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gaseous radioactive waste processing systems for light water reactor plants

an American National Standard

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American National Standard for Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants

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American Nuclear Society

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Abstract This standard sets forth minimum design, construction and performance requirements, with due consideration for operation, for Gaseous Radioactive Waste Processing Systems for light water reactor plants, for routine operation including design basis fuel leakage and other design basis occurences. Design requirements and recommendations, as well as quality requirements, are presented. Various methods of treating and disposing of input quantities of gaseous radioactive waste are discussed along with sizing, capacity, arrangement and redundancy of the systems. Instrumentation and control requirements are provided as well as operating guidance to assure that the performance, safety and operational objectives of this standard are met.

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Foreword

(This Foreword is not a part of American National Standard for Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants, ANSI/ANS-55.4-1979.)

A major aspect of nuclear power plant operation is management of the gaseous radioactive waste generated as a by-product of nuclear power.

The development of facilities and equipment to handle and process gaseous radioactive waste has provided the nuclear industry with the capability to maintain releases of radioactive material in gaseous effluents within applicable regulatory requirements.

It is the purpose of this standard to establish uniform practices and minimum requirements for design, construction, and performance, with due consideration for operation of Gaseous Radioactive Waste Processing Systems. Adherence by system designers to the criteria contained in the standard will enable the operator: (a) to control, to regulatory levels, radiation exposures to operating personnel, (b) to assure a low probability of accidental release of radioactivity from the system, and (c) to control system releases of radioactivity, during and following design-basis inputs, as low as is reasonably achievable. It is not the intent of this standard to develop "standard systems" for processing gaseous radioactive waste; it is clearly recognized that there is a wide variety of systems and equipment now in use and others continually being developed.

A number of designs, concepts, operating system histories and practices were reviewed in preparation of this standard. In addition, applicable Nuclear Regulatory Commission regulatory guides were considered in the development of this standard. The standard sets forth design, construction and performance requirements for acceptable Gaseous Radioactive Waste Processing Systems. It is not intended to limit the development or application of alternate methods of processing, provided that such alternate methods meet the design and performance requirements of this standard.

Various quantities of gaseous radioactive waste are generated by operation and maintenance activities and are dependent upon several factors including design conditions, type of equipment, equipment arrangements and operating philosophy. The expected and design basis input activities and volumetric flowrates, methods of processing and discharge of these wastes, are the subject of this standard.

The requirements of this standard consider that the Gaseous Radioactive Waste Processing systems are operated on a level commensurate with other facility operations. This standard establishes the minimum quality requirements for the design, construction and performance requirements, with due consideration for and operation of the system.

This standard was prepared by Working Group ANS-55.4 of the Standards Committee of the American Nuclear Society. At the time of preparation, the members of the Working Group were:

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Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants

1. Scope

This standard sets forth minimum design, construction and performance requirements, with due consideration for operation, for Gaseous Radioactive Waste Processing Systems for light water reactor plants. It is applicable for routine operation including design basis fuel leakage and other design basis occurrences.

For the purpose of this standard, the Boiling Water Reactor (BWR) Gaseous Radioactive Waste Processing Systems begin at the point of discharge from the main condenser air removal equipment, the main condenser mechanical vacuum pump and the turbine steam packing exhauster. For Pressurized Water Reactors (PWRs), the Gaseous Radioactive Waste Processing Systems begin at the point of discharge from plant components, systems and equipment designed for the removal of radioactive gas from the reactor coolant system. The standard also addresses the release of radioactive materials in gaseous discharges from other plant systems. The systems terminate at the point of introduction into the plant ventilation exhaust stream(s). The Gaseous Radioactive Waste Processing Systems are not safety systems nor do they contain components that are "safety class." The requirements of this standard take precedence over requirements set forth in American National Standard Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor Plants, ANSI/ANS-52.1-1978, American National Standard Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, N18.2-1973/ANS-51.1, and American National Standard Revision and Addendum to Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants (N18.2-1973), N18.2a-1975/ANS-51.8.[1,2,3][1]

[1]Numbers in brackets refer to corresponding numbers in Section 13, References.

2. Definitions

2.1 Limitations. The definitions given below are of a restricted nature for the purposes of this standard.

2.2 Glossary of Terms.

clean steam. Steam generated by the vaporization of condensate.

cover gas. Gas in liquid storage tanks pressurized to prevent in-leakage of air.

charcoal adsorption system. A processing system incorporating activated charcoal at ambient or reduced temperatures for adsorption and decay of radioactive gases.

cryogenic adsorption systems. Processing systems utilizing an adsorbent at cryogenic temperatures for separation or adsorption and decay of radioactive gases.

cryogenic distillation units. Equipment employing cryogenic temperature distillation for separation of noble gases from waste gas streams.

decontamination factor (DF). The ratio of the concentration of the radioactive material in the influent stream to its concentration in the effluent.

pressurized gas storage tank system. A system using tanks, operating at pressures above 1.5 atmospheres absolute, for the holdup of gaseous radioactive waste prior to release or reuse.

gas stripper. Degassing equipment to remove dissolved gases from liquids.

high efficiency particulate air filter (HEPA). A disposable dry-type filter having