# American Nuclear Society

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# nuclear criticality safety criteria for steel-pipe intersections containing aqueous solutions of fissile material

**WITHDRAWN**
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Revision of
ANSI/ANS-8.9-1978

# American National Standard
# Nuclear Criticality Safety Criteria for Steel-Pipe Intersections Containing Aqueous Solutions of Fissile Materials

Secretariat
**American Nuclear Society**

Prepared by the
**American Nuclear Society**
**Standards Committee**
**Working Group ANS-8.9**

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**American National Standard**

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# Foreword

(This Foreword is not a part of American National Standard Nuclear Criticality Safety Criteria for Steel-Pipe Intersections Containing Aqueous Solutions of Fissile Materials, ANSI/ANS-8.9-1987.)

Basic parameters and practices for nuclear criticality control outside reactors are described in American National Standard for Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors, ANSI/ANS-8.1-1983, and in documents referenced therein. However, for the most part, the data in that standard are single parameter limits.

In the past there has been a paucity of experimental and calculated data for geometric arrangements, such as crosses, ells, and tees, for storage and processing of aqueous solutions of fissile materials in pipes. This situation resulted in overly conservative applications which became evident soon after Work Group 8.9 undertook the drafting of a standard on this subject in 1968. Over the succeeding years, additional experimental data and advanced computational technology became available and now provide the means to reduce the conservatism in industrial practice and permit greater flexibility in process applications. The American National Standard Nuclear Criticality Safety for Pipe Intersections Containing Aqueous Solutions of Enriched Uranyl Nitrate, ANSI/ANS-8.9-1978, has been extended to include typical aqueous solutions of fissile materials and, in particular, uranium containing no more than 5 wt% $^{235}U$. Acceptable configurations are presented as standard schedule pipe sizes for a variety of parameters.

In order to facilitate the applicability of this standard allowances have been made for situations which cannot be known or controlled absolutely. The specifications given in this standard are based upon validated calculations in which consideration of an adequate margin of subcriticality included variations in chemical concentrations ($k_{eff} \sim 0.03$), a bias in calculations of solution systems ($k_{eff} \sim 0.02$), the influence of container materials ($k_{eff} \sim 0.05$), and a minimum margin of subcriticality ($k_{eff} \sim 0.05$). Thus, the systems as specified have a nominal $k_{eff}$ of 0.85. Submerged intersections have a nominal $k_{eff}$ of 0.90. Generally, fissile and other materials will be present in addition to aqueous fissile solutions contained in piping. It will be necessary for a safety specialist to evaluate their reactivity contribution to proposed pipe intersections in order to confirm compliance with requirements of the standard. It would be unusual for a design not to require review by a safety specialist.

This standard was prepared by Work Group ANS-8.9, under the guidance of American Nuclear Society Standards Subcommittee 8. The Work Group, chaired by J. T. Thomas, was comprised of the members of the Subcommittee 8 and J. E. Bigelow, Oak Ridge National Laboratory.

The membership of Subcommittee 8, Fissionable Materials Outside Reactors, at the time of preparation and approval of this revision was:

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E. B. Johnson, Secretary, *Oak Ridge National Laboratory*
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H. K. Clark, *Savannah River Laboratory*
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Consensus Committee N16, Nuclear Criticality Safety, which reviewed and approved this standard in 1985, had the following membership:

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Dixon Callihan ..... American Nuclear Society
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