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## APPENDIX 1

# BEACHWATCH POLLUTION ASSESSMENT GUIDELINES

The guidelines used by council beach inspectors to categorise pollution on their beaches are outlined below:

### ASSESSING BEACH POLLUTION

Beach pollution assessments are best begun along the most recent high tide mark. Sewage pollution and other debris that washes up on the beaches is concentrated on the high tide mark. Inspectors walk along the high tide line and assess whether there are any sewage-related items. Close inspection is required to identify small particles of sewage grease.

Sewage-derived items include: grease particles or balls; condoms; sanitary napkins; cotton buds; and plastic remnants. These items float when discharged from the outfalls.

Beach inspectors choose an area of the beach along the most recent high tide mark that is typical of the sewage found on the beach. An area one metre square is used to assess pollution. The amount of visible sewage items in this area will determine the level of pollution reported to Beachwatch. Inspectors are careful not to avoid pollution by choosing an area which is cleaner than the rest of the beach.

In previous seasons 'old' sewage grease was not used in assessment of beach pollution. When the cliff face outfalls were operating in Sydney, the grease on the beach indicated that the plume was contaminating the beach. Now that the plume is dispersed offshore, the returning grease has become the pollution, rather than an indicator of the plume. 'Old' grease is rated the same as fresh grease, although inspectors usually describe it as old in the comments section of their assessment form.

Noticeably higher levels of sewage pollution on an isolated section of the beach, not representative of conditions on the beach are generally reported in the 'comments', e.g. 'medium sewage pollution in the southern corner, but low levels elsewhere'. If there is no evidence of sewage pollution on the high tide mark (the beach may have been raked), inspectors look very carefully for grease along the new wave marks on the wet sand.

The level of sewage pollution may be classified as:

- CLEAN (NIL or TRACE)
- LOW
- MEDIUM
- HIGH.

These categories provide all council beach inspectors and Beachwatch scientific officers with a uniform standard for assessing and reporting beach pollution.

In this classification scheme, sewage-derived litter such as condoms and sanitary napkins are considered along with large items of beach grease.

### **Sewage Pollution on the Beach**

#### ***CLEAN:***

CLEAN is separated into two categories - NIL and TRACE.

#### ***NIL:***

NIL is reported where there is no evidence of sewage-related items on the beach or in the water.

#### ***TRACE:***

The category TRACE was added as a 'buffer zone'. TRACE is used when there are scattered sewage-related items that are not consistent with conditions on the day. A few items could be left over from previous days. When TRACE is reported, the beach is otherwise clean.

Beaches assessed as either NIL or TRACE are reported to the media and the public as CLEAN beaches.

#### ***LOW:***

LOW is reported when there is a consistent small amount of sewage pollution on the beach. It is often hard to see, and easy to walk over without noticing it. If minor amounts of sewage-derived items are found consistently along the beach, the pollution level is classified as low.

Numerical Indicators along a 1 metre length of tide line:

- \* Granular size beach grease; maximum 50 items.
- \* Small size beach grease (2-5)mm); maximum 10 items.
- \* Large lumps of beach grease (1 cm or larger) ; maximum 2 items.

#### ***MEDIUM:***

MEDIUM is reported when there is a consistent amount of sewage-derived items along the beach or along the tide mark. If the adjacent numerical indicators are consistent with what is seen on the beach then the sewage pollution level is MEDIUM.

Numerical Indicators along a 1 metre length of tide line:

- \* Granular size beach grease; between 50 and 100 items.
- \* Small size beach grease (2-5 mm); between 10 and 20 items.
- \* Large lumps of beach grease (1 cm or larger); between 3 and 5 items.

### **HIGH:**

HIGH levels of sewage pollution are probably the easiest levels to assess. When sewage pollution is extensive and the high tide mark is whitened by tiny grease particles, or the beach is littered with larger lumps of sewage grease, HIGH levels are reported.

Numerical Indicators along a 1 metre length of tide line:

- \* Granular size beach grease; more than 100 items.
- \* Small size beach grease (2-5 mm); more than 20 items.
- \* Large lumps of beach grease (1 cm or larger); more than 5 items.

### **Sewage Pollution in the Water**

Sewage pollution in the water is difficult to assess. When the cliff face outfalls were in operation at North Head, Bondi and Malabar, the sewage plume coming into the beach created extremely poor conditions for swimming. The plumes from these outfalls now end up away from the beach and so this method of determining pollution is becoming less reliable.

#### **1. Grease on the Wet Sand**

The most reliable indicator of sewage pollution in the water is the presence of 'fresh' grease particles on new wave marks. The amount of grease present along the new wave lines on the wet sand will not appear as great as it will later when all the grease is pushed up and concentrated along the next high tide line.

