Manual vs. Automatic

Samples must be collected from all receiving waters, all outfalls or a combination of receiving waters and outfalls, and tested for turbidity. An outfall is the point at which concentrated runoff (via pipe, ditch, channel, etc.) crosses the property line. Primary permittees may use manual or automatic sampling methods to meet permit requirements.

Manual Sampling
Manual sampling involves filling a plastic bottle by hand. For turbidity testing, a 500-mL wide mouth polyethylene bottle will provide an adequate sample volume. The mouth of the bottle should face upstream, and floating debris should be avoided. When sampling mid-depth, avoid stirring bottom sediment. Always sample upstream from where bottom sediments have been disturbed. Label sample containers prior to collection to reduce the risk of sample mix-ups. Manual sampling can be used for any sampling event but is best suited for base flow sampling during dry weather or as a backup for automatic sampling.

The biggest advantage to manual sampling is its simplicity—it is not extremely difficult to fill a bottle with water. Another major advantage is low equipment costs. Chest waders are better than hip waders or rubber boots. It is surprising how deep even small streams can get, particularly when one loses his or her footing. Even with breathable chest waders and a 12-ft sampling pole, the startup material cost should be below $300.

The most significant disadvantage of sampling manually is the risk of physical injury to sampling technicians. Even in good weather, technicians can encounter steep banks, rocks, snakes, poison ivy, etc. Bad weather, however, poses the most danger. The requirement to collect samples within 45 minutes of the target accumulation of rainfall (0.5, 1 or 2 in.) will often place workers on site during storms. Lightning, tornados and flash floods might all be encountered. Because of the safety risks, it is wise to collect samples in teams of two.

Another disadvantage is the increase in labor. Because the permit allows only 45 minutes to collect multiple samples, there is no time to lose. During every significant rain event, the sampling technicians must be on site checking the rainfall accumulation often so that the date and time of the target accumulation can be recorded and sampling efforts can begin. Even when using an automatic rain gauge with telemetry, technicians should be on site to respond quickly when sampling manually.

The permit clearly indicates that missing the 45-minute window is a violation and authorizes up to $50,000 per day per violation in fines. Although fines issued to date have been significantly less than the maximum allowed, they are typically many thousands of dollars.

Automatic Sampling
Automatic sampling involves the installation of sampling devices that will automatically collect samples within the required 45 minutes of target accumulation. Samples should be triggered by automatic rain gauges and can be programmed to...
sample varying amounts of rainfall accumulations. Automatic sampling is best used for rain events and allows sampling technicians to properly collect samples while reducing exposure to physical hazards and severe weather.

The best advantage of automatic sampling is the convenience. No longer must sampling technicians work through the night or during weekends to sample run-off. Technicians can retrieve samples on the next business day, when storms have passed and conditions are usually safer. While technicians may still work in teams of two, retrieving samples after a storm has passed is substantially less hazardous and can be performed by single technicians. Because technicians do not have to keep track of accumulations during storms, they are likely to spend less time on site and make fewer trips. This results in significant savings in labor costs.

A second major advantage is that technicians can sample more sites than possible using manual methods. A single technician can operate 12 or more automatic samplers on several different construction sites, increasing productivity and helping reduce overhead.

Another benefit of automatic samplers is their ability to record and analyze data from off-site locations. Automatic samplers can collect samples within the 45-minute time limit and, in most cases, provide documentation of such. Most automatic devices have data logging functions that record data such as rainfall accumulations and date and time of sample collection. Also available is telemetry, which will post data recorded on site to the Internet and signal by phone or pager when a sample has been collected. Data can be downloaded monthly and attached to the monthly monitoring report. The data logging feature is not only convenient, but the documentation can be useful in defense against enforcement actions or third-party lawsuits.

The most significant disadvantage of automatic sampling is equipment costs. An upfront investment of several thousand dollars is commonly needed to begin a project. Contractors may be able to arrange pay schedules to provide more upfront cash for equipment purchases. Fortunately, much of this investment can be recovered by reduced labor costs.

<table>
<thead>
<tr>
<th>TABLE 1. AUTOMATIC SAMPLING COSTS</th>
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<tbody>
<tr>
<td>Activity</td>
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<tr>
<td>Sampling site selection</td>
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<tr>
<td>Sampling site preparation</td>
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<tr>
<td>Sample storm No. 1</td>
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<tr>
<td>Sample storm No. 2</td>
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<tr>
<td>False alarm</td>
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<tr>
<td>Sample storm No. 3</td>
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<tr>
<td>Sample storm No. 4</td>
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<tr>
<td>Sample storm No. 5</td>
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<tr>
<td>False alarm</td>
</tr>
<tr>
<td>Sample storm No. 6</td>
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<tr>
<td>Sample storm No. 7</td>
</tr>
<tr>
<td>Sampler take down</td>
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<td>TOTAL</td>
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Another disadvantage is a risk inherent to any device—it can fail. No device is totally foolproof, and care must be taken to maintain charged batteries, protect equipment and properly program the sampler. While extra training may be needed, vendors generally make every effort to provide user-friendly products backed by capable technical support.

**Sampling Scenario**

Let’s assume we have a 22-acre site with discharges into two separate streams and that sampling receiving waters is more feasible and representative than sampling outfalls for this project. We will establish one upstream and one downstream sampling station in each stream, for a total of four sampling stations. Assuming that the project takes eight months before final stabilization is achieved, we might reasonably have seven qualifying rain events to be sampled, and a two-man sampling team will collect samples manually. Because not all storms will bring enough rain to meet target accumulations, there will be trips to the job site that will not result in a sampling event. These false alarms may be fairly common, but watching weather forecasts and paying close attention to rainfall accumulation predictions provided by the National Weather Service can help minimize them. We will assume that erosion control inspections are performed by others and that our technicians have no other purpose for visiting the job site. Our labor cost is established at $20-per-hour per technician, and overhead cost will not be included. The cost analysis shows the project cost for manual sampling to be $4,250, or $531.25 per month. Now let’s compare the cost of sampling the same project with automatic devices. We will assume that one technician is needed to retrieve samples. Since we do not have to monitor accumulating rainfall, we can wait until we have looked at storm totals on the Internet before retrieving the samples. This will greatly reduce the time spent on site. False alarms can happen, however, so we will account for two. We will also assume one episode with equipment failure where manual samples are collected upon arrival, extending the trip a couple of hours. Equipment costs are based on the price of four automatic samples at $1,100 each. Table 1 shows the total project cost for automatic sampling to be $5,617, or $702.13 per month.

The cost of automatic sampling, not surprisingly, was higher than the cost of manual sampling. The money saved on labor, though, almost paid for three of the four automatic samplers purchased for the project. Furthermore, we now own these samplers for future projects. While these numbers are theoretical, it is clear that sampling is labor intensive and that labor is expensive. Overtime, overhead and potential injuries can significantly increase the cost of manual sampling. We also left out equipment repairs and replacement, assuming that we had no difficulties throughout the project. On real projects, one may indeed experience damaged, lost or stolen equipment. A potential cost savings not included in the cost analysis is the decreased risk of fines, as more samples can be collected on time and provide more high-quality data documentation.

The bottom line? Automatic samplers will pay for themselves by reducing labor expenses.

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