

REFERENCE MANUAL 83D1 BATHING BEACHES

NPS Unit Managers will reduce the risk of waterborne diseases by ensuring designated bathing beaches are properly operated, maintained and monitored. Deficiencies will be promptly corrected, in compliance with the *Beaches Environmental Assessment and Coastal Health Act of 2000* and applicable state/local regulations. In the absence of applicable state or local regulations, the following NPS policies will apply. Bathing beaches can be located at lakes, rivers, oceans, hot springs, and other bodies of water. Additional guidance is provided in RM83(D1). The complete *Beaches Environmental Assessment and Coastal Health Act of 2000* can be accessed at:

<http://www.epa.gov/ost/beaches/beachbill.pdf>.

A. GENERAL

- A.1 Bathing beach monitoring is required for each designated bathing beach. Designated bathing beaches are those that the Park has identified (using signs, brochures, etc.) for contact recreational water activities. Monitoring is recommended for other areas that are heavily used (40 or more people per 100 linear feet of shoreline). Specific requirements of the monitoring program include:
- a. Conducting a sanitary survey;
 - b. Preparing a water quality monitoring protocol. This protocol includes the names of areas to be sampled; sampling station locations (GPS); a map or sketch of each area showing the location of each sampling station; the bacteriological standard used; and the name of the laboratory performing the analyses;
 - c. Sampling for enterococcus or *Escherichia coli* bacteria levels; and
 - d. Issuing swimming advisories when bathing beach waters exceed the specified standards.
- A.2 A copy of the bathing beach monitoring plan and current bathing beach sanitary survey report will be sent to the Regional Public Health Consultant (PHC) for review and concurrence approximately one month before the beginning of the recreational season. The plan does not have to be resubmitted annually if there are no changes in beach conditions or the monitoring plan.
- A.3 Samples will be collected in conformance with the most recent edition of Standard Methods for the Examination of Water and Wastewater. Enclosure 2 is a recommended sampling procedure.
- A.4 Analyses will be performed in conformance with the most recent edition of Standard Methods for the Examination of Water and Wastewater. Parks that have

their own laboratory facilities must meet state certification requirements. Parks that do not do their own facilities will use a certified laboratory.

- A.5 Parks located in states that have bathing beach water quality standards will comply with those standards or, in the absence of state standards, comply with DO-83.
- A.6 Parks will submit bacteriological sampling results to the PHC.
- A.7 When the applicable bacterial density standard is exceeded, Park managers will report the bacterial density results to the PHC and the applicable state agency. Advise the PHC, applicable state agency and the local news media that a health advisory regarding the affected area will be posted. The advisory will notify the public of the potential health risks from swimming at the designated beach. The affected beach will be re-sampled immediately by taking two samples each day at each sampling location where the bacterial standard was exceeded. Re-sampling will be continued until the bacterial standard is not exceeded for two consecutive days. The PHC can waive this re-sampling requirement. Resume routine monitoring and notify the PHC, the local public health agency and the news media of the decision to reopen the beach. All signs should be removed.

B. SANITARY SURVEY

- B.1 The sanitary survey is a health risk assessment of the swimming beach and surrounding area to determine whether the beach is safe for water contact activities such as wading, swimming and snorkeling. The survey takes into consideration all factors that have an actual or potential bearing on the microbial quality of the water. It includes potential sources of pollution, physical factors that can affect the distribution and concentration of microorganisms, and the microbial quality of the water at the time of the survey. The survey can be completed by the Park staff, State/Local health department personnel, or the PHC utilizing the assessment criteria outlined in this document (see B.2 below). There is no formal report format; a 2-3 page submittal is sufficient. The assessment criteria may also be accessed in the shellfish sanitary survey protocol (www.issc.org) and the EPA performance standards (www.epa.gov/beaches).
- B.2 Potential sources of human-caused bacterial contamination include but are not restricted to: commercial and agricultural activities, sewage outfalls; storm drains; raw sewage overflows from manholes, septic tanks and sewage treatment plants; boating activities and people using the beach. Potential sources of animal-caused microbial contamination include, but are not limited to, streams, animal enclosures, and feedlots and forage areas for both domestic and wild animals
- B.3 Physical factors that have a bearing on water quality include precipitation, topography, runoff patterns, prevailing winds, tides and currents. Water quality is also affected by characteristics of the receiving water such as thermal and salinity stratification, water depth, and surface area. An initial site assessment should

consider potential sources of pollution and the physical attributes of the beach area. Should the initial site assessment note any potential sources of pollution, a more in-depth evaluation may need to be undertaken which provides pollution characterization, epidemiology data linking illness to the area, and dilution factors.

