK and the water companies, the Inspectorate and the Water Supply and Regulation Division of the Department of the Environment, Transport and the Regions. This letter brings together, for the benefit of all water companies, the

clarification and further advice provided in those letters and during that meeting.

Timetable

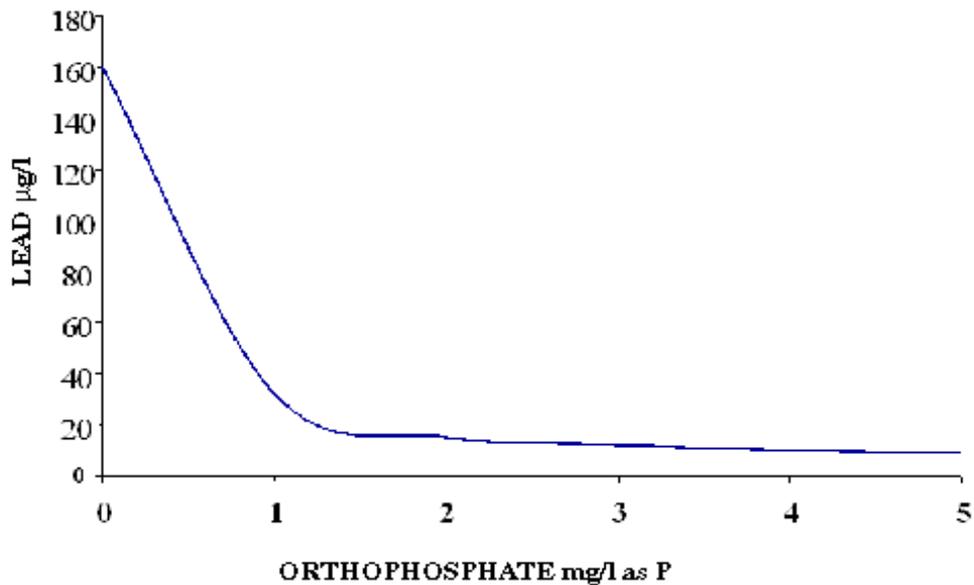
3. To comply with the timetable required by the Directive, Ministers and the Water Supply (Water Quality) Regulations 2000 (the 2000 Regulations):
 - all new and further plumbosolvency treatment measures required to attempt to meet the **10 µg/l** standard must be installed and commissioned by **31 December 2002** and optimised for **10 µg/l** by **25 December 2003**;
 - where necessary, existing plumbosolvency treatment measures must be optimised for **10 µg/l** by **31 December 2002**;
 - after plumbosolvency treatment has been optimised, any strategic lead pipe replacement required to meet **25 µg/l** must be completed by **25 December 2003**; and
 - after plumbosolvency treatment has been optimised, any strategic lead pipe replacement required to meet **10 µg/l** must be completed by **25 December 2013**.
4. Regulation 30(1) of the 2000 Regulations, which comes into force on 1 January 2004, requires water companies, where there is a risk (the prescribed risk) of exceeding **10 µg/l** at consumers' taps, to treat the water so as to eliminate the risk or reduce it to a minimum. Water companies should assume that there is such a risk in all their water supply zones, unless evidence is available that there is no such risk. Evidence of no risk is when, say, a minimum of 100 random day time samples have been taken in the zone or zones supplied by a treatment works or group of treatment works and all are less than 10 µg/l. Strictly therefore treatment should be installed at all treatment works that supply a zone or zones where any failures to meet 10 µg/l occur. However, the Inspectorate recognises that it is not appropriate, or the most effective method, to install treatment to reduce the risk at treatment works that supply a zone or zones where only a small percentage of random daytime samples exceed 10 µg/l. Consequently the Inspectorate has only required treatment to be considered at those treatment works or groups of treatment works that supply a zone or zones where more than 5% of random daytime samples exceed 10 µg/l. Where plumbosolvency treatment is being, or has been, installed it has to be optimised to get the best practical reduction in lead concentrations.
5. So that water companies comply with regulation 30(1) when it comes into force, the Inspectorate considers that water companies should attempt from the start to optimise plumbosolvency treatment for **10 µg/l**. The dates proposed by the Inspectorate in recent letters to water companies for the completion of the installation and commissioning of plumbosolvency treatment measures by **31 December 2001** and optimisation for **10 µg/l** by

31 December 2002 would give a minimum of 12 months, prior to the coming into force of the standard on **25 December 2003**, to carry out any strategic lead pipe replacement needed to meet **25 µg/l**.

