3. Surveys

3.1 Nature and scope of community surveys

A community survey is an evaluation of all the factors and resources (physical and human) that affect the water-supply service, sanitation, and environmental health of a community. An example of a report form for a community survey is shown in Fig. 3.1; the form will vary with location, and should take account of local conditions.

At the beginning of surveillance programmes, and subsequently at intervals less frequent than those specified (by the surveillance agency) for sanitary inspection, a community survey is required as the foundation of a comprehensive database. The complete community survey should be conducted by the local surveillance agency office (or the area authority in small countries) and should include the following four components:

1. Basic data on water-supply and sanitation facilities with which to update the inventories. Basic inventories have been described in section 2.3.1, and an example of an inventory is shown in Fig. 2.2 on p. 27. The water-supply data (and, in some circumstances, sanitation data) are ideally the responsibility of the water-supply agency; the surveillance agency’s field officer should only have to confirm the information. The reality in many countries, however, is that a variety of agencies are involved in water-supply construction, with the result that inventories are often incomplete. The surveillance agency may therefore have to be involved in preparing the inventory.

2. Sanitary inspection (comprising sanitary inspection and water-quality analysis). Sanitary inspection may be conducted by both the water-supply agency and the surveillance agency; the information they generate is shared.

3. A quantitative diagnostic summary of the five key water-supply service indicators (quality, quantity, coverage, continuity, and cost).

4. Hygiene survey. Hygiene surveys are, ideally, the surveillance agency’s responsibility.

The quantitative diagnostic summary of water-supply service indicators should be reported to the regional and/or national agency for strategic planning purposes. Figure 3.1 shows a suitable report form. The indicators should be entered into a national database and used to allocate resources for water-supply development and improvement on the basis of priority needs.
### Fig. 3.1 Example of a community survey form

<table>
<thead>
<tr>
<th>Survey Details</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>Village</td>
</tr>
<tr>
<td>Date of visit</td>
<td>(Year) Code No.</td>
</tr>
<tr>
<td>Source type</td>
<td>System type: □ open/closed □ piped/unpiped</td>
</tr>
</tbody>
</table>

**Population**
- Number of households ........................................
- Number of standpipes ...........................................
- Number of house connections (taps) ...........................
- School? ................. School tap? .....................

**Coverage**
- \( \frac{\text{no. standpipes and taps}}{\text{no. households}} \times 100\% \)

**Flow data**
- Flow entering a source ............. litres per second = litres per second delivered \( \times 86 \, 400 \)
- Overflow(s) ......................... litres per second = .......... \( \times 86 \, 400 \)
- Flow delivered to taps ............... litres per second = ........ litres per person per day

**System functioning**
- Water entering system on day of inspection?
  - □ Yes □ No
- Proportion of taps operating (tick as appropriate)
  - Tap 1 □ Yes □ No  Tap 2 □ Yes □ No  Tap 3 □ Yes □ No
- Supply all day? □ Yes □ No
- Supply all year? □ Yes □ No

**Continuity**
- Overall = total 'yes' \( \times 100\% = \frac{6}{6} \)

**Cost**
- How many households pay a tariff? .................
- Percentage of household paying .....................%  Monthly tariff .........................

**Quality**
- Thermotolerant (faecal) coliform count per 100 ml  Bacteriological quality
- Source count ................................. /100 ml  Faecal coliform grade: A:B:C:D
- Highest count in distribution .................... /100 ml
- Sanitary inspection (see accompanying sheet)  Sanitary hazard score

**Remedial action priority** □ Low □ Intermediate □ Urgent

Inspector ........................................ Signature ......................................
In Fig. 3.1, the first indicator calculated is coverage, which is logical since there is little point in embarking on sanitary inspections until basic infrastructure has been established in a significant proportion of communities. It is also necessary to demonstrate that substantial water-supply coverage has been achieved both in individual communities and in a majority of communities in the district under consideration.

