WELL PRODUCT FUNCTIONS EVALUATED UNDER NSF/ANSI/CAN 60

Standard 60 is the primary mechanism for evaluating health effects of well drilling and development products in the U.S. and Canada for drinking water applications. This paper intends to reduce confusion amongst manufacturers and water supply regulators regarding the applicability of the functions for drinking water well products.

The function names used by NSF International are as follows:

- Drilling Fluid
- Well Drilling Aid
- Foaming Agent
- Well Sealant

These functions apply to drilling and development of drinking water wells. The evaluation process includes parameters for water used to drill the borehole, residual product in the aquifer, and flushing the well prior to placing into service. The chemical products and their accompanying contaminants shall not exceed the applicable health effects criteria when evaluated under these conditions.

The NSF functions Well Rehabilitation Aid and Well Cleaning Aid apply to chemical products that rehabilitate a drinking water well while the well is removed from service. These functions are not discussed here.

DRILLING FLUIDS

Drilling fluids for drinking water wells are composed of water mixed with clays (e.g. bentonite), polymers, or other additives. The pumped drilling fluid carries the cuttings out of the bore hole, and also cools the drill bit. Clays and polymers stabilize the bore hole walls and enhance the removal of cuttings. Very large volumes of fluid are needed; so most drilling fluids are mixed on site, and/or by the drill operator.

Standard 60 evaluates these chemical mixtures as 3780 liters (1,000 gal) of fluid contacting the aquifer, with 90% removed through drilling and development. This evaluation is more conservative than for a Well Drilling Aid[1].

WELL DRILLING AIDS

Well Drilling Aids are chemical products added to a water-based drilling fluid. Standard 60 splits the evaluation of Well Drilling Aids into non-turbid and turbid additives, which distinguishes the cloudy or opaque drilling aids (e.g. bentonite) from clear additives (e.g. polymers, caustic soda). Non-turbid well drilling aids are evaluated at their dose rate into the drilling fluid. For example, an additive might be evaluated as 0.5% of the 3780 L (1,000 gal) of the drilling fluid into the aquifer, with 90% removed through drilling and development.

Turbid well-drilling additives are evaluated based on turbidity, because well development includes flushing drinking water wells until they run clear. Turbidity of a test mixture is measured, and then the contaminants are mathematically "diluted" to the Standard's 1 NTU requirement.

FOAMING AGENTS

Foaming agents are used during air drilling (no water based drilling fluid) to increase the rate of cuttings removal from the bore hole. These chemical products are evaluated the same as a non-turbid Well Drilling Aids, except that a "foaming factor" is added to account for increased volume by incorporating air. For example, a foaming agent that increases the liquid volume 8-fold will evaluate contaminants at 1/8th their tested concentration.

BORE HOLE SEALANTS

Most commonly clays (e.g. bentonite) or cement materials are used for sealing and grouting drinking water wells. They prevent surface water from traveling down the exterior of the well casing and contaminating the aquifer and reduce corrosion of the well casing. These products are not water soluble and are evaluated using leaching (i.e. extraction) test methods.

REFERENCES

1. Standard 60 Parameters for products used in drinking water well drilling and development

- the aquifer contains 3.1 × 106 L (815,500 gal) of water, based on a 0.5 acre aquifer of 6.1 m depth (20 ft) and 25% porosity;
- the amount of well-drilling fluid used is 3780 L (1,000 gal), to which the drilling fluid additive has been added at the manufacturer's maximum recommended level;
- the bore hole is 61 m (200 ft) in total depth, the screen is 6.1 m (20 ft) in length, and the bore hole is 25.4 cm (10 in) in diameter; and
- the amount of well-drilling fluid removed from the well during construction is equal to the combined volumes of the casing, the screen, and the bore hole annulus around the casing and the screen, plus an additional amount removed through well disinfection and development (90% removed).

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