



**American Water Works
Association**

The Authoritative Resource on Safe Water®

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AWWA Standard

Reactivation of Granular Activated Carbon



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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B605.

I. Introduction.

I.A. *Background.* A number of municipal water utilities employ granular activated carbon (GAC) to remove organic impurities from potable water sources.

These impurities include compounds imparting taste and odors, algal toxins, synthetic organic compounds, endocrine disruptors, pharmaceutically active compounds, and disinfection by-product precursors. As the water treatment service time of a GAC increases, its capacity to adsorb impurities decreases. When the GAC filter no longer produces water of the desired quality, a potable water utility faces the decision either to replace the GAC with virgin (new) carbon or to reactivate the used GAC and use it again. The following document offers guidelines regarding the latter choice. This document is intended to provide standards for use by the potable water utilities that use granular activated carbon and to the suppliers who provide a thermal reactivation service.

I.B. *History.* The Standards Council authorized the development of this standard in 1993. The standard was developed by the AWWA Reactivation of Granular Activated Carbon Subcommittee, and the first edition was approved by the AWWA Board of Directors Jan. 24, 1999. This edition was approved on Feb. 15, 2007.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.* Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health

*Persons outside the United States should contact the appropriate authority having jurisdiction.

effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.
2. Specific policies of the state or local agency.
3. Two standards developed under the direction of NSF, NSF^{*}/ANSI[†] 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.
4. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex*,[‡] and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, “Toxicology Review and Evaluation Procedures,” to NSF/ANSI 61 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of “unregulated contaminants” are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA B605 does not address additives requirements. Users of this standard should also consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

^{*} NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48105.

[†] American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

[‡] Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20418.

II. Special Issues.

II.A. *General.* A description of virgin GAC and its production is provided in ANSI/AWWA B604, Standard for Granular Activated Carbon.

GAC is used to remove a broad spectrum of impurities from water. At some point in the service life of a GAC, the GAC adsorption capacity decreases to the point that the GAC no longer produces the desired effluent water quality. At this time, the GAC is characterized as *spent*, and it must be replaced. The spent GAC can be disposed of and replaced with virgin GAC, or the spent GAC can be reactivated and reinstalled for additional use.

During reactivation, GAC is typically exposed to the following conditions: drying, desorption/devolatilization, pyrolysis, and oxidation. This process requires high temperature conditions. Reactivation is a form of regeneration. Regeneration can also include low-temperature processes that may not be as effective as reactivation.

Varying conditions within a water treatment plant, such as process upsets, length of GAC service, or widely fluctuating influent water quality will affect how efficiently a specific spent GAC may be reactivated. Because of this, characterizing a representative sample of the spent GAC and determining its reactivation characteristics (possibly by laboratory reactivation testing) are the most reliable means for projecting how the GAC will behave in a commercial reactivation system (appendix B discusses collecting representative samples).

For generic classification purposes, lightly loaded GACs are those that have been subjected to low loadings of total organic carbon (TOC), calcium, and disinfectants/oxidants over a short time. At the other extreme are highly loaded GACs that have experienced high loadings of TOC and calcium and have been exposed to higher levels of disinfectants/oxidants over a long time. The relationship between loading and reactivation will vary by GAC type and water quality, but in general, lightly loaded GACs will recover a higher percentage of adsorptive capacity than heavily loaded GACs.

There will be some loss of GAC during reactivation. Causes for this loss include transportation and handling and reactivation losses. Therefore, makeup GAC is added to the reactivated GAC to bring the total GAC volume back to the original level. The makeup GAC should be virgin GAC or other reactivated GAC from the same potable water facility, exclusively. Use of virgin GAC as makeup avoids the