3.2 Sanitary inspections

A sanitary inspection is an on-site inspection and evaluation by qualified individuals of all conditions, devices, and practices in the water-supply system that pose an actual or potential danger to the health and well-being of the consumer. It is a fact-finding activity that should identify system deficiencies—not only sources of actual contamination but also inadequacies and lack of integrity in the system that could lead to contamination.

In small communities, where official visits by the surveillance officer are infrequent, it is essential that responsible community members both assist the official in making the survey and learn how to conduct the survey independently. They should sign a report and agree to act on the recommendations where this is feasible (see Chapter 6).

The two principal activities are sanitary inspection and water-quality analysis. It has been suggested that sanitary inspection should take priority over analysis, but the two should be done together wherever possible. They are complementary activities; inspection identifies potential hazards, while analysis indicates whether contamination is occurring and, if so, its intensity.

A sanitary inspection is indispensable for the adequate interpretation of laboratory results. No analytical, bacteriological, or chemical survey, however carefully carried out, is a substitute for comprehensive knowledge of conditions at the water source and within the distribution system, the adequacy of water treatment, and the qualifications and performance of the operators. Samples represent conditions at a single point in time and—even when there is frequent sampling and analysis—the results are reported after contamination has occurred, especially in systems without long-term storage. Microbiological contamination is often sporadic and may not be revealed by occasional sampling.

3.3 Sanitary inspection reports

The sanitary inspection report is that part of the survey based on the on-site inspection of the water sources (and piped supply systems where appropriate), i.e. a field survey; it therefore provides a direct method of identifying all the hazards that are potential and actual causes of contamination of the supply. It is concerned with the physical structure of the supply, its operation, and external environmental factors. The hazards recorded during inspection are often tangible
and observable, and may be used together with analytical data to derive a risk assessment.

Sanitary inspections thus provide essential information about immediate and ongoing possible hazards associated with a community water supply, even in the absence of microbiological or chemical evidence of contamination. In addition, inspection of supplies over a period of years provides a longer-term perspective and assists in the identification and minimization of risks caused by progressive deterioration in any aspect of the supply.

3.3.1 Functions of sanitary inspection report forms

Inspection forms should provide a simple and rapid means of assessing and identifying hazards associated with water-supply systems. Wherever sanitary inspections are carried out, there will inevitably be a variety of systems to consider, and a decision must then be made on whether to attempt to produce a single inspection form that deals with all types of system or to produce a series of forms, each dealing with a different type. Some of the information that it may be useful to include on one inspection form may already have been collected for inventory purposes. Again, a decision must be made on how much of this kind of detail it is appropriate to include.

The inspection form should include at least a checklist of the components of the water supply from source to distribution and incorporate all the potential points where hazards may be introduced. Any problems identified during the inspection should be highlighted so that a report may be provided directly to the community and copies forwarded to both supply agency and health authority.

The specific functions of the sanitary inspection report are to:

— identify potential sources and points of contamination of the water supply;
— quantify the hazard (hazard score) attributable to the sources and supply;
— provide a clear, graphical means of explaining the hazards to the operator/user;
— provide clear guidance as to the remedial action required to protect and improve the supply;
— provide the raw data for use in systematic, strategic planning for improvement.

The sanitary inspection report may be considered as an integral part of a community survey as defined in section 3.1. It should therefore not be restricted to factors that may cause problems with water quality, but should also take into account other service indicators, e.g. coverage, cost, continuity, and quantity. This is particularly important for supply agencies that may wish to give special consideration to such factors from the point of view of operation and maintenance. It should be possible to determine an overall measure of the sanitary state of the supply based on the checklist, and this hazard or risk score may be used in
deciding priorities for remedial action by the community or by whichever agency is best able to intervene and make improvements.

3.3.2 Design of sanitary inspection report forms

The design, evaluation, and refinement of sanitary inspection forms are among the most important aspects of developing a surveillance or quality-control programme. Two approaches are possible—the use of pictures and brief checklists, or the use of more detailed checklists with explanatory notes. Either may be used successfully. However, in some countries where the level of training of environmental health inspectors or sanitary technicians may not be very high, the use of pictorial inspection forms may be the most effective method, and is therefore considered here.

