Ownership matrix	USQ # 17-1304-D

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1.0 PURPOSE AND SCOPE

(5.1.2)

This standard provides requirements to the Tank Operations Contractor (TOC) and subcontract engineers on heating, cooling, ventilating and air conditioning (HVAC) system design, material selection, fabrication, construction/installation, and construction acceptance testing requirements as required by the TOC Contract.

The scope of this standard applies to the design, procurement, fabrication, construction, and acceptance testing of permanent and temporary ventilation systems, structures, and components (SSCs) for all Tank Farm facilities including permanent SSCs for Double-shell Tanks (DST); 242-A Evaporator; 222-S Laboratory; Effluent Treatment Facility (ETF); Low Activity Waste Pretreatment System (LAWPS); and temporary SSCs for Single-Shell Tank (SST) ventilation systems.

A key element in managing the vapor hazards within tank farm facilities includes adding additional defensive-in-depth features to provide technologies for continuous near real-time identification and detection/measurement of vapor emissions from ventilation systems and stacks. These design features support the ISMS core functions by providing early warning for making risk-based decisions regarding specific tank farm field conditions that are continuously changing and will result in enhanced worker protection and safety.

This standard also identifies the implementing design standards of ventilation systems for non-nuclear facilities such as office buildings and conditioned storage buildings.

The TOC projects historically have used justifications for how ventilation systems met the technology standards of WAC-246-247, "Radiation Protection – Air Emissions," for Tank Farms DSTs, SSTs, and 242-A Evaporator. Components from these sources have been incorporated into project designs where appropriate. Reference to historical documents are not required for designing new ventilation SSCs nor are applicable.

Use of specific contents and applicability within project historical documents is not permissible unless they are technically justified and do not deviate from this revision of this Standard. The Standard Owner will consider use of such specific requirements based on their merits for designing ventilation systems. Approved deviations, clarifications, interpretations, and equivalent codes and standards to ASME AG-1, as a parent standard, are documented in Attachment B. Attachments A and B will be periodically reviewed and updated to reflect newly agreed clarifications. New clarifications or requests for deviations shall be requested from the Standard Owner and may be used once agreed upon, prior to incorporation in Attachment B.

Deviations from these standards may require approval from the appropriate authorities including Washington State Department of Health, and Washington State Department of Ecology.

2.0 IMPLEMENTATION

(5.1.2)

Ventilation system design projects that are started after, or do not have approved design inputs before[1], the issue date of Revision H of this standard shall follow the applicable requirements of this standard and incorporate those requirements into their specifications and applicable design documentation.

[1] As determined by design input approval signatures on the Modification Traveler

Modification of the existing facility systems that are not designed to the ASME AG-1 should use the original design Code of Records unless it is deemed necessary by the system design authority and this standard owner to comply with the requirements of latest revision of this standard as identified in Table A-1 and A-2.

Ventilation system design projects that are in progress with approved design inputs prior to the issue date of Revision H of this standard shall continue to use of their code of record based on the functional and operational requirements at the time the systems were authorized for operation.

Maintenance, repair, and replacement of individual minor components within existing ventilation systems shall normally follow the existing code of record for the system, according to TFC-OPS-MAINT-C-01. WRPS Environmental and the Standard Owner should be consulted if performing an equivalent replacement as to the need to apply the applicable requirements of this standard to the replacement components.

New ventilation stacks with a modification traveler or an initial project specification approved after the release of this standard revision specification shall follow the guidance in this Standard related to vapor monitoring/sampling equipment. Existing stacks are not required to be retrofitted, unless there are additional regulatory/stakeholder drivers.

3.0 STANDARD

(5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.6, 5.1.7, 5.1.12.a-e)

Minimum requirements are identified by SHALL statements; while design goals are identified by SHOULD statements. Design of the ventilation systems shall comply with the government and non-government source documents as listed in the applicable sections of this document.

Deviation to any section of this standard shall be from the Standard Owner as discussed in Section 1.0.

3.1 General Requirements

The objective of HVAC design is to confine and condition the source so that it meets the prescribed discharge requirements.

The Design Authority (DA) has the authority to implement a graded approach to the design input development based upon a determination of the complexity of the problem, according to TFC-ENG-DESIGN-D-55.1. The DA should not use the graded approach in a sole effort to meet schedule commitments or reduce cost.

The DA must determine the complexity of the modification, based upon system and facility knowledge, to target the design inputs necessary to successfully characterize the scope and the functionality of the proposed modification.

Complexity determination is based upon the amount of unique design change required and the ease of implementation of standard commercial and site standards and the interfaces affected by the modification.

3.2 General Design Criteria

(5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.12.e)

This standard identifies appropriate and applicable codes and standards for ventilation system design, fabrication, construction and acceptance testing. HVAC system codes and standards shall be required in hierarchical order by:

- 10 CFR 830, "Nuclear Safety Management"
- 10 CFR 835, "Occupational Radiation Protection"
- 10 CFR 851, "Worker Safety and Health Program."
- Washington Administrative Code (WAC) 246-247, "Radiation Protection - Air Emissions."

The ASME AG-1, "Code on Nuclear Air and Gas Treatment;" DOE-HDBK-1169-2003, "Nuclear Air Cleaning Handbook;" American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbooks and the Industrial Ventilation Handbook, published by the American Conference of Governmental Industrial Hygienists (ACGIH); ASME N509; ASME N510 (withdrawn and consolidated in AG-1-2015); ASME N511; ASME B31.3; ASME Section VIII; NEBB; and coupled with their daughter standards, should be used when designing new ventilation systems or modifications to existing ventilation systems as described in Attachment A, Table A-1or Table A-2.

The ASME AG-1 Code is neither a handbook nor a replacement for education, experience, and the use of engineering judgment. The phrase "engineering judgment" refers to technical judgments made by knowledgeable designers experienced in the application of the Code. This Code applies only to individual components in a system. This Code does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. The responsibility for meeting each requirement of this Code shall be assigned to the design authority.

The requirements of AG-1 for air and gas treatment components may be used for engineered safety features systems and normal systems in nuclear power generation facilities, and for air cleaning systems in other nuclear facilities. The design and procurement specifications shall delineate the design, qualification, and quality assurance requirements appropriate for the application.

When compliance with WAC 246-247-120, Appendix B—"BARCT Compliance Demonstration," is required, ASME AG-1 will take precedence over other national standards in the event of conflicts between standards.

The ASME AG-1 Code applies to individual components in a system. The Code does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. Design/ procurement specifications shall be prepared to delineate the design, qualification and quality assurance requirements appropriate for the application.

The TOC shall define system test boundaries and evaluate system performance with respect to system functional requirements in accordance with ASME N 511. This Standard provides a basis for the development of test programs and does not include acceptance criteria, except where the results of one test influence the performance of other tests. Based on the system design and its function(s), WRPS shall develop a test program and acceptance criteria.

3.2.1 Safety Classification

RPP-13033, "Tank Farms documented safety analysis (DSA)," identifies planned improvements to upgrade the DST primary tank ventilation systems to meet Safety-Significant (SS) requirements to prevent hazards due to the steady state generation of flammable gas and induced gas releases caused by solids dissolution. RPP-13033 refers to this Standard via RPP-RPT-49447, "Safety-Significant DST Primary Tank Ventilation Systems – Functions and Requirements Evaluation Document" for SS VTP during functional and requirements criteria acceptance demonstration. The safety basis requires that DST primary tank ventilation systems meet the SS operability surveillance requirements (i.e., Limiting Conditions for Operation [LCO] in HNF SD WM-TSR-006, "Tank Farms Technical Safety Requirements" [TSRs]). Until these planned improvements are implemented, the systems will remain classified as General Service (GS).

Ventilations systems (whether active or passive) for the SSTs are classified as GS per RPP-13033.

Ventilation systems associated with 242-A Evaporator and 222-S Laboratory are classified as GS in accordance with HNF-14755, "Documented Safety Analysis for the 242 A Evaporator," and HNF 12125, 222 S, "Laboratory Documented Safety Analysis, respectively."

200 Area ETF is a low-hazard radiological facility in accordance with HNF-SD-ETF-ASA-001, ETF Auditable Safety Analysis. The building and vessel ventilation systems are classified as GS.

The Low Activity Waste Pretreatment System (LAWPS) ventilation system is classified as GS except for the SS vessel vent system per the conceptual design basis document. The facility vessel ventilation system is being designed as a standby SS system for maintaining the flammable gas concentration below 25% Lower Flammability Limit (LFL).

Vapor sampling/monitoring equipment for all TOC facilities is classified as GS.

3.2.2 System Design Criteria

HVAC SSCs shall be designed to operate under normal and off normal pressure and temperature process conditions. Attachment A, Table A-1 and A-2, should be used for specific requirements for the design, material selection, fabrication, construction/installation, or testing for a specific component in addition to the "general" information provided in Section 3.2 of this standard.

All new TOC facility designs shall meet the DOE building energy codes program per the latest edition of ASHRAE 90.1, "Energy Standard for Buildings, Except Low-Rise Residential Buildings," as practically as possible.

The system design shall be supported by calculations prepared in accordance with TFC-ENG-DESIGN-C-10.

- <u>Non-Nuclear Facility</u>

Non-nuclear facilities consist of administrative offices, warehouses, locker rooms, restrooms, equipment rooms, truck bays, and contiguous support facilities. These facilities have no direct interface with contaminated areas and shall be designed in accordance with the commercial design industry standards as identified in Attachment A, Table A-1, and as pertinent in applicable sections of this standard.

The design should be based on the available commercial central, packaged, individual air conditioning and uncooled systems. The configuration of commercial systems are very similar to the systems and equipment used in the nuclear facilities and their basic design principles are based on the same industry standards such as SMACNA, ASHRAE, NEBB, AMCA, etc.

Ventilation supply systems include Air Handling Unit(s) operating on 100% outside air and provide filtration, heating, cooling, and humidification. The AHUs are used to support the design conditions listed in this standard. The fans shall comply with the requirements of Air Movement and Control Association (AMCA). The system shall be sized to provide conditioned outside air to the occupied areas and makeup air as necessary to support the contiguous areas.

The ductwork distribution system shall be installed in accordance with Sheet Metal and Air Conditioning Contractor National Association (SMACNA) standards.

- <u>“Radiological or hazard confinement” and “Vapor hazard confinement” Radiological Facilities</u>

Ventilation systems that have potential to emit radionuclides require air-operating permits. Point source emission units require the presence of abatement technology equipment such as High Efficiency Particulate Air (HEPA) filters, demisters, Seal Pots, Heaters, Monitoring Systems including CAM and Record Sampler as specified by the air emission permits.