- B.4 The beach site assessment should also consider user hazards such as; excessive vegetation, infectious snails, poisonous or dangerous aquatic organisms, currents, tides, submerged objects, beach slope, sharp drop-offs, uneven/unstable wading area surfaces, depth in diving areas, and overhead power lines.
- B.4 The Park should conduct an initial sanitary survey at each designated beach site. The results of the survey will help in selecting sampling locations for a beach-monitoring program. It will also help the Park identify potential source(s) and pathway(s) of contamination if the beach water quality subsequently falls below the applicable standard. Subsequent surveys should be performed every three years or when any of the risk factors mentioned above change. Contact your PHC if you have questions about or need assistance in conducting the sanitary survey.

C. BEACH MONITORING PROTOCOL

C.1 Sampling Location

Sample locations should reflect the water quality within the entire recreational zone. The majority of samples should be taken in areas of heaviest use. They should include sites that potentially can be affected by point discharges and surface runoff. Examples are locations adjacent to drains and natural contours that could discharge storm water collections or septic waste. The total number of samples taken at a bathing beach will depend on the size and intensity of use. A minimum of 3 sampling stations per beach is recommended.

C.2 Sampling Frequency

Water samples should be collected as early as possible in the morning to accurately reflect the baseline bacterial quality. The first set of samples should be collected approximately two weeks before the beginning of the recreational season. This will provide sufficient time to re-sample if the initial samples indicate the bacterial standards have been exceeded. Sampling frequency will be based on the sanitary survey which reflects the periods of recreational use, the nature and extent of use during certain periods, the proximity of the recreational waters to known point and non-point sources of pollution, and any effect of storm events on the waters. In any event, the water quality monitoring will follow the relevant state's sampling frequency protocol.

C.3 Data Form

Enclosure 1 is a recommended form for consolidating your beach monitoring data. It includes information about the location, time, date and bacterial densities of each water sample. At the end of each month during the bathing beach season, send a copy of the current month's data form to your PHC.

D. BACTERIAL STANDARDS

- D.1 For states that do not have their own bathing beach standards, enterococcus is the recommended bacterial indicator. However, you may not be able to use enterococcus if laboratory analysis is not readily available. In that case, the recommended standard is *E. coli*.
- D.2 Two types of bacterial density standards are recommended. One standard is the geometric mean. The geometric mean should be calculated weekly for each sampling station beginning with week five. It is a running mean calculated using the most recent five weekly samples. (See Enclosure 3 for an example of how to calculate the geometric mean.)
- D.3 The second bacterial density standard is the maximum standard. It is the bacterial density that should never be exceeded, even by one sample. It is the only standard available from the beginning of the sampling period until week five when the first geometric mean can be calculated.
- D.4 Transcribe the bacterial density data (colonies/100 ml) onto your beach data form (Enclosure 1)
- a. The recommended marine and fresh water bacterial standards are the following:
 1. Marine Water Bathing Beaches
 - a. Enterococci
 - 1) **35 enterococci/100 ml.** (Geometric Mean)
Or
 - 2) **104 enterococci/100 ml.**
Not to be exceeded by any one sample (NTBE).
 2. Freshwater Bathing Beaches
 - a. Enterococci
 - 1) **33 colonies/100 ml.** (Geometric Mean)
Or
 - 2) **61 colonies/100 ml.**
Not to be exceeded by any one sample (NTBE).
 - b. *E. coli*
 - 1) **126 colonies/100 ml.** (Geometric Mean)
Or
 - 2) **235 colonies/100 ml.**
Not to be exceeded by any one sample (NTBE).

E. NOTIFICATION, ADVISORY AND CLOSURE PROCEDURES

E.1 Example advisory:

Bacterial levels in water samples taken from this body of water exceed Local, State and National Park Service standards for recreational activity. Due to the increased human health risk, the National Park Service advises against contact with these waters until further notice.

Please contact the Park at telephone no. XXX-XXXX for updates on this advisory.

