Chapter 9

BART Tester Parameter Codes

9.1 BART tester parameter codes (Pcodes)

Testers that are in commercial production each have a parameter code (or Pcode) abbreviated to a descriptive short-form distinctive name of 20 characters maximum. Each Pcode includes a short description of the tester as a defined substrate technology (DST). Each Bart tester employs a vertically diffusing selective nutritional chemistry that restricts the culture to some of the bacterial communities present in the sample to only those react in recognizable manners to that elevating front. Additionally the tester does generate a oxidative - reductive potential (ORP) interface sometimes referred to as the Redox front. This interface or front commonly also rises during the testing period when bacterial activity occurs. All of the testers involve defined substrate technologies designed to examine activities within specific groups of bacteria within the sample being investigated.

9.2 Product name: IRB- BART Pcode: iron biotester

DST: Tester employs a modified Winogradski ferric-iron culture medium that selectively triggers the growth of both iron oxidizing and iron reducing bacteria within an environment that includes (base to top) reductive to oxidative gradient; and a selective nutrient front that diffuses from the base to the top of the water column in the tester. It has been commonly found that IRB communities often will involve cycling functions between the iron oxidisers (to ferric) and reducers (to ferrous)

.

9.3 Product name: SRB- BART Pcode: sulfide biotester

DST: Tester employs a modified broad spectrum Postgate culture medium that allows the growth of hydrogen sulfide producing bacteria. This happens under reductive conditions and so the tester employs a floating anoxic block to reduce oxygen entry into the culturing sample. There are two

origins for the generated hydrogen sulfide:

(1) Sulfates from the selective medium that are reduced to form a black base, BB, reaction; and

(2) Sulfur containing proteins primarily from the sample that are degraded reductively with the release of hydrogen sulfide usually within the biomass growing around the ball (black top, BT, reaction).

9.4 Product name: SLYM- BART Pcode: slime biotester

DST: This tester employs a rich proteinaceous medium that stimulates the formation of water-bonding extracellular polymeric substances that interconnect the cells into a slime-matrix. In the tester this slime growth commonly causes the culturing sample to go cloudy, CL, very quickly often accompanied by gels, threadlike growths, and the formation of foam bubbles that commonly collect around the BART ball as a ring, FO.

9.5 Product name: HAB- BART Pcode: bacterial biotester

DST: In this general bacterial tester a rich selective culture medium containing proteose and peptone-tryptone is employed to stimulate the heterotrophically active bacterial growth. To determine whether the bacteria are aerobic or anaerobic then the reduction-oxidation potential indictor, methylene blue, is used. This causes the color to shift from blue (oxidative, aerobic, UP) to clear (reductive, anaerobic, DO).

9.6 Product name: APB- BART Pcode: acidogenic biotester

DST: Fermentative bacteria function anaerobically (reductively) producing fatty acid daughter products. These cause the pH to fall into the acidic range (generally 3.8 to 5.4) which increases risks of acidulolytic corrosion in steel structures. The selective medium for this tester contains a mixture of tryptone, peptone, and glycerol to trigger the generation of fatty acids.

9.7 Product name: N- BART Pcode: nitrate biotester

DST: This biotester employs a selective culture medium based on ammonium sulfate mineral salts and the reaction cap is applied after five days to detect the presence of nitrite. When the ammonium is oxidised to nitrate by nitrification by the nitrifiers then nitrates and nitrites appear as daughter products. Nitrate tends to be very transient but nitrite is more persistent and so the test for positive activity is based on the presence of nitrite. This tester contains three Bart balls and is laid on itself to increases both surface areas and the amount of potential oxidative activity.

9.8 Product name: DN- BART Pcode: nitrite biotester

DST: To encourage reductive denitrification by bacteria the selective culture medium used in the DN- tester contains peptone and nitrate along with important macro-nutrients. Samples containing active denitrifiers generate nitrogen gases which become entrapped in the surface biofilms as bubbles. These bubbles rise to the ball where a foam ring (FO) is formed that can commonly last around one to three days.

9.9 Product name: FLOR- BART Pcode: glow biotester

DST: This biotester employs a rich proteinaceous medium that stimulates the growth of pseudomonad bacteria in the oxidative regions around, and immediately below, the ball. Within this zone some pseudomonad bacteria generate fluorescent pigments that glow in natural or artificial UV light and indicate these species are present and active.

9.10 Product name: ALGE- BART Pcode: glow biotester

DST: Microalgae are primarily the single celled photosynthesising microorganisms that function in oxidative waters exposed to sunlight. This biotester employs modified Bold’s medium which does not contain significant organics, but does contain the basic nutrients for plant growth (nitrogen, phosphorus, potassium, sulfur etc.). Carbon is presented in the tester as bicarbonates (pH, 8.2) to encourage the micro-algae to utilize this form of inorganic carbon. Micro-environments are created within porous cellulosic and plastic weaves to allow localised growths of specific algae while the biotester is laid on its side and illuminated.

9.11 Product name: ENH- BART Pcode: bacterial enhancer

DST: Many bacteria are capable of being stimulated to generate more high energy stored phosphorus as adenosine triphosphate (ATP). The enhancer achieves this by using culture medium containing proteose and peptone-tryptone that triggers ATP production in Bart environments that are rotated at 3rpm for one minute. Midpoint testing after rotation shows improved precision with a x3 to x10 increase in ATP.