Radiological control ventilation systems equipment shall be designed in accordance with the implementing standards and daughter standards specified in Attachment A, Tables A-1 and A-2. The ventilation designed and installed for mitigating accident doses as identified in the DSA shall have redundant units (trains) to provide assurance that the system confinement boundary for an operable unit will be available during the Design Basis Accident (DBA), e.g., seismic event, ashfall, etc.

Passive ventilation on waste tanks that have the potential for vapor releases above IH Program guidelines shall provide administrative access controls (e.g., buffer zone) around the ventilation source to mitigate inadvertent exposure to fugitive and diffuse emissions, in accordance with the current Industrial Hygiene program guidelines.

Active ventilation systems on waste tanks that have the potential for vapor releases shall be designed to provide a measureable vacuum on the waste tanks to mitigate inadvertent exposure to fugitive and diffuse emissions from the waste tanks. These active ventilation systems shall also have a stack height and stack exit velocity sufficient to disperse the ventilation emissions including vapors, to exposure levels determined to be safe by the IH Program based on predictive modeling results. Active ventilation systems shall comply with the codes and standards identified in Attachment A, Table A-1, and as pertinent in applicable sections of this standard.

The 222-S Laboratory Lab Ventilation/Local Exhaust and Building ventilation systems is designed to ensure that air flows from areas of low contamination potential to areas of high contamination potential and is operated by maintaining zone differential pressures. The 222-S lab designs comply with the ANSI/AIHA Z9.5 as identified in the Attachment A, Table A-1, and as pertinent in applicable sections of this standard.

A typical radiological or hazard confinement system is composed of the following components: (1) redundant Moisture Separator; (2) Prefilter (a moisture separator may serve this function); (3) Heater; (4) Radionuclide absorbers (e.g., charcoal beds for iodine capture); (5) Two stages of HEPA filters; (6) Fan, drive motor and transition components; (7) Interspersed ducts, test sections, motors, dampers, valves, and related instrumentation.

The redundant trains shall be physically separated so that damage to one unit does not also cause damage to the other unit (e.g., common cause failure). The generation of missiles from a rotating machinery failure or natural phenomena shall be considered in the design for separation and protection for SS and Safety Class (SC) systems.

The outdoor air intake openings should be located to minimize the effects of possible onsite plant contaminants, such as diesel generator exhaust.

The air intake for facilities designed to operate post DB, e.g., ashfall shall consider adequate design filtration features, e.g., pulse-jet bag filter dust collector, etc., to ensure continuous support of the facilities (ANSI/ASHRAE Standard 199).

3.3 Codes and Standards

(5.1.2, 5.1.3, 5.1.7, 5.1.12.e)

Attachment A, Tables A-1 and A-2 identify a list of implementing codes and standards in TOC facilities consistent with applicable industry practices and TOC DSAs, and regulatory documents, (e.g., WAC 246-247).

Table A-2 identifies a list of applicable ASME AG-1 Articles for designing ventilation SSCs in the TOC Nuclear facilities. Design specifications shall be prepared to identify the applicable ASME AG-1 Articles for the specific application.

Construction of new nuclear and non-nuclear facilities shall be in accordance with current codes and industry standards and design criteria specified by DOE directives and federal code (e.g., 10 CFR 851), State, and local regulations. It is expected that the latest editions of the national codes and standards are implemented during development of the facility code of record as practically as possible.

WAC 246-247, "Radiation Protection – Air Emissions," Section 246-247-110, Appendix A – "Application Information Requirements," item (18) requires: "indicate which of the following control technology standards have been considered and will be complied with in the design and operation of new or modified emission unit(s) described" in our air permit application and for each standard not so indicated, to give reason(s) to support adequacy of the design and operation of the emission unit(s) as proposed:

- ASME AG-1, Code on Nuclear Air and Gas Treatment (where there are conflicts in standards with the other listed references, this standard shall take precedence)

- ASME N509, Nuclear Power Plant Air-Cleaning Units and Components
- ASME N510, Testing of Nuclear Air Treatment Systems
- ASME N511, "In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air Conditioning Systems"
- ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities
- 40 CFR. 60, Appendix A, Methods 1, 1A, 2, 2A, 2C, 2D, 4, 5, and 17
- ANSI/HPS N13.1-1999, Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities
- The following standards and references are recommended as guidance only:
  - ANSI/ASME NQA-2, Quality Assurance Requirements for Nuclear Facilities (Incorporated in the latest ASME NQA-1 Editions)
  - ANSI N42.18, Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents
  - ERDA 76-21, Nuclear Air Cleaning Handbook
  - ACGIH Publication # 2098, A Manual of Recommended Practice for Design, American Conference of Governmental Industrial Hygienists.
  - ACGIH Publication # 2106, Industrial Ventilation, A Manual of Recommended Practice, American Conference of Governmental Industrial Hygienists.
- ASTM D6345, Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy is recommended as guidance for vapor sampling/monitoring equipment

3.4 Operating Specifications

(5.1.10, 5.1.11)

The criteria identified in the applicable Operating Specification Document (OSD) shall be used for all tank farm ventilation system design modifications. Ventilation system modifications shall be designed to ensure tank internal pressure is maintained in accordance with OSD-T-151-00013, "Operating Specifications for Single Shell Waste Storage Tanks," and OSD-T-151-00007, "Operating Specifications for Double-Shell Waste Storage Tanks."

3.5 Equipment Location

(5.1.1, 5.1.2, 5.1.3)

Equipment location shall not interfere with operation of other routine activities such as crane set up locations or crane route drawings.

If crane access routes or cranes set up locations are affected then alternate planned routes or set up locations must be shown on the route drawings. TFC-ENG-FACSUP-C-25 shall be used for review and approval of equipment affecting crane routes.

New ventilation systems will be located greater than 20 ft. from an existing building in order to prevent external fire from impinging on the facility systems unless facility hazard analysis preclude the hazard.

3.6 Environmental/Seasonal Design Conditions

(5.1.9)

The equipment shall operate under all climatological seasonal conditions listed in TFC-ENG-STD-02.

For equipment sizing and building heating/cooling load calculations, the ASHRAE Handbook, “Fundamentals” design conditions for the Hanford site measured at 733 feet shall be used, which are:

Annual Heating Design Conditions @ 99% occurrence:

Temperature	12.6°F DB
Dew Point	4.6°F
Humidity Ratio	7.2 grains water/lb. dry air
Mean coincident	15.1°F DB

Annual Cooling Design Conditions @ 2% occurrence:

Temperature	93.3°F Dry Bulb
Mean coincident	64.1°F Wet Bulb
Dew Point	53.4°F

Wind Speed Design Conditions @ 1% occurrence:

Wind Speed (WS)	25.2 mph

Solar Insolation Design Conditions

- Utilize Hanford, WA Specific Conditions and Methodology from ASHRAE Handbook, Fundamentals, Chapter 14 (account for normal, diffuse and ground reflected solar irradiance to comply with the 900 Langley requirement in TFC-ENG-STD-02, Section 3.1.6).

3.7 Tank Headspace Air Temperature Conditions

(5.1.10, 5.1.11)

Waste storage tank headspace (not ventilated) maximum design temperature is 150°F with a maximum 100% relative humidity and may contain varying amounts of hydrogen, nitrous oxides, methane, and ammonia vapors. The storage tanks contain high pH (10-14 nominal) waste.

TOC facility ventilation SSCs shall be designed to operate in a pH and a temperature range during design operating mode (RPP-RPT-58235) and shall not exceed the waste tank headspace design temperature. HNF-IP-1266, “Tank Farms Operations Administrative Controls,” Section 5.9.1, Table 5.9.1-1 provides operational limits and design criteria for temperature for each SST and DST due to maximum waste temperature recorded within each tank.

3.8 Heating Load Calculations

(5.1.9)

ASHRAE outdoor design conditions shall be used for calculating building heating loads (see paragraph 3.6). The indoor design condition shall be no higher than 70-78°F for personnel comfort and no less than 61°F to provide adequate equipment protection per ASHRAE Handbook, "HVAC Applications."

3.9 Cooling Load Calculations

(5.1.9)

When calculating Hanford building cooling loads, the ASHRAE outdoor design conditions for Hanford shall be used (see paragraph 3.6). The indoor design condition shall be no less than 74-78°F for personnel comfort and no higher than 104°F to provide adequate equipment protection per ASHRAE Handbook, "HVAC Application." Where cascading flow conditions are required, lower temperatures are evaluated and approved by the HVAC engineering discipline lead (EDL).

3.10 Fire Protection

(5.1.1, 5.1.2, 5.1.3, 5.1.5, 5.1.9)

A fire hazard and fire safety analysis shall be performed on new systems in accordance with TFC-ESHQ-FP-STD-06, to ensure that the fire protection requirements of ventilation plenum filter installations are evaluated as required by MGT-ENG-IP-05, "ORP Fire Protection Program," and DOE-STD-1066, "Fire Protection Design Criteria."

New TOC facility designs shall comply with DOE-STD-1066 latest edition unless exemptions are obtained by WRPS from DOE fire protection engineers and the standard owner.

TFC-ESHQ-FP-STD-02 shall be used for applicability of DOE-STD-1066.

Building HVAC supply systems shall comply with National Fire Prevention Association (NFPA) 69, "Standard on Explosion Prevention Systems;" Standard 90A, "Installation of Air-Conditioning and Ventilation Systems;" NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems," and NFPA Standard 91, "Standard for Ventilation Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids."

3.11 Materials

(5.1.3, 5.1.10, 5.1.11)

Materials for the ventilation systems in the nuclear facilities shall comply with ASME AG-1, Article 3000, "Materials." Certified material test reports shall not be required for Non-ESF (Engineered Safety Features) SSCs pressure boundary and structural materials. ESF and environmental credited abatement technology SSCs material certifications shall comply with the applicable ASME AG-1 components.

Ductwork/piping, fittings and valve pressure-retaining materials required to be in accordance with ASME B31.3 or ASME AG-1 and shall comply with TFC-ENG-STD-47. When compliance with WAC 246-247-120 is required, ASME AG 1 will take precedence over other national standards in the event of conflicts between standards.

Ductwork and valve pressure-retaining materials shall be furnished with a Manufacturer's Certificate of Conformance with the specified ASME or ASTM designation per ASME AG-1, Article AA-8000.

SS ventilation equipment and ductwork shall be provided with manufacturer's Certified Material Test Reports (CMTRs) to meet NQA-1, Requirement 7, paragraph 503 (a) through (f).

Dissimilar metals, such as those defined by MIL-STD-889B, Chg. Notice 3, "Dissimilar Metals," that have active electrolytic corrosion properties shall not be used in direct contact, except temporary connection material (e.g., connecting ductwork and condensate drain).

Material subject to deterioration when exposed to climatic and other environmental conditions specified herein shall be protected against such deterioration. Age control spare part items based on the vendor's recommendation shelf life must be documented in Business Management System (BMS) Asset Suite and inspected prior to installation.

