

GENERAL INSTRUCTIONS FOR BACKFILLING AN INJECTION-WELL CESSPOOL

(Department of Health, January 2005)

Procedure:

First, complete and submit the Application For Backfilling An Injection-Well Cesspool, with a \$100 filing fee made payable to the State of Hawai'i.

Next, using these instructions, only a geologist or qualified professional engineer may **self-determine** the appropriate **Method** for backfilling an injection-well cesspool. Once the determination is made, the geologist or engineer is responsible for monitoring, assuring, and endorsing that the backfilling work was properly completed.

Lastly, a final completion report signed by the geologist or professional engineer must be submitted to the Department of Health's Underground Injection Control program for file closure. For this requirement, use the Injection-Well Cesspool Backfilling Final Completion Report form (attached). An unclosed file is subject to enforcement and corrective action.

Backfilling Objective:

Proper backfilling indicates that the injection-well cesspool has been properly cleaned out and permanently filled and sealed with an inert material having stability and physical strength. Furthermore, the injection-well cesspool's remaining profile should not ever serve as a preferential route for the infiltration/migration of fluids into, out of, or between soil, sedimentary, or volcanic formations. In this regard, the backfilling should minimally reestablish the subsurface and ground back to its original condition.

INSTRUCTIONS:

1. **These instructions only apply to an injection-well cesspool that is not deeper than 33 feet below ground surface.** For an injection-well cesspool that is deeper than 33 feet, an

individualized application for injection-well cesspool abandonment must be filed with the Underground Injection Control (UIC) program. (See General Remarks, item f.) Site-specific backfilling instructions will then be issued by the UIC program. Injection-well cesspools that are deeper than 33 feet have an increased risk of adversely affecting groundwater.

2. Before starting any backfilling, all sediments, sludge, debris, and organic matter in the injection-well cesspool should be removed and disposed of properly. The injection-well cesspool should be cleared to its original constructed depth.
3. Determine the soil, rock, and formation characteristics of the ground in which the injection-well cesspool was built. Once this determination is made, **select the most appropriate backfilling method from the five methods listed below.** Use the method that best fits the ground condition of the injection-well cesspool.

METHODS:

- I. Ground Condition: Ground characteristics are not known or not considered. Only one generalized backfilling method/specification is desired, regardless of soil, rock, or formation characteristics.

Backfilling: Use a cement mixture. Cement mixtures may range from cement/water (neat cement), to sand/cement (1/1, 2/1, or 3/1), to concrete (1500, 2500 psi). Determining the appropriate mixture depends primarily on the diameter of the injection-well cesspool. Any diameter smaller than 12 inches requires neat cement. Emplacement of the cement mixture into the injection-well cesspool is via the Tremie method (use of a tremie pipe), especially for emplacement below the water table. When a water table is not present, cement mixtures should not free fall more than 6 feet. Cement mixtures should have a water-to-cement ratio of approximately 5 gallons, but not exceeding 6 gallons, per 94 pounds of cement (one sack).

II. Ground Condition: Lava formations: either a`a or pahoehoe lava flows, dikes, welded tuff, or welded cinders, regardless of fractures, clinkers, or voids.

Backfilling: Use a cement mixture as described in Method I. If the injection-well cesspool does not encounter groundwater, a controlled low-strength material (flowable fill) may be alternatively used. The flowable fill should have a minimum strength of 500 psi. Emplacement of the flowable fill is the same as of a cement mixture under Method I.

Cesspool diameters vary, but diameters may typically range from 5 to 8 feet. The use of additional appropriate inert aggregate materials, to help reduce the volume of the cement mixture, or the flowable fill, is possible. However, this method of backfilling must be closely monitored by the attendant geologist or engineer. Appropriate inert aggregate materials may include clean boulders and cobbles, certain types of smaller-sized aggregates, and clean concrete blocks from demolition. Aggregates must be appropriately sized, and emplacement of the aggregates with the cement mixture must not create voids due to bridging or incomplete cement mixture filling. Emplacement of the inert aggregate should never rise above the cement mixture level. In other words, the cement mixture must be emplaced first in the injection-well cesspool to a minimum thickness of 2 feet, and aggregates should then be carefully dropped into the cement mixture. The cement mixture is continually added in order to keep the cement mixture level above the inert aggregate.