6. The Inspectorate recognises that water companies that have a programme requiring plumbosolvency treatment measures at a large number of treatment works may need flexibility on dates for project management reasons and it is happy to consider proposals from individual water companies, provided the overall timetable in paragraph 3 above is met. Water companies should prioritise the work within the plumbosolvency treatment programme so that highest priority is given to areas with highest lead concentrations and largest populations supplied through lead pipes, and areas where there is a risk of not achieving **25 µg/l** by plumbosolvency treatment measures.

Optimisation and Stabilisation

7. Optimisation and stabilisation are not the same. In the context of this letter, optimisation means applying the optimum orthophosphate dose and maintaining the optimum orthophosphate concentration within distribution within the optimum pH range to obtain the best practical reduction in lead concentrations. In the context of this letter, stabilisation means the process by which the applied orthophosphate dose (which may be optimisation dose, or a target dose) reacts with the materials of, and deposits in, the distribution system and with the surface of the lead pipes to obtain a consistent orthophosphate concentration within distribution and a consistent reduction in lead concentrations.
8. The Inspectorate considers that orthophosphate may need to be dosed to all supplies where plumbosolvency treatment is required. Where orthophosphate is dosed, it must be dosed at the optimum orthophosphate concentration and the pH value within distribution maintained within the optimum range. The optimum orthophosphate concentration must be maintained and stabilised as far as practical within the distribution system. It is unlikely that pH and alkalinity control alone will be sufficient to obtain the best practical reduction in lead concentrations. Any water company that wishes to rely solely on pH and alkalinity control for a particular supply or group of supplies will have to demonstrate to the Inspectorate by appropriate tests that dosing orthophosphate at the optimum dose cannot achieve a further significant reduction in lead concentrations.
9. The idealised graph below shows the equilibrium solubility of lead against orthophosphate dose for a particular water supply at a particular pH value. The optimum orthophosphate dose in this example is about 1.3 to 1.5 mgP/l.



The equilibrium solubility of lead against orthophosphate dose will vary with different water supplies or different groups of water supplies of similar composition. It will also vary to a small extent with pH value in a particular supply. The shape of the graphs for different water supplies or different groups of water supplies and different pH values will be broadly similar but the position of the line will vary as will the optimum orthophosphate dose. Experience so far suggests that the optimum orthophosphate dose is between 0.7 and 1.7 mgP/l for the range of waters usually encountered, although values outside this range may be appropriate in exceptional circumstances.

10. The optimum orthophosphate dose depends on the secondary factors of alkalinity, pH value and organic content, particularly organic colour. Although there may be exceptions, experience suggests, in general, that the optimum pH range for the optimum orthophosphate dose will be:

- for hard waters when the pH value is 7.2 to 7.8
- for soft waters a higher pH value than this range may be required, depending on the organic content, particularly organic colour, and the need to minimise corrosion of iron distribution systems.

The optimum orthophosphate dose will be higher in water with a high organic colour content than in waters with a low organic colour content.

11. Water companies are required to determine the optimum orthophosphate dose and pH value for each water supply or each group of water supplies of similar composition. The optimum orthophosphate dose should be demonstrated by graphs similar to that above for each supply or group of

supplies and records of the supporting data should be available for audit, if required by the Inspectorate. Water companies are reminded that the optimum orthophosphate dose has to be maintained as far as practical as a consistent orthophosphate residual throughout the distribution system.