Metallic parts shall be of corrosion-resistant metal, or suitably finished to resist corrosion, except for temporary connection material (e.g., connecting ductwork and condensate piping that can be easily replaced).

3.12 Quality Assurance

(5.1.3)

For ventilation systems, subsystems, or components, a quality level (QL) determination shall be performed in accordance with TFC-ESHQ-Q_ADM-C-01. Quality assurance for the ventilation systems in the nuclear facilities shall comply with the AG-1, Article 8000, "Quality Assurance."

Ventilation systems design control documents shall comply with the applicable portions of TFC-PLN-02, Attachment 20-I-3, Quality Implementation Plan (QIP), and TFC-PLN-112. The graded quality determination for the ventilation systems must ensure potential impacts on health, safety, security, and the environment are determined, potential for achieving quality and organizational objectives are determined, and consequences of product failure or service performed incorrectly are taken into account.

Ventilation systems software quality determination and grading levels shall be based on risk, safety consequence, facility life cycle, complexity, project quality, regulatory compliance, and mission impacts in accordance to TFC-BSM-IRM-STD-01.

Table 3 of this standard identifies typical procurement quality clauses for items associated with the ventilation system SSCs. Identification of the applicable clause should be based on the item functional and operational performance requirement in conjunction with the industry best practices identified in national standards. These quality clauses can be further evaluated in the design specifications for general service and important to safety ventilation systems.

3.13 Human Factors

(5.1.1)

The design shall meet the requirements of 10 CFR 851, "Worker Safety and Health Program," as outlined in TFC-PLN-09, TFC-ENG-STD-01, TFC-ENG-STD-23, and TFC-ENG-DESIGN-D-29.

3.14 Tank Vacuum

(5.1.10, 5.1.11)

The maximum vacuum allowable on the waste storage tanks is established to prevent sidewall buckling or bottom lifting of the tank as described in the operating specification documents (OSDs). The criteria identified in the applicable OSDs shall be used for all tank farm ventilation system designs.

DSTs and SSTs are not designed to ASME Boiler Pressure Vessel Code Section VIII, are not Code stamped, and their design pressure is well below the ASME Code minimum 15 psig. Therefore, DST and SST ASME Code compliance is not required for installation of pressure relief devices.

Tank protection from fan over speed due to Variable Frequency Drive (VFD) failures shall be considered in designing each tank farm ventilation system. Ventilation systems with VFD controlled ventilations must be provided with engineered features to ensure set points below OSD-T-151-00007 and OSD-T-151-00013 specifications for DST and SST tank integrity and operability requirements.

Consideration shall be given to pointing tank air intakes downward for weather protection with metal mesh grates for protection against large debris.

3.15 Noise and Vibration Levels

(5.1.1, 5.1.3, 5.1.4, 5.1.5)

Factory fan noise level testing shall comply with AMCA 301, “Methods for Calculating Fan Sound Ratings from Laboratory Test Data.”

The stack and mechanical equipment noise emissions at the design limit flow rate condition shall be less than 85 dBA, 8-hour time weighted average, or equivalent noise dose when measured by a calibrated noise meter at 1 meter from the source.

National Environmental Balancing Bureau (NEBB), “Procedural Standards for Measurement of Sound and Vibration,” can be used for post installation and in-service measurement and reporting of sound and vibration levels.

3.16 Reliability

(5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.6, 5.1.9)

The design life shall be documented in the design/performance specification for all new systems. Permanently installed ventilation systems shall be designed for life expectancy and reliability in selecting and locating equipment, to minimize the need for personnel access in the area for a useful life of 40 years. However, a graded approach shall be used when specifying equipment useful life per TFC-ENG-DESIGN-D-29.

3.17 Maintainability

(5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.9)

Equipment, instrumentation, and items requiring maintenance shall be accessible for ease of inspection and removal/replacement. The ventilation system shall be constructed to facilitate maintenance with commercially available tools wherever possible. The ventilation design shall meet the Guidance for Inclusion of Human Factors in Design per TFC-ENG-DESIGN-D-29.

3.18 Ductwork

(5.1.6, 5.1.8, 5.1.10, 5.1.11, 5.1.12.d)

3.18.1 Design Requirements

Ductwork fabricated from sheet metal shall be stainless steel (e.g., 304 or 316) and comply with ASME AG-1, Article SA and SMACNA Standard (See Attachment A, Tables A-1 and A-2).

Pipe can be used as round ductwork for ventilation exhaust systems. If pipe is used as ductwork, the material shall be stainless steel and comply with ASME B31.3 (ERDA 76-21). Ductwork and pipe design loads shall be per TFC-ENG-STD-06. Tank farm pipe (ductwork) designed after 2013 shall have raised face and fiber gaskets. The ductwork design shall eliminate potential condensate leaks. Ductwork shall be designed to minimize the entrainment of liquids.

Design loads on tank farm pipe (ductwork) shall be derived using TFC-ENG-STD-06, Section 3.5. Specific combinations of these design loads defined in ASME B31.3 code are combined with the system operating loads (thermal, pressure, dynamic loads, etc.) and subsequently compared to calculated code allowable. Use of approved software (e.g., AutoPIPE) is recommended to expedite calculation of the pipe stresses, code allowable and resulting design ratios.

Design of piping shall comply with the pressure-temperature ratings for listed components contained in Table 326.1 as identified in ASME B31.3 Section 302.

Unlisted components may be used as identified in ASME B31.3, Section 302.2.3.

3.18.2 Duct/Hood Flow Rate Requirements

The design duct flow rate shall be determined based on the expected system resistance, e.g., clean and dirty filters, demisters, etc., to achieve design flow and operating conditions. Active (powered) ventilation system ductwork systems shall be designed in accordance with the ASHRAE Handbook “Fundamentals; Applications; Systems and Equipment.” Maximum velocities, limited by pressure drop and noise, shall not exceed 2500 fpm.

The minimum duct velocity may be as low as 500 fpm for non-contaminated supply air per the ASHRAE Handbooks “HVAC Applications” and ASHRAE Standard 111, “Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems”.

Hood design shall comply with the “Industrial Ventilation: A Manual of Recommended Practice for Design (ACGIH- Publication #2098),” and companion ANSI/AIHA® Z9.5, “Laboratory Ventilation,” ANSI/AIHA Z9.2, “Local Exhaust Ventilation Systems,” and ASHRAE ventilation standards, or other recognized standards of good practice as specified in the design specifications.

.All hoods have a minimum flow rate (measured at the hood face) of 125 fpm and a maximum flow rate of 175 fpm in accordance with the maintenance procedure (2S99003) for the 222-S Labs.

3.18.3 Slope Requirements

New ductwork/condensate pipe shall be sloped to meet the International Code Council (ICC) Uniform Building Code 1 (UPC) based on the pipe size as practicable as possible. For example, slope of a 2 ½” or less pipe shall be ¼” per foot; for 3” to 6” the slope shall be 1/8” per foot; and 8” or larger pipe shall be 1/16” per foot nominally.

3.18.4 Leakage/Pressure Test Requirements

The ductwork shall meet the acceptable leak tightness requirements of ASME N509, Sec. 6.6 and AG-1, Article SA-4500. Ductwork shall be pressure tested per SA-5410 pressure test requirement at 1.25 times the maximum operating pressure, but not to exceed the structural capability pressure (See AG-1 Article TA-III-4000, “Procedural Guidance”).

Ductwork designed to ASME B31.3 shall meet the required leak test requirements in ASME B31.3, Section 345.1, “Testing”. This applies to shop testing of ductwork assemblies, post field installation leak testing of AG-1 ductwork systems shall meet the required leak test requirements in ASME AG-1.

In-Service testing of pipes used in ventilation systems shall be pressure tested pneumatically at 1.25 times the fan operating pressure (maximum static pressure condition) and requires visual inspection in accordance with ASME AG-1, TA-3610, TA-3523, and Article TA-III-4000 as specified in the design specifications, (i.e., audible [electronic sound detection equipment optional], bubble/smoke leak detection methods, etc.).

Tank farm ductwork design shall minimize the use of flanges and other potential sources of leakage. Raised face flanges and fiber gaskets are required for connecting inline component per design specifications and drawings. Non-metallic materials shall be selected based on waste compatibility in accordance with TFC-ENG-STD-34.

3.18.5 Expansion Joint Requirements

Expansion joints shall be stainless steel and meet the requirements of ASME AG-1 SA-4400 or ASME B31.3, Part 2, “Pressure Design of Piping Components,” 304.7.4, Appendix F and Appendix X, and guidance given by expansion joint manufacturers association (EJMA) standards. The stiffness of the expansion joint shall be considered in flexibility analysis of the piping and the design, arrangement, and location of restraints shall ensure that expansion joint movement occur in the direction for which the joint is designed. Expansion joint restraint hardware, if required, must be specified in the drawing bill of materials with the expansion joint.

Deflection limits shall be addressed in design of the expansion joints and control rods per manufacturer’s recommendation.

Duct support installation spacing adjacent to expansion joints should be in accordance with the manufacturer spacing requirements. Expansion joints shall be installed with an insert to avoid condensation from entering into convolutes. Expansion joint shall be installed with an insert in the direction of the flow. Reverse flow condensation shall be prevented from entering convolute as well. Expansion joints should not be installed close to isolation valves as practically as possible.

3.18.6 Fitting Requirements

Ductwork fittings shall comply with industry accepted practices as recommended by ASHRAE and ACGIH. Use of straight tees and short radius elbows shall be avoided in accordance with the ACGIH and industry best practice for installation of ductwork.

3.18.7 Insulation Requirements

Ductwork shall be insulated to minimize condensate formation. The ductwork between the demister and heater, along with the filter housings, shall be insulated per the Washington State Department of Health Radioactive Air Emissions License No. FF-01, dated February 23, 2012.

The following insulation standards shall be used for insulating ventilation components:

- ASTM C 534 Type I, “Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Foam,” shall be used for thermal insulation of pipe-above ground piping as specified in HPS-114-M
- ASTM C449, “Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.”
- ASTM C547, “Specification for Mineral Fiber Pipe Insulation”
- ASTM C552, “Standard Specification for Cellular Glass Thermal Insulation”
- ASTM C553, “Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications”
- ASTM C 585, “Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.”

3.19 Isolation Dampers/Valves

(5.1.8, 5.1.9, 5.1.12.a-e)

Dampers/Air Control Devices shall be designed, fabricated, and tested per the applicable requirements of ASME AG-1, Article DA, “Dampers and Louvers,” TA-4230 “Pressure Boundary Tests,” AMCA 500-D, “Laboratory Methods of Testing Dampers for Rating,” AMCA 502, “Damper Application Manual for Heating, Ventilating and Air Conditioning,” and AMCA 511, “Certified Ratings Program Product Rating Manual for Air Control Devices.” (See Attachment A, Table A-2)

Dampers credited in the fire hazard analysis shall comply with DOE-STD-1066, NFPA 90A, and AMCA 511-1, “Certified Ratings Program Product Rating Manual for Air Control Devices.”

