COMMONWEALTH of VIRGINIA

Department of Health

ROBERT B. STROUBE, M.D., M.P.H.
STATE HEALTH COMMISSIONER

P O BOX 2448
RICHMOND, VA 23218

TTY 7-1-1 OR
1-800-828-1120

VDH Beach Program Monitoring Protocol - March 2007

General guidelines

1. Beach water monitoring will be conducted on a weekly basis from mid-May through September. The particular day of the week will be determined in cooperation with the laboratory conducting the analysis.

2. The indicator organism used for estuarine and marine beaches is enterococci. Laboratory analysis of enterococci levels in beach water samples will be conducted using an EPA approved method.

3. The turn around time for beginning of beach water sampling to delivery to the lab and the start of sample processing must not exceed 6 hours.

4. The number of sampling locations per beach is determined by the Health District conducting the sampling. Sampling locations should represent the area of use by swimmers. Locations and sites are identified in the EPA database by latitude and longitude and should remain uniform over the years in an effort to construct a long term database on beach water quality.

5. Water samples should be collected in water at least 0.5 meters deep, samples should be collected at 0.3 meters below the surface.

6. If the results of sampling show the site to be in compliance, the next water sample should be taken the next week on the regularly scheduled sampling day.

7. Samples should be collected on the regular monitoring day, rain or shine, unless conditions are dangerous to sampling staff. If a decision is made not to sample because you expect an exceedance of the standard, the beach should be posted with a swimming advisory.

8. Beaches that exceed the standard for bacteria will normally be posted with a swimming advisory. The Health Director for a district participating in beach monitoring may decide to close the beach for certain circumstances, e.g., an oil spill, fish kill, harmful algal.

9. bloom, sewage spill, hurricane, etc. A beach closure may be imposed under the discretion of the Health Director. However, for exceedances of the standard for bacteria, a swimming advisory is the general response.

Interpretation of Results and Data Averaging

10. The single sample maximum for enterococci is 104. Samples above this level are an exceedance of the Virginia Water Quality Standards. The geometric mean for enterococci is 35, application of the geometric mean is discussed below (see #18).

11. Duplicate results from the same dilution, e.g., 2 duplicates analyzed at 10 ml, will be averaged and the average result will be reported to the public.

    Example 1: Averaging replicate samples

Sample Description	SAMPLE TIME	ENTEROCOCCI #/100mL	Duplicate average
208-Hilton Beach	8:50	84/86	85
205-Huntington Beach	9:15	74/131	103
206-Huntington Beach	9:15	31/52	57
207-Huntington Beach	9:15	31/20	26
210-King-Lincoln Beach	10:00	30/30	30
211-Anderson Beach	11:35	20/20	20
203-Yorktown Beach	13:00	30/<10	16
204-Yorktown Beach	13:00	<10/<10	1

    The data in Example 1 are data reported from the Newport News Waterworks for the Peninsula Health District. The duplicate average is a simple arithmetic average of duplicate results. Even though the result for 205-Huntington Beach comes close to 104, the result is less than 104 and therefore meets the water quality standard.

12. Multiple samples taken on the same date from the same site should also be averaged and the average result used to determine whether the beach is in compliance or needs to be posted with an advisory and re-sampled.

    In Example 2 below, the results for Huntington Beach: 103, 57, and 26 are averaged for the entire site, resulting in a replicate average, or site average of 62.

Example 2: Determining a site average

Sample Description	SAMPLE TIME	ENTEROCOCCI #/100mL	Duplicate average	Site average
208-Hilton Beach	8:50	84/86	85	85
205-Huntington Beach	*9:15*	*74/131*	*103*	
206-Huntington Beach	*9:15*	*31/52*	*57*	
207-Huntington Beach	*9:15*	*31/20*	*26*	*62*
210-King-Lincoln Beach	10:00	30/30	30	30
211-Anderson Beach	11:35	20/20	20	20
203-Yorktown Beach	13:00	30/<10	16	
204-Yorktown Beach	13:00	<10/<10	1	9

If the results show that one site out of three or one site out of four exceeds the standard, use the average values to determine if the site should be posted and re-sampled. In Example 3, data show that one out of three samples taken from Huntington Beach exceed the standard. The site average is within the water quality standards. As a general rule, if only one value out of three for the same site exceed the standard, consider the site to be in compliance, especially if the site average meets the standard.

Example 3: Determining beach status from a site average

Sample Description	SAMPLE TIME	ENTEROCOCCI #/100mL	Duplicate average	Site average
208-Hilton Beach	8:50	84/86	85	85
205-Huntington Beach	*9:15*	*185/131*	*158*	
206-Huntington Beach	*9:15*	*31/52*	*57*	
207-Huntington Beach	*9:15*	*31/20*	*26*	*80*
210-King-Lincoln Beach	10:00	30/30	30	30
211-Anderson Beach	11:35	20/20	20	20
203-Yorktown Beach	13:00	30/<10	16	
204-Yorktown Beach	13:00	<10/<10	1	9

There are times when one sample exceeds the standard and the other two or three samples comply but are close to an exceedance. In Example 4, there's one duplicate average that exceeds the standard. However, the other two averages, even though they are within the standard, are high and result in a site average that exceeds the standard. In this instance, post the beach and re-sample the water.