12. Because the timetable for installation and optimisation of treatment is extremely tight, water companies need to make a start now on determining optimum orthophosphate doses and pH values, if they have not already made the determination. This can be carried out at the same time as the treatment is being installed provided the treatment equipment is sized to allow for the maximum likely orthophosphate dose.
13. The Inspectorate considers that laboratory lead pipe rigs may be used to make an estimate of the optimum orthophosphate dose and optimum pH value. These pipe rigs can use "new" lead pipe rather than "old" lead pipe exhumed from the water supply being tested. Pipe rigs and their uses are described in DWI Information Letter 2/90. Full scale or pilot scale trials (using 30 minute stagnation samples from selected properties supplied through lead pipes or lead pipe rigs) as suggested in Annex A to IL 12/2000 (a revised Annex A is attached to this IL) will enable account to be taken of distribution characteristics. But they may take too long to determine the optimum dose given the tight timetable for optimising treatment, unless the system stabilises quickly (within months).
14. If a water company is ready to start orthophosphate dosing, but has not determined the optimum orthophosphate dose, the Inspectorate would support the commencement of dosing at the company's best estimate of the likely optimum orthophosphate dose (target dose) and the likely optimum pH value. Such support is conditional on the understanding that the target dose is the initial step in the process of optimising plumbosolvency treatment measures. Once it has determined the optimum orthophosphate dose, the water company can adjust the orthophosphate dose and, if necessary, the pH value.

Best practical reduction in lead concentrations

15. The optimum orthophosphate dose is that which gives the best practical reduction in lead concentrations. Apart from complying with the Directive and 2000 Regulations requirements, the aim is to minimise the amount of lead pipe replacement required. The best practical reduction in lead concentrations is **not** measured by a target in terms of a specific percentage of random daytime samples exceeding **10 µg/l**, because what is achievable will vary with different types of water supplies and systems.
16. The Inspectorate will use the following criteria as appropriate for determining when treatment is optimised for a particular water supply or particular groups of water supplies:

- the optimum dose, determined by laboratory pipe rigs tests at a range of orthophosphate concentrations, has been stabilised and maintained as far as practical throughout the distribution system
 - the optimum dose, determined by full scale or pilot scale trials at a range of orthophosphate concentrations, has been stabilised and maintained as far as practical throughout the distribution system
 - the optimum dose, determined by practical experience of similar circumstances at a range of orthophosphate concentrations, has been stabilised and maintained as far as practical throughout the distribution system
 - the optimum dose, determined by solubility or other computational models (if appropriate) at a range of orthophosphate concentrations, has been stabilised and maintained as far as practical throughout the distribution system
 - where sufficient numbers of random day-time compliance samples have been taken since the target dose has stabilised, no samples have exceeded **10 µg/l**
 - where sufficient numbers of random day-time samples have been taken since the target dose has stabilised, a small number of samples, say less than 2%, have exceeded **10 µg/l** and there are exceptional circumstances which explain each exceedance, such as a very long length of lead pipe
 - an increase in the orthophosphate dose produces no further worthwhile reduction in lead concentrations as measured using stagnation samples, lead pipe rigs or, if the water company can justify their use, random day-time samples.
- 17.If, for a particular water supply or group of water supplies, a water company can demonstrate that it can achieve and maintain full compliance with 10 µg/l with less than the optimum orthophosphate dose, then it will not be required to dose at the optimum.

Monitoring the effectiveness of plumbosolvency treatment

18. Water companies are required to demonstrate that the plumbosolvency treatment measures:

- have stabilised, that is orthophosphate has penetrated throughout the distribution system at the optimum dose and has reached equilibrium with the distribution system and the lead pipework, and the pH value is as consistent as practical and as close to the optimum value as practical, throughout the distribution system; and
- have achieved a significant reduction in lead concentrations.

The former is demonstrated by monitoring orthophosphate concentrations and pH values in distribution and by monitoring lead concentrations at consumers' taps (or in situ lead pipe rigs) and the latter by monitoring lead concentrations at consumers' taps (or in situ lead pipe rigs).

The Inspectorate expects water companies to set targets and allowable ranges for relevant parameters at treatment works and in distribution to monitor and control plumbosolvency as part of its strategy for plumbosolvency measures.

19. The Inspectorate considers that this monitoring for lead concentrations should consist of 30 minute (or other period) stagnation samples at a sufficient small number of specially selected properties supplied through lead pipe. These samples should be collected and analysed for a period (ideally at least six months spanning some winter and summer temperatures) prior to commencement of dosing and a period after dosing has commenced until the system has stabilised and no further reduction in lead concentrations is achievable at the stabilised dose. The Inspectorate recognises that stagnation samples can be difficult and time consuming to obtain unless there are appropriate properties occupied by water company personnel. The Inspectorate will accept results from a sufficient small number of lead pipe rigs placed at appropriate points in the distribution system which are designed to automatically take stagnation samples to replace some or all of the properties at which stagnation samples are taken.