Isolation dampers shall be constructed of materials that are compatible with their connecting fittings and suitable for their fluid service(e.g., ASME B31.3, Normal Fluid, listed components per Table 326.1).

ASME B16.34, “Valves-Flanged, Threaded, and Welding End,” can be used as dampers on existing Tank Farm facility ventilation systems for isolation.

Flanders isolation dampers and Ruskin backdraft dampers are used in the 242-A Evaporator system and are preferred in Tank Farm facility ventilation systems. Multiple blade-type dampers are typically not used.

Isolation damper/valve actuators may be modulated manually or automatically with automatic two-position remote detection/indication depending on the size of the damper/valve and operational frequency based on the manufacturer's recommendations.

The valve stem orientation shall be positioned to minimize and avoid stem leakage spillage. Valves installation must consider human factors based on the operation frequency. Motor operated valves shall be provided with the manual override capability.

3.20 Moisture Separator

(5.1.8, 5.1.9, 5.1.12.a-e)

Moisture separators (also termed entrainment separators, mist eliminators, or demisters) are required in some nuclear air cleaning systems to protect the primary components (HEPA filters and adsorbers) from damage or loss of function due to entrained moisture and as identified in the Abatement for radioactive air emissions described in RPP-ENV-56271, "Technical Basis Document for Air Emissions." Moisture separator devices shall comply with AG-1, Article FA (See Attachment A, Table A-2). Moisture separator housing shall comply with the AG-1 Article HA and include bag out features. Metallic components of the pressure boundary shall be a 300 series stainless steel.

The moisture separator housing shall meet pneumatic pressure testing at 1.25 times the maximum operating pressure of the system.

Moisture separators shall be insulated and heat traced for freeze protection.

New ventilation systems shall use AG-1 Articles FA and HA for housing or equivalent requirements as stated in the RPP-SPEC-61094, "General Equipment Procurement Specification for a Moisture Separator" or RPP-SPEC-42592, "Specification for Ordering Moisture Separator Pads and Housings."

3.21 Conditioning Equipment

(5.1.8, 5.1.9, 5.1.10, 5.1.11, 5.1.12.a-e)

The design and procurement specifications shall be prepared to delineate the design, qualification, procurement, testing, and quality assurance requirements appropriate for the application. Double shell tank ventilation systems shall comply with the RPP SPEC 45605, "Double Shell Tank Ventilation Subsystem Specification.

Active (powered) ventilation systems shall be designed to control air conditions such that air entering any HEPA filter assembly does not exceed 70% relative humidity (RH).

Duct heaters intended for use in a hazardous location shall be designed based on its compliance with the requirements in this standard, together with the requirements for hazardous location equipment included in other applicable standards. Duct heaters designed to be connected to air-duct systems are intended for installation in accordance with the Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA 90A, and the Standard for the Installation of Warm Air Heating and Air Conditioning Systems, NFPA 90B.

Air heaters shall be designed, constructed, and tested in accordance with AHRI-410, ASHRAE 33, and NFPA UL 1996 for non-nuclear facilities (see Attachment A, Table A-1).

Air heaters shall be designed, constructed, and tested in accordance to applicable articles of ASME AG-1, Article CA for TOC nuclear facilities (see Attachment A, Tables A-1 and A-2).

Electrical air heater design and installations in locations shall consider presence of potential ignitable concentration of flammable gas per TFC-ENG-STD-45.

3.22 Filters

Prefilters and HEPA filters shall withstand anticipated range of operating parameters of temperature, pressure, relative humidity, radiation levels, airborne concentrations, and compatible with the chemical composition and physical conditions of the air stream.

3.22.1 Prefilter

(5.1.8, 5.1.9, 5.1.10, 5.1.11, 5.1.12.a-e)

Prefilters provide a Minimum Efficiency Reporting Value (MERV) #8 filter, per ASHRAE Standard 52.2, unless usage of space dictates a higher efficiency and class of filter. Providing a minimum 30% efficient filter may require less filter replacement frequency.

The airflow capacity shall be the same or greater than the HEPA filter for the same filter frame face area.

3.22.2 HEPA Filters

(5.1.8, 5.1.9, 5.1.10, 5.1.11, 5.1.12.a-e)

HEPA filters in the nuclear facility systems shall comply with the AG-1 Articles FC HEPA Filters, and FK Special HEPA Filters requirements (see Attachment A, Table A-2). HEPA filters shall comply with requirements of RPP-SPEC-60522, “General Procurement Specification for Standard Nuclear Grade High Efficiency Particulate Air.”

HEPA filters not requiring compliant with ASME AG-1 Article FC shall comply with RPP-SPEC-60635, General Procurement Specification for Standard, Nuclear Grade, High Efficiency Particulate Air (HEPA) Filters (For Filters That Do Not Conform to ASME AG-1).

HEPA filters used in confinement ventilation systems in Category 1 and Category 2 nuclear facilities that perform a safety function in accident situations, or are designated as important to safety (e.g., safety class or safety significant) shall comply with DOE-STD-3020, “Specification for HEPA Filters Used by DOE Contractors,” and meet additional inspection requirements at the independent Filter Test Facility for axial and radial flow HEPA filters glass fiber medium per articles FC and FK of the ASME AG-1, and UL 586.

Air flow, aerosol, and HEPA bank in in-place testing shall be based on the system operating at design flow rate (± 10 %). If the system is designed to operate at more than one specific flowrate, e.g., VFD, tests shall be performed at each flow rate (± 10 %) during initial SSCs installation. Filters with rated flows less than 125 ACFM will be tested at rated flow only.

3.23 Filter Housing

(5.1.6, 5.1.8. 5.1.9, 5.1.10, 5.1.11, 5.1.12.a-e)

Filter housings shall be designed, fabricated, installed, inspected, and acceptance tested per ASME AG-1, Article HA, “Housings” and ASME N511, “In-Service Testing of Nuclear Air Treatment, Heating, Ventilation, and Air-Conditioning Systems” (see Attachment A, Table A-2).

Filter housings shall comply with the requirements of RPP-SPEC-61096, Filter Housing General Equipment Procurement Specification.

Filter housings shall be equipped with a floor drain centered at the bottom with a condensate drain to prevent contaminated water from accumulating in the housing. Drain lines shall be connected to a condensate collection system or sloped to a waste storage tank.

Filter housings including inlet and outlet transition sections shall be stainless steel 304L/316L and 100% welded construction, and comply with ASME AG-1 Article HA. Nonmetallic materials maintainability shall meet AG-1, Article HA-3214.

Filter Housings should be designed to exhibit on test a maximum total leakage rate as defined in Article HA-4500 of ASME AG-1. Housing leak tests shall be performed in accordance with Article a HA-5300 and TA 4300 of ASME AG-1.

Filter Housing design should consider the effect of fans and systems, vibration, seismic, etc., for operations.

For once-through supply air ventilation units shall be designed to prevent freezing air supplied to a building.

3.24 Fans and Blowers

(5.1.5, 5.1.8, 5.1.9, 5.1.10, 5.1.11, 5.1.12.a-e)

Fans and blowers shall be designed, constructed, and tested in accordance with the applicable industry standards identified in ASME AG-1 Article BA (see Attachment A, Tables A-1 and A-2) in accordance with the RPP-SPEC-61095, “General Equipment Procurement Specification for a Fan. Fans and blowers shall be constructed of material that is compatible with interconnected ducting and/or stack.

AMCA 204, ISO 1940, ISO 10816, or ISO 13373 are used for performing the required fan vibration test as stated in ASME AG-1, Article BA-5143.

The fan or blower used in conjunction with AHUs/filter housing shall be capable of operating under the environmental conditions postulated including radiation.

The fans shall comply with the requirements of AMCA 99 (Standard Handbook), AMCA 201(Fans and Systems) and AMCA 210 (Laboratory Methods of Testing F and for Rating), AMCA 300 (Reverberant Room Method for Sound Testing of Fans), AMCA 301 (Methods for Calculating Fan Sound Rating from Laboratory Test Data) based on the best management practice, process conditions, and locations in the facility.

Ventilation fans powered by adjustable frequency drives shall be programmed with proportional, integral and derivative (PID) error compensation settings to automatically account for air pressure and/or duct flow variations which may be result from constantly changing air flow demands. The VFD control system shall be programmed with closed loop feedback signals based on primary process variable instrument measurements (for example, remote end of air duct pressure and air flow) such that ventilation fan speed will automatically ramp up or down to account for changing air pressure, temperature & flow rates. VFD should be rated to match the motor horsepower, speed and service factor at maximum fan loading. Provide manufacturer certified fan and motor operating curves based on anticipated load and operating conditions of ventilation system.

Fans and blowers shall be provided with isolation dampers and shall be capable of operating under the environmental conditions postulated including radiation.

Fans and blowers shall be selected to operate on the stable portion of its performance curve at the design airflow range. The rating and characteristics of the fan shall account for the pressure drops encountered from existing in-place components, loading of HEPA filters, etc.

Fans shall be selected with minimum 75% fan efficiency at design operating point. Fan type and configuration shall be designed based on efficiency, system curve, and fan characteristics at all anticipated design conditions. Fans shall not be routinely operated in the surge region of the fan curve.

Fans shall be dynamically balanced and factory-tested in accordance with AMCA 204-96 at the design operating RPM to Fan Application Category BV-3, Balance Quality Grade G6.3 (HP ≤ 50) or BV-4, G 2.5 (HP > 50).

Design resonant speed of fan system (not critical speed) shall be minimum 25% greater than its maximum operating speed.

Design specifications shall identify required epoxy coating finish as a minimum with additional protective coatings on fans.

Fan shafts shall be constructed of AISI grade 1040 or 1045 solid hot-rolled steel, turned, ground, and polished. The shaft's first critical speed shall be at least 125% of the fan's maximum operating speed.

Ductwork, housing, and fan acceptable leakage class requirements shall be per the leakage classification schemes as identified in AG-1, FIG. SA-B-1410-1 Single-Pass Air Cleaning System Configuration. TOC ventilation scheme 10, where the protected space is not being challenged contaminated space, fan's shaft leakage shall be per acceptable industry standards.

Fan shaft penetration of fan housings shall be designed to minimize leakage. When the fan is located properly so that leakage does not impose a contamination burden on the space, or the fan is located in the space supplied by air from the fan, then no special sealing is required. The basis for limiting the shaft leakage in ASME AG-1, Article BA-5142.2 is from derived air concentration (DAC) values to limit intended chronic occupational exposure. However, if there is a potential for a significant increase of DAC levels or a significant impact on airflow rate from the space the air is being induced from, then shaft seals should be installed. Shaft seals should limit leakage to 0.01 percent of design airflow rate per inch of fan operating pressure or 0.5 cfm, whichever is greater. The safety analyses should be consulted for allowable leakage for SC and SS designs, especially for systems with multiple HEPA filter banks. If the fans are located upstream of the HEPA banks or if in a potentially contaminated area, extremely small levels of fan shaft in-leakage (< 0.001 cfm) may be unacceptable for maintaining the desired level of removal.