Example 4: Determining beach status from a site average

Sample Description	SAMPLE TIME	ENTEROCOCCI #/100mL	Duplicate average	Site average
208-Hilton Beach	8:50	84/86	85	85
205-Huntington Beach	*9:15*	*185/131*	*158*	
206-Huntington Beach	*9:15*	*101/103*	*102*	
207-Huntington Beach	*9:15*	*99/96*	*98*	*119*
210-King-Lincoln Beach	10:00	30/30	30	30
211-Anderson Beach	11:35	20/20	20	20
203-Yorktown Beach	13:00	30/<10	16	
204-Yorktown Beach	13:00	<10/<10	1	9

If data are collected that show more than one site out of three or four exceed the standard, the site should be posted and re-sampled. You can compute the averages and report those but you should still post the beach and re-sample. In Example 5 below, two duplicate averages out of three from Huntington Beach exceed the standard. The site average also exceeds the standard, although not by much. In an instance such as this, you should post the beach and re-sample.

Example 5: Two out of three duplicate averages exceeding the standard

Sample Description	SAMPLE TIME	ENTEROCOCCI #/100mL	Duplicate average	Site average
208-Hilton Beach	8:50	84/86	85	85
205-Huntington Beach	*9:15*	*185/131*	*158*	
206-Huntington Beach	*9:15*	*131/152*	*142*	
207-Huntington Beach	*9:15*	*31/20*	*26*	*109*
210-King-Lincoln Beach	10:00	30/30	30	30
211-Anderson Beach	11:35	20/20	20	20
203-Yorktown Beach	13:00	30/<10	16	
204-Yorktown Beach	13:00	<10/<10	1	9

13. For results that are reported at two different dilutions e.g., a membrane filter test conducted at a 25 ml dilution and at a 50 ml dilution, you should use the more accurate result. For a membrane filter test we're looking for a certain concentration of bacteria on the filter. We're looking for a result that shows more than 20 and less than 80 colonies of bacteria on the test plate. Using two different dilutions for a membrane filter test can provide you with a usable result in instances when there is a high amount of bacteria in the water. If the number of colonies is too high the result may read "TNTC," or, too numerous to count. This is not a usual result for beach monitoring. For beach monitoring results, we look for the number of colonies on the plate and the dilution. Use the result from the higher dilution unless the number of colonies would be 80 or more or

the result is TNTC. In Example 6 below, 2003 data from Fairview Beach help demonstrate this recommendation.

Example 6: Determining the reportable result from a membrane filter (MF) test

Sample Description	SAMPLE TIME	ENTEROCOCCI #/100mL 25 ml dilution	ENTEROCOCCI #/100mL 50 ml dilution	# of colonies/plate 25ml/50ml	Reported result
Fairview Beach #1	9:30	76	88	19/44	88
Fairview Beach #2	10:00	100	130	25/65	130
Fairview Beach #3	10:00	100	120	25/60	120
Fairview Beach #4	10:00	96	74	24/37	74

In Example 6, all of the reported results came from the 50 ml dilution. However, they weren't always the highest value measured. Knowing that you are looking for a plate count between 20 and 80 colonies and that using the 50 ml dilution because it is more accurate, can help you determine the reported result.

Issuing and Lifting Swimming Advisories

14.   If there is an exceedance of the standard, the site should be posted with an appropriate sign, procedures for contacting the locality where the beach is located should be followed, a press release should be issued to notify the public and a follow-up sample should be taken as soon as possible and delivered to the lab.

15.   No additional sampling should be conducted until the results of the last test are received, either by fax, phone or e-mail.

16.   If the follow-up sample shows the site to be in compliance with the standards, lift the advisory by removing the posted sign and issue a press release notifying the public that the advisory is lifted.

17.   If the follow-up sample exceeds the standard, the advisory continues and another water sample should be collected as soon as possible. The single sample maximum is used to issue and lift swimming advisories.

18.   The geometric mean is used for assessment purposes by DEQ to determine if a water is impaired and not for issuing and lifting swimming advisories. The geometric mean is calculated on samples from the same site on different days. Duplicate or replicate samples from the same day are not used to calculate a geometric mean; duplicate and replicate samples are averaged arithmetically and the result is used in the calculation of the geometric mean. State Water Quality Standards require the geometric mean to be used for the assessment when a site is sampled two or more times in a calendar month. The new database for beach monitoring will calculate the geometric mean for each site.

Keep an eye on the value to ensure that the mean stays below 35, additional sampling may be warranted if the geometric mean is not in compliance with State Water Quality Standards.

19.   If rainfall results in an exceedance of the standard and the rain event has been continuous since the last water sample was taken, you may delay re-sampling until after the rain stops and water levels and water flow rates return to normal as long as the swimming advisory stays in place. If a decision to re-sample is made, the advisory can be lifted when bacteria levels are in compliance.