

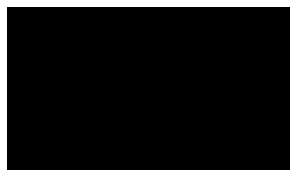
American Water Works Association

ANSI/AWWA B605-99

(First Edition)



AWWA STANDARD
FOR
REACTIVATION OF
GRANULAR ACTIVATED CARBON



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AMERICAN WATER WORKS ASSOCIATION

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Foreword

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

I. Introduction.

I.A. *Background.* A number of municipal water utilities employ granular activated carbon to remove organic impurities from potable water sources. These impurities include taste and odors, total organic carbon, disinfection by-product precursors, and synthetic organic compounds. As the granular activated carbon continues its water treatment service, it generally becomes exhausted in its initial capacity to remove additional organic impurities at the level desired. When this occurs, the municipal water utility faces the decision to either replace the granular activated carbon with virgin (new) carbon or to reactivate the used granular activated carbon and use it again. The following document offers guidelines regarding the latter choice. This document is intended to provide standards to both the municipal 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 this first edition was approved by the AWWA Board of Directors on Jan. 24, 1999.

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 all 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 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, ANSI[†]/NSF[‡] 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 61, Drinking Water System Components—Health Effects.

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

[†]American National Standards Institute, 11 W. 42nd St., New York, NY 10036.

[‡] NSF International, 3475 Plymouth Rd., Ann Arbor, MI 48106.

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 ANSI/NSF 60 (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.

Appendix A, "Toxicology Review and Evaluation Procedures," to ANSI/NSF 60 (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 Appendix A procedures may not always be identical, depending on the certifier.

AWWA B605 does not address additives requirements. Thus, 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 all parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

II. Special Issues.

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

As a result of its large internal porosity, GAC is used to remove a broad spectrum of organic substances from water. At some point in its use, the adsorption pore structure becomes saturated with the organic substances, and the GAC no longer produces the desired effluent 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 custom reactivated and reinstalled for additional use.

During reactivation, GAC is 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 will leave adsorbed organic compounds on the GAC.

Table F-1 presents the reactivation trends expected for the recovery of iodine number for GAC that has become spent under different water treatment conditions and that has certain spent characteristics. Very broad categories are used to define spent GAC characteristics. Therefore, 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

*Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

commercial reactivation system (appendix C discusses collecting representative samples).

NOTE: Once spent GAC has been characterized, the purchaser and supplier should contractually agree to the reactivated GAC characteristics expected, rather than rely exclusively on Table F-1.

For generic classification purposes, lightly loaded GACs (Type A) 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 (Type D) that have experienced high loadings of TOC and calcium and have been exposed to higher levels of disinfectants/oxidants over a long time.

There will be some loss of GAC during reactivation. Causes for this loss include transportation and handling, and gasification within the reactivation furnace. 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 potential liability of introducing leachable foreign material from reactivated GAC from sources other than the purchaser's own water.

Table F-1 General guide for classification of spent GACs and expected iodine number recovery when reactivated

GAC Class	Characteristics	% Adsorbent Capacity Recovery
A	Light Loading < 6 months in service < 25% reduction in original I ₂ number < 0.5 ppm residual oxidants in water applied to GAC* < 0.5% increase in total calcium on GAC < 1.5 ppm TOC in water applied to GAC	> 90%
B	Moderate Loading 1–2 years in service 30% reduction in original I ₂ number† < 1 ppm residual oxidants in water applied to GAC* < 1% increase in total calcium applied to GAC < 2 ppm TOC in water applied to GAC	85%
C	Moderately Heavy Loading 3 years in service 40% reduction in original I ₂ number† < 2 ppm residual oxidants in water applied to GAC* < 1.5% increase in total calcium applied to GAC 2–3 ppm TOC in water applied to GAC	80%
D	Heavy Loading ≥ 4 years in service > 40% reduction in original I ₂ number† 2 ppm residual oxidants in water applied to GAC* > 1.5% increase in total calcium applied to GAC > 3 ppm TOC in water applied to GAC	≤ 75%

*Or other adsorption capacity test as defined in Sec. II.D below.

†E.g., HOCl, KMnO₄, H₂O₂, O₃, etc.