Waste tank and process vessels ventilation systems designed to maintain flammable gas below 25% LFL and having an explosive air stream shall be spark resistant per TFC-ENG-STD-45. ANSI/AMCA Standard 99-10 contains guidelines that are to be used by both the manufacturer and user as a means of establishing general methods of construction.

The seal arrangement shall be non-contact labyrinth or equivalent. Fan design and installations in locations shall consider presence of potential ignitable concentration of flammable gas per TFC-ENG-STD-45.

Fans should be equipped with grease zerks and hoses (or tubing), and/or auto-lubrication devices to support lubrication of bearings. Fan should include recommended lubrication details for bearings, etc., including grease type, volume, and lubrication frequency.

Machine Guards shall be provided to protect personnel per TFC-ESHQ-S-STD-21. Machine guards should not have access/opening greater than 1 inch. Machine guards will include two each 1 inch access ports for each bearing to allow bearing condition/vibration monitoring. These access ports shall be perpendicular to each other (for a horizontal and a vertical bearing vibration reading). Where possible, the machine guard should include access to allow an axial vibration reading to be taken on the fan motor per ASME N511, Section 4.3.

3.25 Stacks

(5.1.1, 5.1.2, 5.1.3, 5.1.5, 5.1.8, 5.1.9, 5.1.10, 5.1.11, 5.1.12.a-e)

The stacks as components, are not within the scope of ASME AG-1, and shall be designed in accordance with ASME-STS-1, "Steel Stacks," ASC 7 and IBC. ASME AG-1, Article AA should be considered for the system structural interface requirements based on the component service levels as described in Section 3.32.2. Stack structural loading conditions shall be in accordance with TFC-ENG-STD-06.

Stack monitoring instrument and sampling ports shall meet the current EPA regulations, 40 CFR 60, Subpart A; DOE-HDBK-1169-2003, Section 5.5; and ASHRAE Handbook – "Applications;" shall be considered in the stack design.

Stack height shall be sufficient to disperse the ventilation emissions including vapors, to exposure levels determined to be safe by the IH Program based on predictive modeling results.

Dispersion calculations shall be performed to demonstrate that the elevated, ground-level, or mixed mode effluent release is adequate to maintain offsite personnel exposures within the plant environmental permit and the exposure levels to the on-site worker are within federal and state regulations. Dispersion calculations used to calculate offsite personnel exposures are performed as described in TFC-ESHQ-ENV-STD-03 and TFC-ESHQ-ENV-STD-04.

To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.

For the engineering evaluation of impacts from non-radiological emissions including vapors, compliance with applicable IH Program guidelines shall be determined using the plume model AERMOD or the computational fire dynamic simulation model (FDS). Other computer models can be used provided they have been evaluated and deemed appropriate by the responsible Design Authority.

For laboratory fume hood ventilations, American Industrial Hygiene Association (AIHA) Standard Z9.5, "Laboratory Ventilation," recommends a minimum stack height of 10 ft. above the adjacent roofline, a ventilation stack velocity of 3000 fpm, and a stack height extending one stack diameter above any architectural screen. Additionally, NFPA Standard 45, "Standard on

Fire Protection for Laboratories Using Chemicals," specifies a minimum stack height of 10 ft. to protect rooftop workers.

The system shall be designed to maintain a minimum capture velocity of 100 fpm to minimize spread of contamination per ACGIH, "Industrial Ventilation: A Manual of Recommended Practice." Ductwork friction loss for round duct should be obtained from ASHRAE Handbook – "Fundamentals."

Stack wake downwash occurs where low-velocity ventilations are pulled downward by negative pressures immediately downwind of the stack. Stack exit velocity should be at least 1.5 times the wind speed at roof height in the approach wind to avoid stack wake downwash (Chapter 24 of the 2013 ASHRAE Handbook, "Fundamentals," or estimated by applying Table 2 of Chapter 24 of that volume to annual average wind speed).

Because wind speed increases with height, a correction for roof height should be applied for buildings significantly higher than 30 ft., using Equation (4) and Table 1 of Chapter 24 of the 2013 ASHRAE Handbook, "Fundamentals." ASHRAE Handbook, "HVAC Applications," Chapter 45 shall be followed for determination of the optimal stack velocity above minimum of 2000 fpm for general applications. However, for the engineered safeguard feature systems, i.e., SS, SC, a minimum stack exit velocity of 3,000 fpm is recommended to prevent downwash from winds up to 22 miles per hour (mph), to keep rain out, and to prevent condensation from draining down the stack (Ref. DOE-HDBK-1169, section 5.5.2).

Stacks shall be designed with particulate sampling ports that meet WDOH, 40 CFR 60 or 61 requirements for obtaining representative samples (see Section 3.29).

3.26 Instrumentation and Controls

(5.1.9, 5.1.11)

The instrumentation and control system shall be designed to operate in anticipated environmental/ seasonal design conditions per TFC-ENG-STD-02.

DOE-STD-1195 applies to SS SISs identified in safety basis documents for new nonreactor facilities and for major modifications as defined in 10 CFR Part 830.3.

For the safety significant Safety Instrumented Systems (SIS), the design shall follow the design requirements of ANSI/ISA-84.00.01, "Application of Safety Instrumented Systems for the Process Industries," as implemented in TFC-ENG-DESIGN-P-43 and TFC-ENG-DESIGN-P-44.

The ventilation systems shall be equipped with instrumentation and controls necessary to perform required in-service testing in accordance with ASME N511, "In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air-Conditioning Systems," Table 1, "Instrument Accuracy Requirements."

The ventilation system shall be capable of monitoring the pressure within the waste storage tanks in which the system is ventilating. The system shall also have vacuum interlocks to shut down the ventilation fan on abnormal tank pressures established in the OSDs.

The components exposed to a ventilated space or ventilation stream shall meet the requirements of TFC-ENG-STD-45.

The control system shall meet the requirements of National Electrical Manufacturer's Association (NEMA) Type 4, per NEMA ICS 6, "Industrial Controls and Systems," for equipment enclosures. Lesser protection may be adequate based on the design, environment, and location of the control systems.

Ventilation instrumentation and control systems shall have instrument error sources and applied uncertainty evaluations performed according to TFC-ENG-STD-14.

Process graphic displays Human-Machine Interfaces (HMI) shall meet the requirements of TFC-ENG-STD-23.

Ventilation control systems, which will become part of the Tank Farm Monitoring and Control System (TFMCS), shall meet the requirements of TFC-ENG-STD-36 and RPP-36610, "Tank Farm Monitor and Control System Software Requirements Specification."

New transmitters shall be able to communicate diagnostic data via the HART or Foundation Fieldbus protocol.

New transmitters, temperature sensors (except thermocouples), and velocity probes' accuracy levels shall be within the accuracy requirements of ASME AG-1 Table TA-3200.

- Instrument range > 1 psig, 2% accuracy (of full scale)
- Instrument range > 1-in. w.g. to 1 psig, ± 0.1-in. w.g.
- Instrument range > 0.1-in. w.g. to 1-in. w.g., ± 0.01-in. w.g.

The full-scale range of instruments shall be limited as necessary to ensure the readings are within the accuracy requirements of ASME AG-1, Table TA-3200, "Instrument Accuracy Requirements." This shall provide for periodic in-place testing and calibration of instrument channels and interlocks.

A low point drain shall be provided in new instrument tubing runs as needed to ensure condensate does not pool in the tubing.

Install humidity instruments downstream of the glycol heater, electric heater, and HEPA filters to detect humidity levels above 70% RH per AG-1, Table 1A-C-1000. Heater operations should be based on the continuous operation of the system and significant electrical demand imposed to achieve humidity instrumentation readings above 70%. Design specification shall identify the operation of the heaters based on the air stream relative humidity above 70% RH, system continuous operation, and significant electrical consumption.

Install airflow continuous measuring devices in the outlet ventilation duct of waste tanks and vessels to ensure the airflows satisfy the minimum safety significant airflow requirements of the facility DSA.

Differential pressure (DP) measuring devices shall be provided to indicate DP across the system components such as inlet plenum (tank head space relative to atmosphere, In-line heater, moisture separator (or demister), prefilters, and HEPA filters.

3.27 SST/DST Air Inlet Stations

Outdoor air intake openings should be equipped with louvers, grills, screens, or similar protective devices to minimize the effects of high winds, rain, snow, ice, trash, and other contaminants on the operation of the system.

3.28 Welding

(5.1.11, 5.1.12.a-e)

3.28.1 Piping used for Ductwork

Piping and components used in lieu of ductwork shall be welded per ASME B31.3 welding requirements. These welds shall be visually inspected per normal fluid service requirements. Welding shall be qualified per ASME BPV Code, Section IX.

3.28.2 Structural, Ductwork Support Welding

Structural welding shall meet the requirements of the following codes as applicable and all welds will be visually inspected per statically loaded criteria.

- AWS D1.1/D1.1M, "Structural Welding Code–Carbon Steel"
- AWS D1.3/D1.3M, "Structural Welding Code–Sheet Steel"
- AWS D1.6/D1.6M, "Structural Welding Code–Stainless Steel."

3.28.3 Ductwork Welding

Ductwork fabricated from sheet metals shall be welded and inspected per the following:

- AWS D9.1M/D9.1, "Sheet Metal Welding Code."

3.29 Effluent Sampling and Monitoring System

(5.1.1, 5.1.2, 5.1.12.e)

For the general operating requirements of point source air emission units, abatement equipment, and monitoring refer to RPP-16922, "Environmental Specification Requirements." Airborne effluent sample operating and handling activities for radioactive emission sources shall comply with TFC-ESHQ-ENV-STD-05. The requirements apply to Potential Impact Category (PIC) 1 and 2, continuously sampled, emission sources (potential off-site effective dose equivalent > 0.1 millirem per year). The requirements also apply to Category 3, periodically sampled, emission sources while operating. Category 1, 2, and 3 emission sources are defined in TFC-ESHQ-ENV-STD-03. WAC 246-247-075, "Monitoring, Testing and Quality Assurance," requires that facilities be able to demonstrate the reliability and accuracy of the radioactive air emissions monitoring data.

3.29.1 Particulate Monitoring/Sample Collection System

(5.1.1, 5.1.2, 5.1.12.e)

Sample collection system design temperature shall be the same as tank headspace temperature (see section 3.7). Design temperature chosen for the projects needs to consider process conditions and heat tracing effects.