Ideally, forms should be designed in such a way that the community or owner of the supply can either conduct the survey or be given a summary of the problems identified before the departure of the inspector. This means that any actions required at local level can be agreed and implementation can be started immediately. Where actions are required by others, e.g. water-supply or health agencies, the community should also be informed of the recommendations that will be made. Copies of the full sanitary survey should be sent to all relevant authorities, and this is facilitated by well designed inspection forms, for example with duplicate or triplicate sheets and “tear-off” slips for recommended actions.

A series of model inspection report forms is presented in Annex 2. With one exception, these are in double-page format and include illustrations of a range of water supplies in a recognizable setting; potential hazards are identified and numbered. The forms include details of the type of facility, the supply, the date of the sanitary inspection visit, and so on. The checklist of 10 or more points allows a hazard score to be assigned based on the total number of hazards identified.

In some countries it may be necessary to consider hazards other than those illustrated in Annex 2, and these should also be included in the checklist. Sanitary inspection forms should be designed to match local circumstances; they should be suitable for the inspectors to use, and the recipients of the information should be able to understand and act on them. Any pictures that are included must be carefully drawn to reflect the cultures and situations that they are designed to depict. The range of report forms given in Annex 2 covers most of the main types of small water-supply installations. Nevertheless, the list is not exhaustive, and local variations in design and in cultural habits may have a profound impact on the design of such forms.

The principle on which the design of sanitary inspection report forms is based is that every fault that may reduce the quality of the supply should be listed and checked during the sanitary inspection. Each fault represents a sanitary hazard. Every additional fault increases the probability that contamination will occur; the number of hazards may therefore be totalled to provide an additive
sanitary risk score, but this implies an equal weighting of all the risks. However, it is most unlikely that such equal weighting will be correct and that the score will be directly proportional to the intensity of the resulting contamination. Thus it is important to incorporate differential weighting for local conditions that permits a better interpretation of the information and promotes remedial action.

3.4 Carrying out sanitary inspections

Staff responsible for field sanitary inspection work should always try to notify the local community representatives in advance of the visit, especially where the presence of the latter is required in order to obtain access to certain points in the supply system and where the assistance of community members in conducting the inspection is needed.

On arrival in the community, the surveillance officer must verify basic data with community representatives, as indicated in Chapter 2 (Fig. 2.2). Any records that the community keeps, for example of tariffs, should be examined and the information noted, including the amount charged and the number of households paying.

Before visiting the community, the surveillance officer may have prior knowledge of the type and number of supplies, sources, and taps. This should be checked against local records and maps held by the local health post or health centre, for example. If no map is available, an attempt should be made to prepare at least a sketch map of the supply or sources.

Much of the information required for the investigation of drinking-water supply services will be obtained by interviewing community members; this is especially important when visiting households to assess the continuity of service. Wherever possible, the surveillance officer should verify any information so obtained by direct observation during the field survey.

While it may appear logical for inspection and sampling to begin at the source of piped supply and to progress through the system with the flow of water, the converse is actually the case. Working against the flow (i.e. beginning with the distribution network and progressing up through the system) makes it less likely that any samples taken will have been accidentally contaminated by the sampler earlier in the system, e.g. when opening little-used lids of reservoirs or protected spring sources.

The surveillance officer should complete the sanitary inspection report on site together with the community representatives. Opportunities to point out problems or defects in the field to community members, their representatives, or the system caretaker or operator should be taken whenever possible. It may also be appropriate to undertake simple repairs, e.g. replacement of washers in public taps, at the same time.

After completing the sanitary inspection, the survey officer should circle each of the points of risk on the diagram, preferably in red ink. The diagram (see Annex 2) should be separated from the inspection report form and given to a
member of the water committee or community representative. Before leaving the community, the surveillance officer should discuss, agree, and schedule any follow-up actions and indicate the date of the next survey.

The survey officer carrying out the sanitary survey should record whether or not sampling or analysis will be undertaken. Labour and hence time can sometimes be saved by carrying out the analysis in the field at the same time as the inspection; elsewhere, water analysis may be part of follow-up, with samples transported to a laboratory for testing.

