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MANUAL OF WATER WELL CONSTRUCTION PRACTICES



ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF WATER SUPPLY

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Introduction

During 1969 through 1971 the U.S. Environmental Protection Agency and its predecessor the USPHS Bureau of Water Hygiene, through the Southern Regional Education Board, conducted limited surveys of individual home water supply systems in Georgia, Tennessee and Kentucky to determine the quality of drinking water from individual home supply systems and to establish the relationship of the quality of water to type supply system.

The first study, conducted in Georgia in 1969, produced unexpected results. Bacterial analyses of 760 sampled systems showed verified coliform bacteria in 300 (40%) of the samples. Included in the survey were 709 wells of which 265 (37%) showed verified coliform bacteria. A break down of all individual home supply systems versus verified coliform showed the following contamination: cisterns—84.2%, springs—73.9%, dug well—74.5%, bored wells—39.4%, drilled wells—18.0%, driven wells—16.7%, and jetted wells—7.1%. Secondly, from this it is obvious that there is some relationship between contamination and type of water supply. The high levels of contamination of cisterns and springs could be explained but the high contamination of wells which tap presumed bacterially pure ground water was unclear. Furthermore, data and information from Tennessee and Kentucky supported the findings in Georgia.

Historically, ground water coming from its natural environment has been considered of good sanitary quality requiring little or no treatment before use as drinking water. Consequently nearly 50 million Americans obtain their drinking water from individual home supply wells tapping this water resource. The data from Georgia, Tennessee and Kentucky, however, indicate that we may have been taking the high bacterial purity of our ground water supplies for granted.

The data collected on system construction appears to have produced the answer on the bacterial contamination of wells. The method used to construct wells, and the construction details themselves affect the bacterial safety of the supply.

Deficiencies in well construction among individual supplies were found to be numerous and included: 1) insufficient and substandard well casing; 2) inadequate "formation seal" between the well casing and the bore hole; 3) poor welding of casing joints; 4) lack of sanitary covers; and 5) use of well pits to protect from freezing. Any one of these deficiencies may allow introduction of bacterial contamination from the surface to the ground water and into the supply system.

The problems facing the person receiving drinking water from an individual water supply system were brought forth during testimony in Congress on the Safe Drinking Water Act. Testimony indicated that millions of Americans may be receiving drinking water which would not meet drinking standards mandated by the Act. As designed, the standards only apply to water delivered by public water supply systems, leaving the individual home supply system unprotected. Congress expressed concern and desire that adequate protection for persons relying on individual water systems for their drinking water be made available.

Predicated upon the results of the State surveys and the testimony before Congress an unsolicited proposal for the development of well construction specifications was presented to the EPA in September of 1971 by the National Water Well Association. NWWA was concerned that the profession they represent (water well drillers and ground water specialists) was using construction procedures which could affect the public health. They felt "a set of generally accepted specifications for well construction that could be widely distributed to consulting engineers, water well contractors, municipalities, industries, agriculturalists, and individual home owners would serve to complement existing regulations, help educate the public, upgrade existing well construction techniques and thereby afford a greater protection to our ground water reserves."

During preparation of the manual, consideration was given to minimum standards already required by many States as well as pertinent suggested standards and specifications already available from other national and state associations. The manual was designed recognizing that well construction techniques will vary with six major criteria; namely, the intended use of the water, the required capacity of the well, the nature of the producing zone, the intended drilling method, and the manner in which the well construction will be paid for. Using these criteria to describe a well, alternate methods were established for the many facets of well construction such as test drilling, logging, casing, grouting, cementing, gravel packing, plumbness, alignment, development, testing, disinfection, sampling, and abandonment.

Also in the manual is a section titled "General Conditions" which is methodology by which a contractor may be engaged to construct a water well. These articles are included in this technical construction manual to inform those unfamiliar with the water well construction profession of normal procedures used when contracting for a well. The EPA feels this information should be made available to the public but recognizes that there may be other adequate alternatives.

Even though the original purpose of this project was to solve contamination problems of the individual supply system, the manual has been designed to be applicable to all types of water wells for all purposes. Proper use of this manual will result in a productive and safe water supply well.

The well construction practices outlined in this manual are supported by EPA as being complete and environmentally sound. The manual is to be a guide to well construction which provides protection of public health, safety and welfare, and protection of the ground water resources. Practices and techniques discussed are not EPA recommendations, regulations or standards required under any Federal action; they are furnished for informational and educational purposes only.