For the general requirements for point source air emission units, abatement equipment, monitoring, record sampler and CAM system operating requirements refer to RPP-16922, "Environmental Specification Requirements." The system shall meet the requirements of 40 CFR

61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities;" and American National Standards Institute (ANSI)/Health Physics Society (HPS) N13.1 latest edition, "Sampling and Monitoring Release of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities," and shall be designed to minimize depositional losses and condensation.

The sample transport lines shall be provided with fittings that provide a near seamless connection at all tubing joints. The quantity of compression fittings used in the lines should be minimized. Tube bends are preferred over 45 degree and 90 degree tube fittings. The above restrictions do not apply to the vacuum return lines that are connected downstream from the CAM heads, or the record sample filter holder. The sample transport lines shall be insulated and heated to prevent condensation between the sample probe and the entry into the sample pump and the return line shall be insulated from the sample pumps to the ventilation stack. All lines shall be sloped to the condensate collection point.

3.29.2 Particulate Record Sampler

(5.1.1, 5.1.2, 5.1.12.e)

A permanently installed particulate record sampler is required for emission points with a PIC 1 and 2. One may be installed on a PIC 3 system as directed by management. For the general operating requirements of point source air emission units, abatement equipment, monitoring, record sampler and CAM systems, refer to RPP-16922, "Environmental Specification Requirements."

3.29.3 Particulate Beta Continuous Air Monitor

(5.1.1, 5.1.2, 5.1.12.e)

For the general operating requirements of point source air emission units, abatement equipment, monitoring, record sampler and CAM systems, refer to RPP-16922.

Sample points and the measurement systems shall comply with ANSI/HPS N13.1, ANSI N42.18, Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents, 40 CFR 52, 40 CFR 61, and WAC 246-247. A permanently installed particulate beta CAM is required for all emission points with a potential impact category (PIC) 1. The CAM loop shall consist of a sample probe, delivery tubing, the CAM, flexible hose/tubing, mass flow controller, vacuum gauge, isolation valves, and manifolding into the redundant vacuum pumps.

Radioactive effluent Sampling and Monitoring System shall be designed in accordance with ANSI/HPS N13.1, "Sampling and Monitoring Releases of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities," and N42.18, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," and 40 CFR 61.93(b) (2) (i) and 40 CFR 61.93(b) (2) (ii).

3.29.4 Stack Vapor Monitoring

Incorporation of continuous near real-time identification and detection/measurement technologies for vapor emissions from stacks shall be provided in the design to meet requirements established by specific tank vapor information sheets (TVIS) in accordance with TFC-ESHQ-S_IH-C-48 and to implement IH Program guidelines to address vapor hazards. If the IH Program has not yet developed specific vapor monitoring guidelines for the system, the design must include appropriate accommodating design features that will facilitate later installation of vapor monitoring technologies and instrumentation. These accommodating design features should include adequate sampling ports, electrical power, structural capacity, and other infrastructure considerations.

If it is determined that a vapor monitoring system is required, the following shall be used in the design of the system:

The vapor sample shall be drawn from the vent system, downstream of the HEPA filters, using the method described in ASTM D6348, "Standard Test Method for Determination of Gaseous Compounds by Extractive Direct Interface Fourier Transform Infrared (FTIR) Spectroscopy." This method is also applicable Ultraviolet Differential Adsorption Spectroscopy (UV-DOAS). The extractive sample methodology describe in ASTM D 6348 Section 7.2 is applicable to gas analyzers (e.g., AreaRAE, Autosampler). The method describes extracting an ideal gas (air with compounds where the concentration is generally less than 1% by volume) using a strait sample probe inserted into the centroid of the turbulent flow and delivering the sample to the instrument through environmentally controlled tubing. In general, to prevent condensation of vapors, the gasses should allow transport through the sample system to the instrument and the concentration of the gasses should be quantifiable by the selected instrument (e.g., FTIR, UV-DOAS, AreaRAE, and autosampler).

The sampling system shall have the following functionality:

- The sample line shall have a heated filter near to the sample probe where feasible
- The sample system shall have the functionality to deliver calibration verification gas ('spike") into the sample flow before the sample filter
- The system shall have the functionality for Instrument calibrations directly to the instrument
- For exhausted flow where particulate is expected to condense on the sample probe, the sampling system shall have blowback functionality where the probe can be cleared by high pressure pulse of air.
- The sample system shall have the functionality to return the sample gas to the system or destroy the sample after analysis by the instrument.

Below are some key design characteristics to consider.

- The wetted surfaces of the sample flow path should be constructed with chemically compatible materials. Also, the wetted surfaces of the sample flow path should be constructed or coated with materials that minimize the condensation of reactive condensable gasses (e.g., ammonia).
- The strait sample probe should generally be ½ inch stainless steel tube with the tip cut at a 45 degree angle ("stinger") to allow condensation to drip off the probe.
- All wetted surfaces should be heated to a temperature to maintain all gasses in the gaseous phase.

- The extractive sampling system shall be considered a separate system from the vapor monitoring instruments and shall be operable as a standalone system.

- The exhauster should be configured with enough ports for the sample draw and return of the sample after analysis.

- The vapor sample probe shall be located in a location (housing, ducting or stack) that does not affect N13.1 certifications for particulate sampling.

3.29.5 Stack Flow Monitoring Instrumentation

(5.1.1, 5.1.2, 5.1.12.e)

For the general requirements of the stack Air Flow and monitoring systems, refer to RPP-16922. Continuous stack discharge flow measurements shall be designed in accordance with the applicable sections of WAC 246-247. Stack flow measurement shall be determined using the methods of 40 CFR 60 Appendix A, Method 2, for manual measurements, or by an integral continuous flow monitor that complies with 40 CFR 61, Subpart H, and ANSI N13.1. These flow measurements are used in conjunction with monitoring or sample data to account for total emissions from monitored/sampled point sources. The instrumentation shall be compatible with ventilation stream temperature and constituents. The mounting design shall be such that the flow instrument can only be installed in the correct orientation.

Dedicated non-ground fault interrupted (non-GFI) circuits shall be provided for the stack effluent monitoring and sampling control circuits. When practical, the means of supplying alternative power (e.g., generator) should be incorporated into the design.

3.29.6 Environmentally Controlled Sample Cabinets

(5.1.12.a-e)

The effluent monitoring system cabinets (for both vapor and particulate monitoring) shall be equipped with environmental controls to maintain instrumentation within necessary temperature ranges. . The sample cabinet shall meet NEMA 4 per ICS 6, “Industrial Controls and Systems.” Lesser protection may be adequate based on the design, environment, and location of the control systems.

A heat load analysis shall be performed to verify that the maximum and minimum temperatures expected in the cabinets do not fall outside the published operating limits for the included equipment for new systems.

3.30 Condensation Collection System

(5.1.12.e)

A condensate collection system should be provided to ensure reliable operation of the ventilation system equipment, including flow control valves, flow instrumentation, and other sampling components. This system shall be designed to ensure confinement of tank headspace contamination by preventing bypass of the HEPA filters through the condensate drain lines. Condensate from equipment shall gravity drain into the seal pot below the liquid level, ensuring that the liquid seals the drain lines, preventing airflow through that pathway. Pumping condensate is allowed only in cases where gravity draining is not practicable and it is not recommended.

The condensate collection piping, and condensate drain piping shall be designed, fabricated, and shop tested to ASME B31.3. Metallic components of the pressure boundary shall be a 300 series stainless steel. Field-testing shall include in-service leak testing coupled with the demister and filter housings per TA 4300 of ASME AG-1

3.31 Freeze Protection

(5.1.4, 5.1.5, 5.1.8, 5.1.9)

Seasonal protection measures shall be incorporated into designs as described in TFC-ENG-STD-02.

Heat tracing analysis shall be performed in accordance with ASTM C680, “Standard Practice for Estimate of Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs,” or IEEE-515, industry practices, and as specified in WRPS standards and project specifications.

Heat tracing shall be installed on condensate lines and on the seal pot reservoir in accordance with IEEE 515 and NECA 202, as applicable.

Heat tracing and insulation effects on the design temperatures of system components shall be considered.

3.32 Structural Requirements

3.32.1 Equipment Design

(5.1.4, 5.1.5, 5.1.6, 5.1.9, 5.1.12.a-e)

Ventilation equipment design criteria shall comply with the ASME AG-1 Division I General Requirements Article AA-4200 and Table AA-4212-1 Design Load Conditions, (e.g., live loads, dead weight, wind loads, external loads, seismic loads consistent with DOE-STD-1020, and TFC-ENG-STD-06).

Design of ventilation system SSCs shall be based on their assigned Natural Phenomenon Hazard Category (NDC) designation as discussed in TFC-ENG-STD-06. Natural phenomena hazard category designation should be evaluated and may be upgraded to provide additional conservatism per DOE O 420.1C. The TOC DSAs, RPP-13033, HNF-14755, and HNF-12125 identify Safety-Significant and GS ventilation system SSCs for the facilities.

3.32.2 Component Conditions

The operating conditions for the equipment are referred to as Service Levels per ASME AG-1.

Component Service Level A

Level A service limits are those sets of limits that must be satisfied for all loads identified in the equipment design specification to which the equipment may be subjected in the performance of its specified normal service function. This service level allows equipment design load for live loads, normal loads, and constraint of free end displacement loads as identified in the design specifications. These loads shall meet the IBC or ASCE 7 requirements as described in TFC-ENG-STD-06.

Component Service Level B

Level B service limits are those sets of limits that must be satisfied for all loads identified in the equipment design specification for which these service limits are designated. Equipment must withstand load combinations specified for Level B service limits without damage that would require repair. This condition allows equipment design load for live loads, normal loads, design wind, constraint of free end displacement, and seismic design (or acceleration) loads, as identified in the design specifications. These loads shall meet the IBC or ASCE 7 requirements as described in TFC-ENG-STD-06.

Additional dynamic loads resulting from structural motion caused by a design basis accident such as hydrodynamic, pipe breaks, or mechanical shock loads shall not be considered. Such events have not been identified in the DSA for design features associated with the ventilation systems.

The Operational Basis Earthquake (OBE)/Safe Shutdown Earthquake (SSE) terminology is not applicable to the design of TOC SSCs. Seismic design loads (or accelerations) shall be determined based on the established component conditions as identified in TFC-ENG-STD-06.

Service conditions, design, and service limits shall be established based on the facility and system operating conditions for the intended service life of the permanent installation of new equipment as specified in ASME AG-1 General Articles AA-4213, AA-4214.

3.32.3 Retrieval Ventilation Equipment

All GS retrieval ventilation equipment including ductwork, moisture separator and its housing, filter housing, fan, shall meet Service Level A as a minimum per ASME AG-1, Articles AA-4200 per TFC-ENG-STD-06. ASME AG-1 component load conditions for Service Level A are per Table AA-4412 and deflection limit of d all $\leq 0.6\ d_{max}$ per Table AA-4231.