Some countries have introduced special postcards the community can use to report serious operational or remedial requirements; these are posted to the agency responsible for operation and maintenance, which then makes an appropriate response and provides the necessary technical support.

The procedural steps for carrying out a sanitary survey are summarized in Fig. 3.2.

3.5 Timing and frequency of sanitary inspections

Sanitary inspections should be undertaken on a regular basis, ideally at the frequencies indicated in Table 3.1.

3.5.1 New sources

One of the most important surveys is that undertaken when new sources of water are being developed. This survey should provide sufficient information to indicate the suitability of the source and the amount of treatment required before the water can be considered suitable for human consumption. When alternative water sources are under consideration, each should be surveyed. Physical, bacteriological, and chemical analyses should be carried out during catchment surveys when new water sources are explored to assess potential new water supplies. Chemical and bacteriological analyses should also be done when hydrogeographical surveys are carried out. The guiding principle is that no new public water supply should be approved without a sanitary inspection.

Surface-water sources may be extremely difficult to survey adequately, particularly in remote rural areas and where land-use patterns are changing rapidly. Not only may there be daily and seasonal changes in flow to consider but, in addition, variations in physical, chemical, and microbiological characteristics necessitate analysis throughout the year to take account of the effect of changes in rainfall patterns.

3.5.2 Routine surveys of existing supplies

Although it is unrealistic in most instances to expect the surveillance agency to devote more than 1 or 2 days per system each year to a survey, this can hardly be
3. SURVEYS

Fig. 3.2 Procedural steps for carrying out a sanitary survey

1. Sanitary surveys → Water samples to laboratory
2. Sanitary inspections → Thermotolerant coliform analysis
3. Coordinator: 1. Identifies risk source
4. 2. Grades faecal contamination
5. Combined evaluation with supplier
6. Prioritize and select urgent actions
7. Remedial action
8. Follow-up survey
9. Evaluate results of impact of rehabilitation
Table 3.1 Suggested minimum annual frequency of sanitary inspections

<table>
<thead>
<tr>
<th>Source and mode of supply</th>
<th>Community&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Water-supply agency&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Surveillance agency&lt;sup&gt;a,b,c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dug well (without windlass)</td>
<td>6</td>
<td>—</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Dug well (with windlass)</td>
<td>6</td>
<td>—</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Dug well with hand-pump</td>
<td>4</td>
<td>—</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Shallow and deep tubewell with hand-pump</td>
<td>4</td>
<td>—</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Rainwater catchment</td>
<td>4</td>
<td>—</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Gravity spring</td>
<td>4</td>
<td>—</td>
<td>1&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Piped supply: groundwater sources (springs and wells), with and without chlorination</td>
<td>—</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Treated surface source of piped supply, with chlorination:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5000 population</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5000–20000 population</td>
<td>—</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Distribution system of piped supply&lt;sup&gt;e&lt;/sup&gt;</td>
<td>—</td>
<td>12</td>
<td>1</td>
</tr>
</tbody>
</table>

<sup>a</sup> For family-owned facilities (e.g. dug wells with or without hand-pumps), the family is responsible for inspections, with support from the surveillance agency.

<sup>b</sup> All new sources should be inspected before commissioning.

<sup>c</sup> Under emergency conditions, such as onset of epidemic diseases, inspection should take place immediately.

<sup>d</sup> Where it is impractical to inspect all such facilities, a statistically significant sample should be inspected.

<sup>e</sup> Public standposts are cleaned by the community if the population is less than 5000. The water-supply agency maintains the distribution system and tapstands if the population is between 5000 and 20 000.

Traditionally, the frequency of inspection and analyses has been based on population size. For community supplies, it is necessary to involve community members, especially where there is no official water-supply agency. The diversity of water-supply facilities and administrative arrangements makes it difficult to provide other than general guidelines for the frequency of these surveys, as suggested in Table 3.1. However, it is important to note that these suggested frequencies are minimum values. It is also vital that any community report which suggests that serious risks exist should be officially logged and acknowledged, and that follow-up action is taken by the surveillance agency.