Enclosure 1

SUMMARY BEACH BACTERIOLOGICAL DATA FORM

BEACH NAME: _____
SAMPLE SITE: _____
INDICATOR ORGANISM: _____

ORGANISM PARAMETER	
MARINE WATER STANDARD (enterococci)	35 enterococci/100mL (Geometric Mean) 104 enterococci/100mL (Not To Exceed Limit)
FRESH WATER STANDARD (enterococci)	33 enterococci/100mL (Geometric Mean) 61 enterococci/100mL (Not To Exceed Limit)
FRESH WATER STANDARD (E. coli)	126 enterococci/100mL (Geometric Mean) 235 enterococci/100mL (Not To Exceed Limit)

WEEK #	DATE (DD/MM/YY)	TME (NNNN)	COLLECTED BY	COLONIES/100mL	STEP #1	Step #2	Step #3	Step #4
					LOGARITHM OF SAMPLES	SUM OF LOGS	AVERAGE OF LOG SUM	GEOMETRIC MEAN OF ANTILOG

¹Describe all activities that might affect the beach water quality (e.g., boating, storm water runoff, weather conditions, unusually large crowds).

An excel spreadsheet which will automatically calculate the geometric mean can be downloaded at the following NPS website:

http://www.nps.gov/public_health/intra

Enclosure 2¹

RECOMMENDED SAMPLING PROCEDURES

1. Collect samples using bottles provided by your laboratory.
2. Collect samples as early as possible in the morning before visitors begin using the beach.
3. Wade out into the surf about thigh deep and face the current, if any.
4. Collect the sample from an incoming wave, taking care to avoid getting debris into the sample.
5. The object is to avoid capturing surface water, and to collect from at least 1-foot depth. Grasp the bottle near its base with one hand and remove the cap with the other. Be careful to avoid touching the inside of the cap or the rim of the bottle. Rotate your wrist so the mouth of the bottle is pointing downward at about a 45-degree angle. Rapidly plunge the bottle to a depth of about one foot. Rotate your wrist so the mouth of the bottle points up, loses its air bubble, and fills with water. Replace the bottle cap while still under water.
6. Lift the capped bottle out of the water. Remove the cap and pour out enough water to leave a 1/2-inch air space. Replace the cap. Be careful not to touch the lip of the bottle or the inside of the cap.
7. Immediately place the bottle in an upright position in a covered cooler containing sufficient ice to keep the samples cool until they arrive at the laboratory.
8. Record the sample bottle number, station name, date and time of sampling, sampler's name, and other appropriate information on the field data sheet (See Enclosure 1).
9. Transport the sample to the laboratory on ice, in a covered cooler preferable within six hours but no longer than twenty-four hours of sampling.

¹

See most recent edition of Standard Methods for the Examination of Water and Wastewater, 18th Edition, Part 9060 for additional information about sample collection, preservation and storage.

Enclosure 3

Two Geometric Mean (GM) Sample Calculations Using the Results of 5 Weekly Samples Taken From the Same Sampling Station

GM = antilog [1/n (log sample 1 + log sample 2 + log sample 3 + log sample 4 + log sample 5)]

Example 1: Week 1 = 23 enterococci/100 ml
Week 2 = 33 enterococci/100 ml
Week 3 = 33 enterococci/100 ml
Week 4 = 37 enterococci/100 ml
Week 5 = 47 enterococci/100 ml

Step 1: log 23 = 1.36172
log 33 = 1.51851
log 33 = 1.51851
log 37 = 1.56820
log 47 = 1.67209
7.63903

Step 2: [1/n (7.63903)] = [1/5 (7.63903)] = 1.52781

Step 3: Antilog 1.52781 = 33.7 = 34 colonies/100 ml

Example 2: Week 2 = 33 enterococci/100 ml
Week 3 = 33 enterococci/100 ml
Week 4 = 37 enterococci/100 ml
Week 5 = 47 enterococci/100 ml
Week 6 = 53 enterococci/100 ml

Step 1: log 33 = 1.51851
log 33 = 1.51851
log 37 = 1.56820
log 47 = 1.67209
log 53 = 1.72458
8.00189

Step 2: [1/n (8.00159)] = [1/5 (8.00189)] = 1.60003

Step 3: Antilog 1.60003 = 39.8 = 40 colonies/100 ml

Conclusion: The GM of 34-colonies/100 ml **does not exceed** the marine beach standard of 35 enterococci colonies/100 ml. **Conclusion:** The GM of 40-colonies/100 ml **does exceed** the marine beach standard of 35 enterococci colonies/100 ml.

*Note: n = the number of samples