#### **2. Discolouration**

Discolouration or turbidity in the absence of other indicators is not sufficiently reliable to confirm the presence of sewage.

Other agents which may give rise to discolouration or turbidity are stormwater, suspended sediments, algae and sewage. A big swell, particularly when accompanied by choppy seas, will often result in turbid or discoloured water. For this reason an assessment of sewage pollution in beach waters is not based on turbidity or discolouration.

The numerical indicators used to assess sewage pollution on the beach apply only to grease accumulated along the high tide mark and cannot be used when assessing grease on new wave lines.

When using grease on new wave lines and sewage odour as indicators, inspectors classify the amount of sewage pollution in the water as follows:

- CLEAN: CLEAN is reported if there is no sign of any grease.

- **LOW:** If on close inspection, a small amount of grease is being washed ashore, LOW is reported
- **MEDIUM:** If, on close inspection, a small amount of grease is being washed ashore and the water has a sewage odour, MEDIUM is reported.
- **HIGH:** HIGH is reported if a lot of easily visible grease is being washed ashore. Sewage odour may or may not be present.

### **Assessment of Stormwater Pollution**

Stormwater runoff will affect most beaches during and after periods of rain, particularly after thunderstorms. Leaves, twigs and street litter, carried to the beach in stormwater drains, are later washed up on the sand. It is a very common event and quite natural for a small amount of natural debris (leaves, twigs and other organic matter) to be washed up on beaches.

Stormwater runoff may also cause discolouration of beach water.

Stormwater litter is often mixed up with marine debris such as seaweed, and other marine plant and animal remains. Marine debris is quite natural and should not be confused with pollution. When reporting stormwater pollution, that is, litter or discoloured water, inspectors do not confuse it with marine debris.

Sewage grease and sewage-derived litter may also become attached to seaweed and stormwater litter. Care is taken to distinguish between stormwater pollution and sewage pollution to avoid overestimating the level of sewage pollution.

Stormwater pollution on the beach or in the water is classified as follows:

- **CLEAN (NIL):** NIL is reported when there are no signs of stormwater effects.
- **CLEAN (TRACE):** If there is a small amount of stormwater litter which would not inconvenience beach usage, TRACE is reported.
- **LOW:** LOW levels are reported when stormwater litter is noticeable but unlikely to affect beach usage.
- **MEDIUM:** Reports of MEDIUM levels occur when stormwater litter and/or discolouration of the surf waters significantly detract from the appearance of the beach and is likely to discourage beach users.
- **HIGH:** HIGH levels are reported when stormwater significantly discolours the surf and/or when large amounts of stormwater litter and debris make conditions unpleasant for beach users.

Copies of the Guidelines in booklet form, with photographs of different levels of pollution, are available.

## APPENDIX 2

### MICROBIOLOGICAL METHODS

For each beach, the sampling location was in the water at a depth of one metre and in line with the area of beach between the flags, or, where flags were not present, at the most commonly used area for swimming. Sterile, 350 ml sample bottles with a secure screw lid were used and each sample bottle was marked with the beach name, time and date of sampling. Samples were collected by holding the bottle near its base and plunging it, neck downward, below the surface. The bottle was then turned until the neck pointed slightly upward and pushed gently forward horizontally in a direction away from the hand. A 1 cm air space was left in the bottle and the lid was secured. Samples were stored in eskies with ice to ensure that they were held at a temperature below 10<sup>0</sup> C. Samples were transported as soon as possible after collection to the laboratory.

Analysis of Beachwatch water samples was carried out by a commercial laboratory. The most frequently used method for the enumeration of indicator bacteria from marine water samples, and the one approved by Beachwatch, is membrane filtration. This involves passing a known volume of water through a membrane of sufficiently small pore size (routinely 0.45 µm) to retain bacteria on its surface. The membrane is then transferred onto a nutrient medium and incubated at a constant temperature. The combination of chemicals in the media and incubation temperature selects for particular groups of bacteria. A single colony forms on the membrane for each viable selected bacterium in the original sample. The number of colonies which grow on the membrane is a measure of the number of bacteria in the original sample.

Samples were analysed for faecal coliform density using method 9222 D and for enterococci density using method 9230 C from *Standard Methods for the Examination of Water and Wastewater*, 18th Edition (APHA, 1992).

The geometric mean (the log-arithmetic transformation of the arithmetic mean) was used to calculate the central tendency of bacterial counts when replicate samples were collected. This statistic is considered to be more appropriate than the arithmetic mean because bacteriological data are approximately log-normally distributed (Gameson, 1982; Zar, 1984). As a result, the geometric mean best represents the average of the samples collected at a beach, i.e. the bacterial density to which a swimmer may be exposed.