20. The then Department of the Environment issued advice in the early 1980s on monitoring the effectiveness of plumbosolvency treatment. This recommended a minimum of two and a maximum of four properties for each area supplied by a treatment works (or group of similar treatment works). It recommended taking three stagnation samples (clusters) over a period of seven days each month to minimise variability. It indicated that plots of lead concentrations against time can be used to measure effectiveness. The Inspectorate considers that this general advice is still valid, however the maximum number of fixed sampling points (properties and rigs) should be at the discretion of the water company and should reflect the complexity of the treatment and supply systems for each scheme. The Inspectorate considers that orthophosphate residual at the property (or pipe rig) should also be included in the plots mentioned above.

21. Once no further reduction is achievable at the optimum dose, the Inspectorate considers that monitoring should continue, albeit at a lower frequency, at at least one site (property or pipe rig) to check that the reduction is being maintained.

22. Any water company that wishes to use other types of monitoring system (for example random daytime samples) for assessing stabilisation and effectiveness of treatment, will have to provide a full justification which demonstrates that equivalent results can be obtained to those from the systems described above. Water companies should bear in mind that

random daytime samples are much more variable than stagnation samples.

Complex water supply areas

23. Where it is necessary to apply plumbosolvency treatment to a group of treatment works that supply a number of water supply zones, it is important that a consistent orthophosphate dose is maintained throughout all the zones and that the pH value is as consistent as possible. This means that water companies will need to optimise plumbosolvency measures at each of the treatment works supplying the area, whether supplying continuously or intermittently.

Small water supply zones

24. IL 12/2000 stated that treatment will be required at treatment works which exceed the specified criteria unless:

- such treatment cannot achieve a significant reduction in lead concentrations; or
- treatment is not reasonably practical

The new Water Supply (Water Quality) Regulations 2000, which transpose the Directive, do not include reference to zones where the prescribed risk relates only to water supplied to an insignificant part of the zone. The reasons for this are that if the percentage of properties supplied through lead pipe is low the specified criteria for triggering plumbosolvency treatment measures will not be exceeded and the Directive makes no provision for excluding small zones from the requirements for lead. It follows that plumbosolvency treatment measures will be required at treatment works supplying small zones where the specified criteria are exceeded.

Need for future additional treatment

25. After a Statement of Intent for plumbosolvency treatment measures has been agreed, a water company may find that it needs to consider plumbosolvency treatment measures at a treatment works not included in the original programme. In such a case a water company should submit its proposals with full justification and supporting evidence to the Inspectorate for consideration. If the Inspectorate agrees to support the proposals the treatment works will be added to the programme. Funding arrangements would, as usual, be a matter for the water company to resolve with OFWAT.

Operational constraints

26. IL 12/2000 made water companies aware of the potential impact that changes to supply arrangements could have on the effectiveness of plumbosolvency treatment measures. The Inspectorate will assume that

water companies have made adequate provision for foreseeable changes to supply arrangements in their programmes of work to be included in the Statements of Intent.

Strategy for plumbosolvency control by treatment

27. Attached at Annex A is a revised Framework for a Strategy for Plumbosolvency Control by Treatment which reflects the clarification and further guidance in this letter. The Inspectorate expects all water companies to use this Framework and the advice in the associated Guidance in preparing their strategies for Plumbosolvency Control by Treatment, unless a water company can demonstrate that it is inappropriate for its circumstances. With the issue of the further advice in this Information Letter, water companies should finalise their strategies as quickly as possible. In due course, when the Inspectorate has issued further advice, water companies will be required to prepare supplementary strategies on Lead Pipe Replacement.

Lead pipe replacement

28. Subject to an assessment of the reduction of lead concentrations accruing from the optimisation of plumbosolvency treatment measures, strategic lead pipe replacement may be required to meet **25 µg/l** by **25 December 2003** and **10 µg/l** by **25 December 2013**. A start should be made on the replacement programme to meet **10 µg/l** before the end of the current AMP3 period (31 March 2005).

