15

Timescale and cost implications

This chapter provides an indication of how long it might be expected to take to establish a water safety plan. It also examines the likely cost implications; this is done through a series of examples drawn from supply experiences.

15.1 TIMESCALE

The time it will take to establish a water safety plan will depend upon a number of factors. These include:

- the experience of the staff;
- the amount of data available on the water supply;
- the size and complexity of the supply; and
- other systems that have already been adopted.

These factors are all inter-related and it is clearly difficult to define exactly what length of time is required to establish a water safety plan in all circumstances.

The experience of the team is critical, for instance one utility in Australia found that the time taken to prepare HACCP (Hazard Analysis Critical Control Point) plans (the systems from which water safety plans have been developed) for water supplies decreased as experience increased and found that the time taken reduced by approximately 50% with increasing experience with no decrease in the quality of the output. In Uganda, as staff became more familiar with data needs for water safety plan development and how the plan should be prepared, again the time input could be reduced. Similar experiences can be expected in most countries and water supplies when developing water safety plans.

The degree to which experience can reduce the time required to develop a plan will also depend on whether a dedicated individual or team are assigned to the project and how many other duties they must perform. In the longer term, internal auditing will also require a significant allocation of staff time to ensure that processes are being followed and actions taken to secure water safety.

The amount of data available is also an important factor. In water supplies where there are a lot of data on the supply, particularly the distribution system, the water safety plan is not only more comprehensive but it can be prepared more rapidly. Where data is lacking, the quality of the water safety plan may be compromised, necessitating additional data collection. In such circumstances, draft plans may be developed and linked to an ongoing process of improvement and data collection.

The size and complexity of the supply most obviously affects the time it is likely to take to put together a water safety plan. Large and complex systems, with more than one source, multiple treatment works and/or large and complex distribution systems will inevitably require a greater time input than small, simple systems. However, at the same time larger systems typically have more comprehensive data on the supply and more skilled staff and therefore although the time taken may be greater, if calculated on a per capita or volume of water produced the plan preparation may be more efficient.

The experiences of Gold Coast Water (GCW) in putting together their HACCP plan are outlined in Box 15.1. GCW operates several thousand kilometres of water main with 74 storage tanks and two water treatment plants, serving a population of 450,000 in Australia. The company had already achieved ISO 9000 and their experience in implementing their HACCP plans reflects this

Box 15.1: GCW experiences in establishing HACCP plans and their implementation

Assemble team: The candidates were identified rapidly and their commitment secured. Most of those selected were keen to be involved but concerned about the likely time input. In the approach adopted by Gold Coast Water (GCW) the majority of work is done by the time leader, with the other team members adding advise and experience.

Describe water supply: It is estimated that a water plant needs a day or two, plus a few hours to create the flow chart. In a reticulation system, more time may be required but the GCW experience suggests that it is not practical to construct a detailed reticulation flow diagram and it can be kept at a relatively simple level (reservoir ▸ pipeline ▸ secondary reservoir ▸ rechlorination ▸ customer).

Conduct hazard analysis: This depends upon the approach taken, use of the probability/consequence matrix or a brainstorming approach. GCW favour a brainstorming approach, which includes identification not only of potential hazards but also control issues. It is estimated that this takes about a day for each plant. This is where choosing the right team can pay dividends with an appropriate balance being stuck between theory/science and practical experience. It may be that this step will be revisited as the monitoring and corrective actions are established.

Identify control measures, monitoring and corrective actions: This was the stage at which procedures were written. The approach taken by GCW was to adopt a similar format for all procedures, including:

introduction (including the theory behind the process step);
monitoring and control measures;
corrective actions;
reporting process; verification information.

The team leader wrote each procedure and the time taken for each varied (between and day and a week). In order to write each procedure, however, it was important to gain detailed knowledge of the process and this meant spending time with operational staff, attending repair activities, reservoir inspection and so on. For a water plant it has been estimated that ten weeks were required to cover the whole of the facility, while the reticulation system was more complex and spread out and took approximately four months. During the setting of critical limits, some analytical work was done to validate the limits and time was spent having measuring instrument and calibration procedures verified. In some cases it was necessary to purchase additional instrumentation. A possibly unforeseen time commitment may include staff negotiation to ensure that any procedures requiring a change in work practices are accepted.