III. Ground Condition: Consolidated material: either hard coral, cemented sand, in situ decomposed rock, tuff, or conglomerate.

Backfilling: Use a controlled low-strength material (flowable fill). When a water table is not present, the flowable fill should have a minimum strength of 300 psi. When backfilling below a water table, the flowable fill's minimum strength should be 600 psi.

Emplacement of the flowable fill is the same as of a cement mixture under Method I. The use of appropriate inert aggregate materials, to help reduce the volume of the flowable fill, is possible, as described under Method II.

- IV. Ground Condition: Unconsolidated material: either soil, sand, gravel, loose coral, loose cinders, or alluvium.

Backfilling: Use a material that is similar to the site's natural material. The condition of the injection-well cesspool, e.g., the dimensions, open-hole integrity, accessibility, standing water, etc., may affect the determination to use a site-similar material. The geologist or engineer may elect to use a more stringent backfilling material, e.g., a cement mixture, in order to accomplish the job more efficiently and properly.

When using a site-similar material, the material should in general be emplaced in one-foot layers and compacted sequentially to match or exceed the site's natural formation density. As an alternative to a site-similar material, a controlled low-strength material (flowable fill) may be used. When a water table is not present, the flowable fill should have a minimum strength of 150 psi. When backfilling below a water table, the flowable fill's minimum strength should be 300 psi. Emplacement of the flowable fill is the same as of a cement mixture under Method I.

If a site-similar material is used to backfill inside an injection-well cesspool's casing, and if the casing's top is less than 5 feet below the ground surface, then the inside top 24 inches of the casing must be completely filled with concrete, minimum 1500 psi.

- V. Ground Condition: Regardless of the ground condition, the injection-well cesspool is fully eliminated by excavation, i.e., the entire cesspool profile is

excavated away.

Backfilling: Use a material that is similar to the site's natural material. The material should be emplaced in layers and sequentially compacted to match or exceed the site's natural formation density. Local soil engineering principles and practices should be used for backfilling, in full consideration of stability, strength, and safety objectives.

General Remarks:

- a. The Department of Health reserves the authority to conduct quality assurance inspections at any point before, during, or after field work operations to verify that satisfactory work and the proper use of methods and materials in backfilling an injection-well cesspool are being accomplished. Unsatisfactory work or the improper use of methods or materials will be subject to enforcement and corrective action, which may include penalties for violations.
- b. Hawai'i injection well regulations are under Hawai'i Administrative Rules, Title 11, Chapter 23, titled Underground Injection Control.
- c. Backfilling with a cement mixture or flowable fill may stop short of reaching the ground surface in order to accommodate top soil, landscaping, grading, underground utilities, or foundation considerations. Stop-short depths should generally not exceed 4 feet. The remaining unfilled hole may be filled with soil. Stop-short depths do not apply in casings; casings must always be filled completely.
- d. All backfilling methods should not leave behind a depression in the ground. The final ground surface should be shaped or graded to prevent tripping or falling, as well as water ponding.
- e. When backfilling with a site-similar material, the geologist or engineer may use professional judgement and geotechnical

principles regarding the compaction method needed to achieve proper compaction.

- f. For an individualized injection-well cesspool abandonment, the abandonment application form is available at www.hawaii.gov/health/environmental/water/sdwb/uic/uicprogrm.html. When applicable, the application fee is \$100, payable to the State of Hawai`i. Project specific, written backfilling instructions are then issued to the applicant. The instructions will contain details about the backfilling work methods, material, and reporting requirements. The backfilling methods and material under an individualized abandonment cannot be self-determined.

- g. Questions about the general instructions may be directed to the Underground Injection Control program, Safe Drinking Water Branch at 808-586-4258 (Honolulu).