29. The Inspectorate has indicated that it would welcome proposals for opportunistic lead pipe replacement, particularly where synergy can be gained in conjunction with the "quality-driven" mains renovation programme. No new investigating work is necessary for opportunistic lead pipe replacement to be supported by the Inspectorate but the following conditions will need to be met:

- evidence that the **10 µg/l** standard has been exceeded within the zone, or sub-zone, in which the mains renovation programme is to take place; and
- there is reason to believe that plumbosolvency treatment measures alone will not meet **10 µg/l**.

Water companies wishing to make use of opportunistic lead pipe replacement should submit their proposals and justification to the Inspectorate for consideration. The evidence submitted may be subject to confirmation by audit by the Inspectorate. All proposals must be agreed in advance by the Inspectorate to count as "quality-driven" work.

If the Inspectorate supports opportunistic lead pipe replacement, and optimisation of plumbosolvency treatment measures are subsequently shown to achieve compliance with **10 µg/l**, the Inspectorate confirms that the replacement carried out will continue to count as "quality-driven" work.

Financial provision

31. Matters relating to the financial provision for programmes of work in the 1999 Periodic Review to meet the new lead standards were addressed in ILs 13/98 and 12/2000. It was made clear that if the criteria for action were different to those assumed for the 1999 Periodic Review, OFWAT had confirmed that the lead programme will be recognised as a relevant change of circumstance.
32. The criteria for action set out in IL 12/2000 are different to those assumed for the 1999 Periodic Review. The criteria will result in more plumbosolvency treatment measures and less lead pipe replacement for most water companies than assumed in the 1999 Periodic Review for the period to 31 March 2005. It cannot be assumed, therefore, that the impact of the combined programmes of work for plumbosolvency treatment measures, strategic lead pipe replacement, and opportunistic lead pipe replacement in the period to 31 March 2005, will require the same financial provisions as that assumed in the Final Determinations for the 1999 Periodic Review.
33. The Inspectorate will record and report to OFWAT all plumbosolvency treatment measures and lead pipe replacement supported by the Inspectorate and confirmed as having been carried out by water companies. Allocation of the costs of supported programmes is a matter between OFWAT and water companies.

Statements of Intent

34. Water companies are reminded of the urgent need to agree Statements of Intent for their lead programmes, so that they can submit by **31 March 2001** to the Inspectorate for approval their programmes of works as required by regulation 41 of the 2000 Regulations.

Enquiries

35. General enquiries on this letter should be addressed to Owen Hydes (020 7944 5960) or Milo Purcell (020 7944 5993).
36. Copies of this letter are being sent to Pamela Taylor, Chief Executive, Water UK; Rodney Anderson, Water Supply and Regulation Division, Department of the Environment, Transport and Regions; Bob Macey, Environment Division, The National Assembly for Wales; Tim Hooton, Water Services Unit, Scottish Executive; Randal Scott, Drinking Water Inspectorate for Northern Ireland; Rowena Tye, Office of Water Services.
37. Please acknowledge receipt of this letter using the enclosed slip and envelope.

Yours faithfully

Michael Rouse
Chief Inspector
Drinking Water Inspectorate

Annex A

DWI Information Letter 12/2000, 12 April 2000

DWI Information Letter 3/2001, 5 February 2001

FRAMEWORK FOR A STRATEGY FOR PLUMBOSOLVENCY CONTROL BY TREATMENT MEASURES

This framework sets out the Inspectorate's guidance to assist water companies to develop their strategies for plumbosolvency control by treatment measures. The framework was first compiled following a careful review of comments received from water companies on Information Letter 14/99 on Lead in Drinking Water and the attached reports thereto on Lead Strategy (by WRc), Lining Techniques (by WRc) and Plumbosolvency Treatment (by Binnie Black and Veatch). The framework has been revised in the light of comments received from water companies since the issue of Information Letter 12/2000 and the experience of water companies in initiating further programmes of plumbosolvency treatment measures. The framework sets out in the left hand column the elements which the Inspectorate considers should be included in a water company's strategy for plumbosolvency control by treatment. In the right hand column guidance is provided on items that water companies should consider including for each of those elements depending on their local circumstances. This framework is advisory and will be subject to future revisions that will take into account relevant experience in the water industry. The Inspectorate welcomes any comments that water companies may have on this framework. Any water company that follows the elements and guidance of this framework will fulfil the Inspectorate's requirement for a strategy for plumbosolvency control by treatment. However, the Inspectorate recognises that the guidance part of this framework is not the only way to fulfil that requirement and any water company that adopts an alternative approach to all or part of the guidance is advised to ensure that it can demonstrate that the alternative approach constitutes an effective strategy.