Box 15.1: GCW experiences in establishing HACCP plans and their implementation - continued

Incident response: A highly evolved Incident Management Procedure (QP-19) was already in place. However, it is estimated that this may take between one and two weeks to develop, as agreement is required from both management and operational staff.

Supporting programmes: ISO 9000 meant that training and asset management was already in place, so there was not a significant time commitment for this step.
Recording keeping: This was not a significant time requirement as GCW already had a record keeping system established under ISO 9000.

Validation, verification and audit: Critical limits were validated at the procedure writing stage. Under ISO 9000, GCW already have a good internal audit system and mandatory review of the quality system by senior management. The HACCP procedures written for the plan include specific verification tools for the various processes. GCW have an estimated 40 HACCP-type procedures in their system and it is thought that it would take one person two to three weeks full time to audit these on site and write the reports.

Certification: In the case of GCW this took three days of scrutiny from the certifying body and can be a positive experience, with the referees adding their experience and insight to the process.

15.2 COST IMPLICATIONS

Cost is an important factor in the implementation of any new approach or procedure. There seems to be a fear that risk-based approaches to water safety management, such as the water safety plan, will increase costs of water production and distribution. There is, however, no solid reason why this should be so and it would be expected that some cost aspects would reduce.

It would be expected that microbial testing would significantly decrease but process monitoring would increase as a result of adopting a water safety plan. This may offer opportunities for significant savings in countries where consumables for microbial testing are expensive. A utility in a developing country, for example, calculated that switching to a water safety plan approach would reduce their routine monitoring bill by almost one-third. Even in developed countries, the recurrent costs of using process indicators (such as turbidity, chlorine, residuals, pH, etc.) for monitoring will almost certainly be lower than those for monitoring *E. coli* as a routine operational tool. The use of process indicators for monitoring and the restriction of microbial analysis to less

frequent verification provides greater assurance that water safety is being achieved. In many cases, the equipment for on-line process monitoring will exist (particularly in larger supplies). Even where this requires initial capital investment the recurrent costs would be expected to be lower than routine microbial testing costs. Where there are current requirements for regular monitoring of, for example, *Cryptosporidium* (as in the UK), costs would certainly be reduced by using a risk-based approach. In this instance the analysis of *Cryptosporidium* could be restricted to periodic risk assessments and validation exercises, with cheaper surrogates used for monitoring (e.g. turbidity) and verification (e.g. *Clostridium perfringens*).

The following boxes present a series of examples drawn from water suppliers in Australia, Europe and Uganda, with experience in using a risk-based approach, similar to the water safety plan, such as those with HACCP plans and/or ISO accreditation. They are qualitative in style, as cost-implications tend to be location specific, but aim to give an insight into likely cost implications, such as what costs may be entailed and where these are likely to be accrued (e.g., staff costs, equipment). All costs have been standardised as Euros.

Box 15.2 Gold Coast Water, Australia

One retail water supplier developed a HACCP plan for their water supply using their existing ISO 9001 and 14001 accreditation as a starting platform. In this case, the development of the HACCP plan cost approximately €11,500 in consultant support and roughly two months of a water quality engineer's time. Ongoing audit costs are estimated at €1,700. This utility considered the development of a HACCP plan to have greatly improved their water safety management and provided a much more transparent means of demonstrating good practice and due diligence.

Box 15.3: Melbourne Water, Australia

A bulk supplier whose total number of consumers is 3.5 million people developed a HACCP plan to cover all their operations, including their retail suppliers. This supplier indicated that establishing the HACCP plan involved 12 months of one existing staff member, which was estimated at €34,500 with an additional €17,200 spent on a consultant to perform a risk assessment of their whole supply (which is very large). This utility did not consider that they accumulated any additional costs for monitoring, but do require 6-monthly audits which cost in the region of €2,800. Every 3 years have an updated risk assessment performed, which costs €5,600. This utility also has a team of internal auditors, all of whom have other jobs, who undertake about 6 audits per year. This supplier considers the HACCP plan to be essential to their water safety management and a significant improvement over the use of microbial tasting as an operational tool. They have been able to re-orientate their microbial testing to verification and have been able to provide more effective internal management and audit of performance.

