Review of Procedures for Operation and Management of the Distribution Network

SUMMARY REPORT

May 2000

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1 Introduction and Background

The Drinking Water Inspectorate (DWI) has become concerned about the number of incidents which have occurred over the last few years resulting in the discolouration of supplies attributable in whole or in part to the activities of company personnel managing and operating the distribution system. The DWI wish to ensure that the procedures used by all water companies take due regard of the risks of discolouration of supplies and that in the event of a discolouration incident, the companies have clear guidelines for the management of the incident so that it's impact is minimised.

The DWI appointed Temporary Technical Assessors from Binnie Black & Veatch (BB&V) to undertake a review of procedures for distribution system operation and maintenance. The DWI defined the categories to be covered by the review, which focused on written procedures to minimise the risk of discolouration of supplies by company personnel operating and managing the distribution system.

2 Method of Review

A series of checklists for the audit were drafted which addressed the DWI identified objectives. These checklists took account of DWI reports of discolouration of supply incidents which had occurred between 1997 and 1999. The checklists covered the following:

- Procedure for revalving and/or rezoning of supplies.
- Procedure for the routine operation of valves.
- Policy for the pre-emptive flushing of mains and its implementation.
- Procedure and practice for flushing small and large diameter mains.
- Procedure and practice for dealing with the discolouration of supplies.
- Approach to mains cleaning and the procedures employed.
- The use of computer modelling and other techniques to assess potential discolouration problems from pre planned operations.
- System for classifying, recording, marking and monitoring valve status.
- Avoidance of rapid fluctuations in flow that could disturb settlement.
- Method of controlling and monitoring the use of fire hydrants by third parties.

The questions on the checklists address aspects that could have prevented or reduced the impact of these discolouration incidents or resulted in their better management. The checklist questions do not necessarily cover all the potential causes of discolouration of supplies and should not therefore be the sole basis for any modification or development of new procedures drafted by companies in response to this audit.

A letter was sent to the companies on 3 September 1999 requesting copies of procedures relating to the content of each checklist. The submitted procedures were audited and the checklists completed.

On completion of the checklists, a series of recommendations and suggestions were made of ways in which the company could improve their current procedures. As is normal practice for DWI technical audits, recommendations were made only where, in the Inspectorate's opinion, action is required in order to avoid a foreseeable risk of a breach of a regulatory duty. Suggestions were made in relation to matters which do not present such a risk, but which concern general good practice.

Copies of the draft report were sent to the water companies and they were invited to comment on the factual correctness of the checklist. Checklists were revised to take account of additional documentation submitted by the water companies and the final report written.

The audit has only reviewed written procedures. Whilst it is accepted that the experience and training of staff strongly contributes towards good practice, written procedures are also important. Written procedures set out operational practices which the company expects all staff to follow. They are a

mechanism for initiating changes to working practices, providing the basis for training staff and for auditing current practices.

3 Summary and Conclusions

This section gives an overall summary of the audit broken down into the ten different checklists. Table 1 summarises the completeness of company procedures by checklist sub section. The table quantifies the number of companies who either have no procedure or where the subsection is inadequately covered and where recommendations have been made. Table 2 shows a summary of the number of recommendations and suggestions which were made to each company for each checklist in the individual company reports. Company names have not been included in the table.

In general, where a company did not have a written procedure for all or part of a checklist, it has been recommended that a written procedure be drafted for each section not covered. The exception to this is where a company has provided documentation that was not classified or deemed to be a procedure, but that was considered to either adequately cover one or more sections of the checklist, or, stated why they deemed it not necessary to produce a procedure. In these cases suggestions have been made where appropriate.

Checklist 1 - Procedure for revalving and/or rezoning of supplies

Checklist 1 determines the extent to which the procedures for the revalving and/or the rezoning of supplies minimise the possibility of discolouration of water supplies.

Most companies had some form of written procedure relating to the revalving or rezoning of supplies; often these require the completion of a risk assessment form. However, the risk assessment forms generally gave little or no guidance on what the risks are with respect to discolouration of supplies. Some procedures stated that discolouration risks should be considered, but few gave specific guidance as to how this assessment was to be completed. Company procedures were generally lacking in guidance on assessing and minimising the risks of flow reversal and increases in velocity from the pre planned operation.

Checklist 2 - Procedure for the routine operation of valves

Checklist 2 determines the extent to which the procedures for the routine operation of valves minimise the possibility of discolouration of water supplies. The content and purpose of this checklist is similar to the content of checklist 1 however it applies to the operation of valves during mains maintenance or repair rather than the rezoning of supplies.

Most companies had procedures which were applicable to the general operation of valves and so this checklist was usually covered by the same procedures as checklist 1. Therefore the same comments for checklist 1 also apply for this checklist.