Elements of a Strategy for Plumbosolvency Control by Treatment	Guidance on items to be considered by the water company
1. Basic data requirements	The Inspectorate suggests that the basic data requirements might include: <ul style="list-style-type: none">• Classification of the chemical character of the treated water from all water treatment works according to the relevant water chemistry such as hardness, alkalinity, pH value and organic content (particularly organic colour).• Identification of the works that currently supply plumbosolvent treated water and confirmation of the extent of optimisation of any plumbosolvency treatment throughout

	<p>the whole of the area of supply from each works.</p> <ul style="list-style-type: none"> • Identification of all zones supplied wholly from each works. • Identification of all zones supplied partly from each works. • Grouping of water supply zones supplied wholly or mainly by the same treatment works. • Grouping of water supply zones supplied by two or more treatment works (group of works) in integrated supply systems. • Grouping of water supply zones in distribution according to water chemistry with the objective of achieving plumbosolvency control. <p>A water company should use the above data to assist in identifying the treatment works that may require consideration of new or further plumbosolvency control by treatment measures or optimisation of existing plumbosolvency control.</p>
<p>2. Identification of treatment works for consideration of new or further plumbosolvency treatment and control or optimisation of existing plumbosolvency treatment and control</p>	<p>The Inspectorate considers that to establish the need for plumbosolvency treatment or optimisation of existing plumbosolvency treatment each water company should:</p> <ul style="list-style-type: none"> • Use random daytime (RDT) lead sample results (compliance samples and special survey provided random) since last relevant treatment change. • Confirm that an appropriate validated analytical methodology with respect to 10 µg/l standard has been used to obtain these results, or estimate the uncertainty due to any analytical shortcomings. • Compile and aggregate the results for all zones supplied wholly and mainly by each individual treatment works, since last relevant treatment change. • Assess each treatment works against the criterion whether 5% of samples from all these zones exceed 10 µg/l. • Undertake additional lead sampling (over 12 months to account for seasonal effects) where the total number of samples taken in zones supplied by each treatment works is less than 100, unless it is obvious from the samples taken and other relevant

	<p>information that the result is likely to be well above or well below 5%. Statistical projection from a smaller but adequate number of results or extrapolation from results from similar works/zones or evidence of plumbosolvency propensity or from modelling may be acceptable.</p> <ul style="list-style-type: none"> • Consider plumbosolvency treatment and control at each works where more than 5% of samples exceed 10 µg/l. • Assume that new or further plumbosolvency treatment and control or optimisation of existing treatment is not required at works where less than 5% of samples exceed 10 µg/l unless there is a zone with significant percentage of samples exceeding 10 µg/l (say 10%) in which case further investigation is needed. • For integrated supply systems compile and aggregate the results for the group of zones supplied by the group of treatment works and assess each group of works against the criterion above. Examine the results further and consider other relevant information to determine whether plumbosolvency control and treatment needs to be considered at some or all of the works in the group. <p>The Directive requires and the new Regulations will require treatment to be provided in order to reduce or eliminate the risk of the water not complying at consumers' taps. Treatment will need to be considered at works or groups of works where more than 5% of samples exceed 10 µg/l. Also plumbosolvency treatment will be required to be maintained where there are significant numbers of lead pipes owned by property owner, irrespective of whether the company has replaced all of its lead pipes.</p>
<p>3. Where plumbosolvency treatment and control has to be considered and there is existing plumbosolvency treatment and control</p>	<p>The Inspectorate suggests the following might be considered for each water treatment works (or location) where plumbosolvency treatment and control is currently practised. The relevant information should be available for audit in order to justify the actions taken by the water company:</p>