Box 15.4: Retail water supplier, Australia

In a second retail water supplier that supplies a smaller city, a total of 8 HACCP plans have been developed including for a very small package plant, two medium size treatment works, a distribution system with 70 reservoirs and four wastewater plants. The utility estimated that HACCP plan creation costs would need to cover 2-3 months of staff time to understand the process and document the procedures and plan. It was noted that this may be extended if significant staff and community consultation were required. The view of the utility was that where such plans had taken longer to complete, this reflected that staff had not been seconded to developing the HACCP plan full-time.

The experience of this utility was that implementing the HACCP plan did not result in extra staff costs at the treatment plants. It simply made staff re-orientate how they worked to become more focused on ensuring that critical risks were controlled and spent less on issues of limited importance. It was also noted that staff were generally more content as they felt they were more involved in determining how safe water can be assured. This utility did recruit an additional staff member for monitoring the distribution system, as they previously did not have a member of staff responsible for investigating consumer complaints or evaluating monitoring data. It could therefore be argued that this was not an additional cost accrued through a switch to HACCP, but was a post that was required irrespective of the approach to safety management adopted. It was noted that where water quality staff exist, no additional staff costs would be expected given that implementing HACCP would simply result in a re-orientation of work plans rather than creation of a new job.

Costs were accrued for equipment purchase, in particular on-line turbidity meters, pH and chlorine meters and telemetry for unmanned sites. Overall, the utility found an annual increase in distribution monitoring of €63,000 but noted that a neighbouring water supplier with a much larger system did not seem to accrue any additional costs when implementing their HACCP plan.

This utility listed a large number of benefits of the HACCP system. There was a clear feeling that water safety was now much more effectively controlled, as risk assessments were carried out on all processes and because control points and critical limits were established. They noted that it was easier to monitor staff and that incentives were created for staff to improve their performance. The HACCP plan was seen as having a particular value as all senior staff were informed by automatic email if a critical limit was exceeded, thus promoting more timely responses. Asset management was seen as being significantly improved, as the HACCP plan focuses on critical risks and therefore resources could be used more effectively. It was also noted that continuous improvement and reassessment of risks were automatic by-products from the HACCP plan. The final statement of this utility was that HACCP was well accepted by their staff who ‘would not consider going back to the old system’.

Box 15.5: European water utility

Data was obtained from a European water utility regarding the cost of implementing a ISO 9000 series accredited management system. It should be noted that this company has to operate a water quality control programme based on microbial testing at the same time because of regulatory requirements. The company serves nearly 7 million people, has an operational area of 14,000 km^2, and operates 150 treatment works with an average production of 2000ML per day, with 380 service reservoirs/water towers and 40,000 km of pipe. The cost of staff time to run the ISO management system, primarily accrued through documenting the process, is estimated to be €141,000, with audit costs in the region of €21,000 to €28,000. This utility notes that they are unable to benefit from expected reductions in cost of microbial monitoring because of current regulations, but did not believe that risk based approaches would increase monitoring costs and may actually lead to a reduction in costs.

Box 15.6: Ugandan experience

In Uganda, as in many other countries, determining the overall costs of producing water safety plans must take into consideration a number of factors. In the first instance, significant external consultant support was provided in order to work with teams from the water supplier to provide training in water safety plan preparation and the relevant tools. This involved approximately nine weeks of UK consultant time (with an associated cost of approximately €35,000) and local consultant time (costing a further €7,000). Equipment and consumable purchases added a further €5,600. Direct local costs for the supplier were more limited and came to approximately a €2,100. Staff time was considerable, but was generally incorporated into normal working practice and thus was not an additional cost. In total for the Kampala system, the overall cost was in the region of €49,000. However, the majority of these costs related to UK consultant time and were, essentially, capacity building and, as such, should be spread across all subsequent water safety plans developed. In Jinja, for example, the UK consultant coasts were in the region of €12,600 (with local consultant costs of €4,200), while the risk assessment of the supplies resulted in a further €9,800 expenditure. If it is assumed that the National Water and Sewerage Corporation will undertake water safety plans for all 11 towns that they supply, the overall consultant costs for each supply would be in the region of €6,300.