Level A service limits shall be considered as a minimum for the modifications to the existing retrieval system interfaces that is equivalent to NDC-0 since the existing system integrity cannot be analyzed per AG-1 Articles AA-4220.

Retrieval ventilation systems classified as SS and NDC-2 shall be designed to Service Level B per ASME AG-1 Articles AA-4213 and AA-4214.

3.32.4 DST, Evaporator, ETF, Lab, LAWPS Ventilation Equipment

Permanent ventilation system equipment including ductwork, moisture separator and its housing, filter housing, and fan shall meet Service Level B per AG-1, Article AA-4200 Design verification of equipment by analysis or testing is acceptable as stated in AA-4312. ASME AG-1 component load condition for Service Level B is per Table AA-4412 that is equivalent to the NDC-2/SDC-2 and Limit State C, as defined in ANSI/ANS - 2.26, Appendix B, that is equivalent to the SDC-2 and Limit State C, as defined in ANSI/ANS - 2.26, Appendix B, and deflection limit of d all $\leq 0.6\ d_{max}$ per Table AA-4231 deflection limits.

The acceptability of design shall be based on structural integrity analysis without dynamic testing to ensure the design meets the intended function and stress limits are satisfied.

3.32.5 Anchorage of Equipment

Anchorage of equipment shall comply with minimum design loads per TFC-ENG-STD-06.

3.32.6 Piping and Duct Supports

Piping and duct supports shall comply with TFC-ENG-STD-06.

3.32.7 Equipment Handling

(5.1.4, 5.1.5, 5.1.8, 5.1.12.a-e)

DOE/RL-92-36, RPP-8360, and TFC-ENG-STD-06 shall be used where applicable to the design of any equipment or items requiring load handling.

3.33 Electrical

(5.1.4, 5.1.5, 5.1.9)

For existing tank farm ventilation systems, electrical service to the system shall be 3-phase, 4-wire, 480 volt alternating current (VAC). The service disconnect shall be sized, as required, for the total electrical load. The service disconnect shall be installed in a weatherproof enclosure suitable for outdoor installation. The symmetrical short circuit current rating shall be as required to withstand the available fault current at the point of connection.

Electrical installations shall comply with TFC-ENG-STD-41. Motors shall meet the requirements of NEMA MG-1 (as applicable), and shall be provided with complete test reports.

Electrical design shall comply with TFC-ENG-STD-45 and TFC-ENG-STD-13, as applicable for meeting NEC, Articles 500-516, CLASS I, CLASS II, CLASS III, DIV 1 and DIV 2.

The motor shall be a totally enclosed fan cooled (TEFC) inverter duty motor designed for variable speed operation to allow for a constant air volume at changing pressure conditions. The motor shall be tested and rated in accordance with IEEE-112 and NEMA MG-1 as determined by the manufacturer.

Electrical power distribution enclosures shall provide permanently installed means for lock and tag application. Provisions shall be made for isolating instruments and equipment from hazardous energy sources during calibration, maintenance, and repair.

Power and instrumentation circuits shall be routed in separate raceways to ensure electromagnetic interference (EMI) noise does not affect the instrumentation, control, and alarm circuits.

Vapor emissions monitoring systems design should consider increasing the electrical power supply (e.g., 240v/100amps) and allow for the future installation of vapor emissions monitoring.

3.33.1 Alarm Indications

(5.1.4, 5.1.5)

Alarm indications shall comply with TFC-ENG-STD-40 and shall consider the human factor considerations as stated in TFC-ENG-STD-01 and TFC-ENG-DESIGN-D-29.

3.33.2 Indicator Location

(5.1.4, 5.1.5)

Fan "Start and Stop" status shall be at a remote control HMI and shall consider the human factor considerations as well as local status indication, e.g., RED for dangerous when energized, as stated in TFC-ENG-STD-01 and TFC-ENG-DESIGN-D-29.

Process graphic displays Human-Machine Interfaces (HMI) for non-ABB systems shall meet the requirements of TFC-ENG-STD-23.

3.33.3 Industrial Control Panel

(5.1.12.a-e)

Industrial control panels shall be fabricated to comply with Underwriters Laboratory (UL) UL 508-A, "General Use Industrial Control Panels," NFPA 70, and NFPA 79, "Electrical Standard for Industrial Machinery." Control panels shall be labeled to indicate UL 508-A compliance. Electrical enclosures shall meet the requirements in accordance with TFC-ENG-STD-41.

Industrial control panels shall be controlled to maintain the interior cabinet temperature within the operating limits of installed equipment. The control cabinet temperature and humidity (if required) measurement shall be provided to aid in preventing the system from exceeding operating limits. Calculations for enclosure temperature and humidity requirements shall be performed in accordance with TFC-ENG-DESIGN-C-10.

3.34 Inspection and Testing

(5.1.12.a-e)

ASME AG-1 applies to individual components in a system. The Code does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. The TOC test program shall define system test boundaries and evaluate system performance with respect to system functional requirements in accordance with ASME N511.

ASME N511 standard applies to the In-Service testing of nuclear air treatment, heating, ventilating, and air-conditioning systems that have been designed, built, and acceptance tested in accordance with ASME AG-1 Div. IV, Testing Procedures. The standard and non-mandatory Appendix C, Test Program Development Guidance, may be used for technical guidance for in-service testing of the system when they are designed and built to other industrial ventilation standards, e.g., ASHRAE, SMACNA, etc. As such, ACGIH Publication # 2106, industrial ventilation recommended practice for operation and maintenance is used for inspection, balancing, measurement, monitoring, and testing for systems designed in conjunction with ASME AG-1.

Ventilation system inspection and testing shall be documented in accordance with TFC-ENG-DESIGN-C-18, TFC-PRJ-SUT-C-01 and TFC-PLN-26. Attachment B provides additional information for pressure testing ventilation systems.

NFPA 90A contains requirements for inspection and testing of smoke detection, automatic shutdown systems, and dampers, where required.

Components of the ventilation systems shall be designed, constructed, and tested in accordance with Division II of ASME AG-1 as modified and supplemented by the following:

HEPA filter meeting ASME AG-1 Article FC shall meet performance requirements as stated in FC-4200 including the aerosol particle penetration test through the filter medium, frame, adhesive bond, and gasket. The penetration test shall not be greater than 0.03% of upstream concentration when tested at rated airflow and at 20% of rated airflow when tested in accordance with FC-5120. Filters with a rated airflow of less than 125 cfm shall be tested at the rated airflow only.

Ventilation components shall be tested after modification to ensure components conform to the acceptance criteria per the design specifications prior to accepting them as operational. Ventilation systems operational capability after modification must be within acceptable limits and demonstrated to be in accordance with the acceptance testing and inspections as specified in ASME AG-1, Article TA-4000, as specified in the design specification.

Flow measurements, testing, and adjusting shall comply with ANSI/ASHRAE Standard 111, "Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems", and ACGIH testing and measurements of ventilation systems as appropriate. In addition, active (powered) ventilation systems shall be field tested in accordance with ASME-AG-1 and ASME N511, "In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air-Conditioning Systems."

For vapor monitoring systems, calibration and span gasses may be required and should follow the vendor recommendations. The vapor extractive subsystem shall be tested in accordance with ASTM D6348.

System Flow Balance Test shall be conducted according to TA-4140, System Functional Tests. Recommended procedures include SMACNA, NEBB, ACGIH, or AABC. Final component reference values shall be obtained with clean system components installed. Fans and blowers shall be tested in accordance with the ASME N511, Table 3, "Fan In-Service Tests," periodically.

Fans and blowers wheels shall be tested for an over speed condition of 15% above its maximum operating speed for 10 minutes without increased vibration.

The manufacturer for performing the required fan vibration test as stated in ASME AG-1 BA-5143 uses AMCA 204, ISO 1940, ISO 10816, or ISO 13373.

Fans performance test can be performed per the applicable design operating RPM and field specifications. In situ fan vibration trouble shooting should be performed per AMCA publication 202 as established by the test procedures and project documents.

Pneumatic pressure test ductwork/pipe at 1.25 times the maximum operating pressure to comply with AG-1 Article TA-III-4000. Ductwork/pipe welded components require only visual inspection. The permissible allowable leakage shall be determined based on Table SA-B-1310 Class I leakage requirements Scheme 10 as shown in FIG SB-B-1410-1, and system functional requirements. Exceptions to leakage requirements shall be considered per SA-4533 when quantitative measurement of leakage is not practical or cannot be determined as specified in the design specification or documentation. Other exceptions to quantitative measurement of leakage requirements shall be technically justified and specifically documented.

Inspection and test interval requirements shall be per ASME N511, Table 2, "In-Service Test Intervals." HVAC components shall be inspected and tested in accordance with AG-1, Article TA-3000, "General Inspection and Test Requirements," and Article TA-4000, "Field Acceptance Tests."

Pressure boundary tests consist of hydrostatic (or pneumatic) tests for leak tests for ducts and housings, including fan, moisture separator, and damper housings. Hydrostatic tests shall be conducted at the hydrostatic pressure defined in the design specification and shall verify that the component will not rupture, leak, or be permanently deformed under design pressure loads. Testing shall be conducted in accordance with the design codes used in this standard and as delineated in the design specifications (e.g., ASME B31.1, B31.3, etc.). Pneumatic testing may be used in lieu of water where allowed by the applicable codes and in the design specification.

Shop pressure test the liquid and condensate drain pipe at 1.5 times the design pressure (hydro tests only) in accordance with ASME B 31.3, Section 345.4.2, "Test Pressure," and conduct required visual inspection and radiography examination testing.

In-Service visual inspection methods for SSCs shall be performed per ASME AG-1 Article AA-5200 and the applicable portions of the ASME N511 Sections 4, 5, Mandatory Appendix I, and TA-III-4000, Duct and Housing Leak Test Procedural Guidelines, as specified in the design specifications and procedures.

Expansion joints welds shall be visually tested per ASME N511, e.g., air, bubble, audio, etc.

The design specification shall identify the required qualification testing for the moisture separators as stated in FA-5100. Design verification by comparative evaluation report based on the documented suppliers' past performance and survey is acceptable per AA-4443, according to TFC-ENG-DESIGN-C-52.

The conditioning equipment acceptance test and inspection shall be per applicable AG-1, Article TA-4500 and Mandatory Appendix TA-I, "Visual Inspection Checklist," and Article TA-I-1000, "General," as applicable.

4.0 DEFINITIONS

ACFM. Actual cubic feet per minute (see Airflow). A unit of volumetric flow rate that is uncorrected for standard conditions.