	<ul style="list-style-type: none"> • The rationale for selecting the type of treatment (orthophosphate dosing, pH/carbonate adjustment/control). • Details of raw and treated water chemistry (pH, alkalinity as HCO₃, orthophosphate residual as mg/l P, dissolved inorganic carbon (DIC), organic content (particularly organic colour). • Details of the existing plumbosolvency treatment, optimisation and control practised at the works taking into account the water chemistry at the works and in the zone(s) supplied from the works. • Similar details as treatment for any plumbosolvency control practised in the distribution system • Details of plumbosolvency control monitoring locations. • Proposals to install further treatment or optimise existing plumbosolvency treatment and control measures at the works and if appropriate in the distribution system including each step to be taken and programme for its implementation and monitoring. • Reasons for expecting significant reduction in lead concentrations (see Section 5). • Monitoring proposals to check effectiveness and compliance. • Reasons for not proceeding with further treatment or optimisation (see Section 5). <p>Where treatment works receive raw water from more than once source and zones receive water from more than one works the water company will need to consider how best to optimise plumbosolvency treatment for these variable conditions to achieve the maximum reduction in lead concentrations.</p>
<p>4. Where plumbosolvency treatment and control has to be considered and there is no plumbosolvency treatment at present</p>	<p>The Inspectorate suggests the following might be considered for each water treatment works (or location) where new plumbosolvency treatment and control measures have to be considered. The relevant information should be available for audit in order to justify the actions taken by the water company:</p> <ul style="list-style-type: none"> • Water quality and associated matters including (see Binnie, Black and Veatch

	<p>report)</p> <ul style="list-style-type: none"> ○ Initial water quality - pH, alkalinity, DIC, organic content (particularly organic colour) ○ pH stability ○ Treatment experience at other water systems with similar characteristics ○ Plumbosolvency testing - laboratory pipe rigs ○ Solubility models and other computational models ○ Compatibility of different water sources in distribution ○ Corrosion of iron mains - red water ○ Corrosion of other metals ○ Effects on cement mortar linings ○ Impact on microbiological quality, including biofilms ○ Calcium carbonate precipitation ○ Effects on disinfection by-products ○ Special users - food processing industries ○ Effects on chloramination <ul style="list-style-type: none"> ● Proposals for new treatment and control ● Reasons for expecting significant reduction in lead concentration e.g. (see Section 5) <ul style="list-style-type: none"> ○ Similar treatment for similar water ○ Pilot scale trials ○ Pipe rigs - laboratory or at operational works/distribution system ○ Solubility or other computational models ● Reasons for not proceeding with further treatment or optimisation e.g. (see Section 5) <ul style="list-style-type: none"> ○ Not capable of achieving significant reduction in lead concentrations with evidence ○ Further treatment not reasonably practical ● Monitoring proposals to check effectiveness and compliance. <p>Where treatment works receive raw water from more than once source and zones</p>
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	<p>receive water from more than one works the water company will need to consider how best to optimise plumbosolvency treatment for these variable conditions to achieve the maximum reduction in lead concentrations.</p>
<p>5. Deciding whether plumbosolvency treatment and control is beneficial</p>	<p>The Inspectorate considers that:</p> <ul style="list-style-type: none"> • New or further treatment should be installed whenever a significant reduction in lead concentrations can be expected at consumers' taps. Significant reduction is lower of 20% or 2.5 µg/l reduction in stagnation samples in full or pilot scale trials or in laboratory or operational pipe rigs. • New or further treatment need not be installed if no significant reduction can be demonstrated • Treatment need not be installed if not reasonably practical (treatment by softening processes is not practical).
<p>6. Optimisation of plumbosolvency treatment and control</p>	<p>The Inspectorate considers that optimisation of treatment and control of appropriate water quality parameters is needed at water treatment works and through distribution to the ends of water supply systems. The determination of water quality parameters to be changed and duration between any changes are key requirements for achieving optimum plumbosolvency control. Optimisation means the best practical reductions in lead concentrations.</p> <p>Optimisation for plumbosolvency treatment and control should be based on one or more of the following:</p> <ul style="list-style-type: none"> • Practical experience of similar circumstances; • Laboratory or operational pipe rigs • Solubility or other computational models (if appropriate); • Full scale or pilot scale trials. <p>Optimisation for orthophosphate dosing</p> <p>Experience now suggests that generally the optimum range from treatment works to the ends of the supply system for</p>