In addition this checklist covered the recharging of mains following the completion of a maintenance or repair operation. The majority of the companies did not have written procedures giving guidance on this.

Checklist 3 - Policy for the pre-emptive flushing of mains and its implementation

Checklist 3 addresses the pre-emptive flushing of mains to minimise the discolouration of supplies.

There was considerable variation in the extent to which the companies had procedures which addressed the flushing of mains and a few companies had no written procedures. Some companies had procedures for flushing during the commissioning of new mains or for expelling contaminated water, but not for pre-emptive flushing to prevent the build up of sediment. Several of these companies stated that they do not have a problem with sedimentation in their mains and so do not undertake routine flushing.

Where companies did have procedures relating to the flushing of mains these tended not to include guidance on:

- The selecting and ranking of areas in need of treatment.
- The velocities required to remove sediment and how this could be achieved.

Checklist 4 - Procedure and practice for flushing small and large diameter mains

The purpose of checklist 4 is to deal with the specific difficulties of effectively flushing large diameter mains (those mains greater than 200 mm in diameter). Checklist 3 covers the pre-planning, notification, implementing and monitoring of pre-emptive flushing operations and these aspects are not repeated in this checklist.

The majority of companies did not have any procedures which addressed the potential difficulties of inducing sufficient velocities necessary to flush large diameter mains effectively. Some companies referred to industry standard documents which warned of the potential problems.

Checklist 5 - Procedure and practice for dealing with the discolouration of supplies.

Checklist 5 covers the procedures and practice for dealing with the discolouration of supplies when it occurs.

Most companies had some written procedures which covered items in the checklist. These were often in the form of emergency procedures. The procedures tended to be fairly general covering all types of water quality incidents without specifically mentioning discolouration. Many of the procedures did not incorporate an action chart or other form of guidance to be used for identifying the cause of the discolouration of supply incident.

Checklist 6 - Approach to mains cleaning and the procedures employed

Checklist 6 addresses the Company's approach to mains cleaning. It covers:

- The identification of areas in need of mains cleaning.
- The selection of the most appropriate mains cleaning technique.
- The steps taken to minimise the risk of discolouration of supplies during and following the cleaning operations.

The cleaning techniques covered are flushing, air scouring and swabbing. Checklist 6 primarily deals with the different cleaning techniques whereas checklist 3 and 4 deal with the specifics of flushing operations.

Many of the companies had little guidance relating to this checklist. In particular most companies did not include guidance on the identification of areas in need of cleaning or on the selection of the most appropriate mains cleaning technique. Some companies stated that they use industry standard documents. However, in such cases these tended not to be referred to in company procedures.

Checklist 7 - The use of computer modelling and other techniques to assess potential discolouration problems from pre planned operations

Checklist 7 covers the Companies approach to the use of analysis techniques including computer modelling to identify potential discolouration problems prior to undertaking pre planned operations on the distribution network.

The majority of companies had computer models of all or part of their network. Many of these companies stated that models are used to help plan operational activities. However, most of these companies did not use them to assess the risk of discolouration.

A few companies had good procedures relating to this checklist. However the majority of companies did not have written procedures for the use of analysis techniques, including the use of hydraulic models to identify areas where velocities are likely to reverse or increase to levels at which sediment could be raised into suspension and cause discolouration.

Checklist 8 - System for classifying, recording, marking and monitoring valve status

Checklist 8 covers the way in which the company classifies, records, marks and monitors the status (position) of its valves.

The majority of companies had reasonable valve management systems. However, many of the companies had described their system in the covering letter accompanying the procedures and did not have formal procedures or standard practice documents relating to the use of the systems.

Many of the procedures were deficient in:

- Guidance on identifying those valve which when operated could pose a risk of discolouration and including warnings of possible discolouration problems on their valve recording systems.
- Having a formal system for monitoring the status of valves and the condition of the valve markers.

Checklist 9 - Avoidance of rapid fluctuations in flow that could disturb sediment

Checklist 9 covers the way in which the Companies avoid rapid fluctuations in flow that could disturb mains sediment causing a discolouration incident.

Few companies had procedures which addressed the content of this checklist. In particular procedures generally did not:

- Include guidance about the maximum rate of operation of valves.
- Record the maximum flows from sourceworks, pumping stations and other supply points above which sediment disturbance could occur.

Checklist 10 - Method for controlling and monitoring the use of fire hydrants by third parties

Checklist 10 covers the way in which the company controls and monitors the use of fire hydrants by third parties, to prevent back siphonage and water quality problems.

Many companies had reasonable procedures relating to this checklist and no recommendations were made to ten of the companies. Most companies had some kind of permission system for the use of fire hydrants by third parties but very few gave out sufficient instructions to users. Few companies monitor the use of hydrants and maintain records which could provide linkage to attributable water quality incidents.