	<p>orthophosphate concentrations and pH value is</p> <ul style="list-style-type: none"> • Orthophosphate residual - 0.7 - 1.7 mg P/l • pH value - 7.2 to 7.8 for hard waters • pH value - for soft waters a higher pH value than this range may be required depending on the organic colour and the need to minimise corrosion of iron distribution systems. <p>The maximum orthophosphate concentration is unlikely to exceed 1.7 mg P/l, but higher values can be considered in appropriate circumstances. The choice of chemicals for orthophosphate dosing and pH control should reflect the water chemistry of the supply. The optimum orthophosphate dose/residual will depend on the chemistry of the water supply and the nature of the distribution system.</p> <p>Optimisation for pH and alkalinity(carbonate)</p> <p>Experience now suggests that pH and alkalinity control alone will not be sufficient to achieve optimised reduction in lead concentrations and that orthophosphate dosing will also be required. Any water company wishing to rely on pH and alkalinity control will have to demonstrate that orthophosphate dosing control cannot achieve a further significant reduction in lead concentrations.</p> <p>Where pH changes are proposed they should generally be no more than 0.5 pH at a time. At treatment works pH value should be controlled to within 0.5 pH and pH changes within distribution should be minimised.</p>
<p>7. Plumbosolvency monitoring and control at treatment works</p>	<p>The Inspectorate considers that monitoring should commence immediately after implementation of plumbosolvency treatment or optimisation changes. Water companies should consider the following:</p> <ul style="list-style-type: none"> • Parameters to be measured at each treatment works (dependent on type of plumbosolvency treatment adopted) - e.g. pH, orthophosphate residuals,

	<p>alkalinity/DIC.</p> <ul style="list-style-type: none"> • Frequency of sampling. • The extent, duration and reason for any deviation from the target water quality should be investigated and rectified.
<p>8. Plumbosolvency monitoring and control in distribution</p>	<p>The Inspectorate considers that monitoring in the distribution system should include the following when appropriate:</p> <ul style="list-style-type: none"> • Lead • Compliance Monitoring <ul style="list-style-type: none"> ○ random day-time samples in accordance with regulatory frequencies to determine compliance with standards • Monitoring effectiveness of treatment <ul style="list-style-type: none"> ○ stagnation samples from sufficient selected properties (consumers' taps) supplied through lead pipes before and after plumbosolvency treatment changes to measure the effect of the change. Stagnation time is normally 30 minutes although there are suggestions that 60 minutes gives less variable results ○ a minimum of two and generally a maximum of 4 properties for each supply or group of similar supplies; however, maximum is at discretion of water company and should reflect the complexity of the treatment and supply systems ○ monitoring should ideally commence at least six months before dosing spanning some winter and some summer periods and continue after dosing until orthophosphate concentrations have stabilised and there is no further reduction in lead concentration ○ one monitoring scheme recommended in 1980s consisted of taking 3 samples from each property in a period of 7 days each month ○ plot lead concentrations and orthophosphate residual against time ○ operational lead pipe rigs may be

	<p>substituted for some or all of the properties</p> <ul style="list-style-type: none"> ○ monitoring should continue indefinitely at least one property or rig to check that reduction is being maintained. <ul style="list-style-type: none"> • pH value, orthophosphate residual, DIC/alkalinity as appropriate <ul style="list-style-type: none"> ○ at sufficient points and frequency to check that optimum concentrations/values are maintained throughout distribution ○ this monitoring should commence soon after the treatment change has been made • Other parameters <ul style="list-style-type: none"> ○ when there is reason to believe that the treatment changes may affect significantly the concentration of another parameter or parameters, then additional operational monitoring at sufficient points should be carried out for any such parameter (in addition to any regulatory monitoring)
<p>9. Timescales</p>	<p>All new and further plumbosolvency treatment measures should be installed and commissioned by 31 December 2002 and optimised by 25 December 2003.</p> <p>All existing plumbosolvency treatment measures, where necessary, should be optimised by 31 December 2002.</p> <p>Companies should aim to give the maximum amount of time to optimise plumbosolvency treatment measures and to evaluate its effectiveness so that sufficient time is available to identify where lead pipe replacement may be needed to comply with the interim standard of 25 µg/l by 25 December 2003.</p>