No.	Checklist Title	Checklist Sections	No. of companies with no Procedure for checklist	No. of companies with recommendations for section
1	**Revalving and/or rezoning of supplies**	• Pre Planning	7	15
		• Notification		9
		• Implementation and Monitoring		11
		• Incident Response		*
2	**Routine operation of valves**	• Shutoffs for Planned Maintenance	8	14
		• Mains Isolation for Burst Repair		14
		• Recharging after Completion of the Maintenance or Repair		21
		• Incident Response		*
3	**Pre-emptive flushing of mains and its implementation**	• Pre Planning	17	20
		• Notification		20
		• Implementation and Monitoring		19
4	**Flushing small and large diameter mains**	• Classification	17	23
		• Large Diameter Mains		23
5	**Dealing with the discolouration of supplies**	• Awareness	8	11
		• Cause		17
		• Advice to Customers		13
		• Incident Response		*
		• Sampling and Analysing		20
		• Notification and Reporting		15
6	**Mains cleaning**	• Areas for Cleaning	11	*
		• Cleaning Techniques		*
		• Minimising the Discolouration of Supplies		17
7	**Computer modelling and other techniques to assess potential discolouration problems from pre planned operations**	• Network Model Coverage	19	*
		• Network Model Application		21
		• Other Techniques		*
8	**System for classifying, recording, marking and monitoring valve status**	• Valve Classification	9	14
		• Recording of Valve Status (Position)		10
		• Marking of Valves		8
		• Monitoring of Valve Status		20
9	**Avoidance of rapid fluctuations in flow that could disturb settlement**	• Guidance	23	23
10	**Controlling and monitoring the use of fire hydrants by third parties**	• Company Instructions	5	8
		• Company Permission		10
		• Monitoring		13

* Recommendations were not made for this section.

Table 1 – Summary of Completeness of Company Procedures by Checklist Sub-section

	Max.	A		B		C		D		E		F		G		H		I		J		K		L		M		N		O		P		Q		R		S		T		U		V		W		X		Y		Z	
	R	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
Checklist1	3	3	1	3	1	3	1	3	1	3	1	3	1	1	3	3	1	2	2	2	2	1	3	3	1	2	2	1	2	1	3	0	3	1	3	0	4	0	3	0	4	0	2	0	4	0	1	0	2	0	3	0	2
Checklist 2	3	3	1	2	2	3	1	2	2	3	1	3	1	3	1	3	1	3	1	3	1	1	3	1	3	2	2	2	1	3	1	1	2	3	1	2	2	0	3	3	1	0	2	1	3	0	1	1	1	0	1	1	1
Checklist 3	3	3	0	3	0	3	0	3	0	3	0	2	1	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	1	1	0	3	3	0	3	0	0	1	3	0	1	1	3	0	0	3	0	3	1	0
Checklist 4	2	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	0	2	2	0	2	0	0	1	2	0	1	1	2	0	2	0	2	0	1	0
Checklist 5	5	5	1	5	1	3	3	4	2	4	1	5	1	5	1	5	1	4	1	3	3	4	2	4	2	5	1	3	3	2	4	2	2	4	2	0	6	0	5	2	2	1	3	2	3	0	3	2	3	2	2	0	4
Checklist 6	1	1	2	1	2	1	2	1	2	1	2	0	1	1	2	1	2	1	2	1	1	1	2	1	2	0	1	1	2	0	1	1	2	1	2	0	3	1	2	1	2	0	1	0	3	1	3	0	3	0	2	0	2
Checklist 7	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	0	1	0	1	0	0	0	1	1	0	1	0
Checklist 8	4	4	0	4	0	4	0	4	0	2	2	3	1	1	3	2	2	2	2	3	1	2	2	3	1	0	3	1	3	0	4	4	0	0	4	1	3	4	0	4	0	1	3	1	2	0	3	0	2	1	2	0	3
Checklist 9	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	0	1	1	0	1	0	0	1	0	1	0	1	1	0
Checklist 10	3	2	1	2	1	3	0	2	1	3	0	3	0	3	0	3	0	3	1	2	1	2	3	0	0	3	2	1	2	1	1	2	1	2	0	3	1	2	0	3	0	2	0	2	0	2	0	2	0	2	0	1	1	2
Total	**26**	**25**	6	**24**	7	**24**	7	**23**	8	**23**	7	**23**	6	**21**	10	**21**	10	**20**	10	**20**	10	**19**	12	**19**	12	**18**	10	**17**	12	**14**	15	**13**	13	**11**	20	**11**	20	**11**	17	**11**	14	**8**	14	**7**	20	**7**	13	**6**	17	**6**	15	**6**	14

Table 2 – Summary of Number of Recommendations & Suggestions Given for Each Checklist
R = Recommendation, S = Suggestion

APPENDIX A
Checklists