AHU. An air-handling unit is equipment that is a confinement structure capable of conditioning, i.e., heating, cooling, humidifying, filtering clean or contaminated air stream. The term AHU is used in the Code on Nuclear Air and Gas Treatment for the purpose of preventing and mitigating consequence of worker and public exposure and to limit radioactive hazardous material exposure as determined by the established regulations.

Air-Cleaning System. An air cleaning system is an assembly of one or more air-cleaning units plus all external components needed to convey air or gases from one or more intake points, through the air-cleaning units, to one or more points of discharge. The system may be either recirculating or once through.

Common-cause failure. Multiple failures of SSCs as the result of a single phenomenon.

Components. A constituent part of the system.

Component conditions. Operating conditions of a component referred to as Service Level A, Service Level B, Service Level C, or Service Level D.

Damper. A damper is a control device, a component of a control loop used to vary or control the flow of air. Valves and dampers perform essentially the same function and must be properly sized and selected for their particular application. The control link to the valve or damper is called an actuator or operator, and uses electricity, compressed air, hydraulic fluid, or some other means to power the motion of the valve stem or damper linkage through its operating range. Butterfly valves were commonly used as dampers on Tank Farm facility ventilation systems for isolation, flow or pressure control, and pressure relief.

dBA. This is the unit used for decibels, a measure of sound pressure level, measured on the A scale, the most widely used sound level filter, which roughly corresponds to the inverse of the 40 dB (at 1 kHz) equal-loudness curve. Using this filter, the sound level meter is thus less sensitive to very high and very low frequencies.

Duct. An air or gas path enclosure.

Electromagnetic Interference (EMI). A disturbance that affects an electrical circuit due to either electromagnetic conduction or electromagnetic radiation emitted from an external source. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit.

Equivalent Replacement. An item that is equivalent but is not identical to the original item. The item may have different form, fit, or certain design characteristics, but, as a minimum, meets the same design basis requirements and performs the same function as the item being replaced. The replacement item also meets all applicable interface requirements of the original item.

Engineered Safety Feature (ESF). Nuclear air treatment system, HVAC system, gas processing system, or component that serves to control and limit the consequences of releases of energy and radioactivity.

Fan Operating Speed. The actual speed (revolutions per minute) at which the supplied fan is to perform. This may be a range of speeds for variable frequency drives and variable speed drives.

General Service. The classification assigned to Structures, Systems, and Components not required to provide a safety class or safety significant function. All structures, systems, and components are, as a minimum, classified as GSs unless it has been determined and documented that a higher classification is required.

Graded Approach. The process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement in this part is commensurate:

- The relative importance to safety, safeguards, and security
- The magnitude of any hazard involved
- The life-cycle stage of the facility
- The programmatic mission of the facility
- The particular characteristics of the facility

- The relative importance of radiological and non-radiological hazards, and
- Any other relevant factor.

HEPA Filter. High-efficiency particulate air filter. A throwaway, extended-media dry type filter with a rigid casing enclosing the full depth of the pleats and exhibiting: (1) a minimum particle removal efficiency of 99.97% when tested with an aerosol of essentially mono-dispersed 0.3 micrometer diameter test aerosol particles; and (2) a maximum resistance-to-airflow, when clean, of 1.0 and 1.3 inch w.g. when operated at rated airflow capacity in accordance with AG-1, Tables FC-4110-1 and FC-5100-1.

Like-for-Like Items. Items may be considered identical or like-for-like if one of the following applies:

- The item is provided from the original equipment manufacturer or successor companies, and has not been subject to design, materials, manufacturing, or nomenclature changes.

- The item was purchased at the same time and from the same supplier, as determined by the purchase date, date code, or batch/lot identification.

- Evaluation of the item confirms that no changes in the design, materials, or manufacturing process have occurred since the procurement of the original item.

Limit State. The limiting acceptable deformation, displacement, or stress that an SSC may experience during or following an earthquake and still perform its safety function.

Modification. FF-01 Radio Active Air Emissions License, FF-01, defines “Modification” as any physical change in, or change in the method of operation of, an emission unit that could increase the amount of radioactive materials emitted or may result in the emission of any radionuclide not previously emitted. This definition includes the cleanup of land contaminated with radioactive material, the decommissioning of buildings, structures, or plants where radioactive contamination exists, and changes that will cause an increase in the emission unit’s operating design capacity. This definition excludes routine maintenance, routine repair, replacement-in-kind, any increases in the production rate or hours of operation, provided the emission unit does not exceed the release quantities specified in the license application or the operating design capacity approved by the department, addition of abatement technology as long as it is not less environmentally beneficial than existing, approved controls, and changes that result in an increase in the quantity of emissions of an existing radionuclide that will be offset by an equal or greater decrease in the quantity of emissions of another radionuclide that is deemed at least as hazardous with regard to its TEDE to the MEI.

Non-Permanent Structures. Used for SST retrieval, closure and facility deactivation that do not meet the definition of a temporary structure, but may be categorized and designed as NDC-0. These structures meet WDC-1 as a minimum and stability verified per RPP-16643 Rev. 1.

Plenum. A section of duct in the airflow path that has a sufficient cross-sectional area and depth to cause substantial reduction in flow velocities. The plenum may contain flow adjustment devices and may collect and distribute several air or gas streams.

Potential Impact Category (PIC). A ranking classification of potential radiological impact, based on factors such as potential effective dose equivalent (PEDE). It is used to implement a graded approach to sampling and monitoring. The potential for impact is based on facility source characteristics, assuming loss of containment of radioactive materials that would otherwise be released to the effluent stream under consideration (ANSI/HPS N 13.1).

- PIC-1: PTE is > 5 mrem
- PIC-2: PTE is ≥ 0.1 mrem and ≤ 5 mrem
- PIC-3: PTE is ≥ 0.01 mrem and < 0.1 mrem
- PIC-4: PTE is ≤ 0.01 mrem.

Safety Class Structures, Systems, and Components. The structures, systems, or components, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive hazardous material exposure to the public, as determined from safety analyses (10 CFR 830.3, "Nuclear Safety Management").

Seismic Design category (SDC). Seismic design category for nuclear facility structures, systems, and components (SSCs) to achieve earthquake safety and criteria and guidelines for selecting Limit States for these SSCs to govern their seismic design.

Safety Significant Structures, Systems, and Components. The structures, systems, and components that are not designated as safety class structures, systems, and components, but whose preventive or mitigative function is a major contributor to defense in depth and/or worker safety as determined from safety analyses.

SCFM. Volumetric flow of air expressed in terms of cubic feet of air per minute (CFM). Standard CFM (SCFM) is a cubic foot of air at standard air conditions. In order to avoid misunderstandings, the cfm of equipment is often expressed at standard air conditions (see standard air).

Standard Air. Standard air is defined as having a specific volume of 13.33 ft^3/lbm. (0.832 m^3/kg) dry air (a density of 0.075 lbm. /ft^3 (1.201 kg/m^3) dry air). This condition applies at 68 °F (20°C) and 29.92 in. Hg. (760 mm Hg).

Temporary Structures. A tent, platform, engineered scaffolding etc. erected for a period of less than 180 days.

5.0 SOURCES

5.1 Requirements

1. 10 CFR 830, "Nuclear Safety Management."
2. 10 CFR 835, "Occupational Radiation Protection."
3. 10 CFR 851, "Worker Safety and Health Program."
4. DOE O 252.1A, "Technical Standards Program."
5. DOE O 420.1C, "Facility Safety." DOE-STD-1189 "Integration of Safety into the Design Process."
6. DOE-STD-1189-08, "Integration of Safety into the Design Process."

7. DOE-STD-3009, "DOE Standard Preparation Guide for U.S Department of Energy Nonreactor Facility Documented Safety Analyses."

8. International Building Code (IBC), International Mechanical Code (IMC), and International Plumbing Code (IPC).

9. National Industry Standards and Practices.

10. OSD-T-151-00007, "Operating Specifications for Double-Shell Waste Storage Tanks."

11. OSD-T-151-00013, "Operating Specifications for Single-Shell Waste Storage Tanks."

12. Washington Administrative Codes (WAC).

    a. Chapter 173-401.
    b. Chapter 51-50, "State Building Code adoption and amendment of the 2012 edition of the International Building Code."
    c. Chapter 51-52, "State Building Code adoption and amendment of the 2012 edition of the International Mechanical Code."
    d. Chapter 51-56, "State Building Code adoption and amendment of the 2012 edition of the Uniform Plumbing Code."
    e. Chapter 246-247, "Radiation Protection – Air Emission."

5.2 References

1. 00-05-006, Hanford Air Operating Permit-2006.

2. 10 CFR 830, "Nuclear Safety Management."

3. 40 CFR 52, "Protection of Environment."

4. 40 CFR 60, "Standards for Performance for New Stationary Sources," Appendix A, "Test Methods."

5. 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Subparts H and I, "National Emission Standard for Radionuclide Emissions from Department of Energy Facilities."

6. ACGIH - Publication #2098, "Industrial Ventilation: A Manual of Recommended Practice for Design."

7. ACGIH - Publication #2106, "Industrial Ventilation: A Manual of Recommended Practice for Operation and maintenance."

8. ACGIH, "Quantitative Industrial Hygiene: A Formula Workbook."

9. AMCA 204, "Balance Quality and Vibration Levels for Fans."

10. AMCA 210, "Laboratory Method of Testing Fans for Aerodynamic Performance Rating."

11. AMCA 211, “Certified Ratings Program - Product Rating Manual for Fan Air Performance.”

12. AMCA 300, “Reverberant Room Method for Sound Testing .”

13. AMCA 301, “Methods for Calculating Fan Sound Rating from Laboratory Test Data – 2007.”

14. AMCA 500, “Laboratory Methods of Testing Dampers for Rating.”

15. AMCA 502, “Damper Application Manual for Heating, Ventilating and Air Conditioning.”

16. AMCA 511, “Certified Ratings Program Product Rating Manual for Air Control Devices.”

17. AMCA 99, “Air Movement and Control Association Standards Handbook.”

18. American Industrial Hygiene Association (ANSI/AIHA) Z9.5, “Laboratory Ventilation.”

19. American Industrial Hygiene Association (ANSI/AIHA) Z9.2, “Local exhaust Ventilation Systems.”

20. ANSI N42.18 2004, “Specification and Performance of On Site Instrumentation for Continuously Monitoring Radioactivity in Effluents.”

21. ANSI/ANS-2.26, 2004 (REAFFIRMED May 27, 2010), “American National Standard Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design.”

22. ANSI/ASHRAE Standard 199, “Method of Testing the Performance of Industrial Pulse Cleaned Dust Collectors.”

23. ANSI/HPS N13.1-1969, “Guide to Sampling and Monitoring Release of Airborne Radioactive Substances in Nuclear Facilities.”

24. ANSI/HPS N13.1-1999 and 2011 Edition, “Sampling and Monitoring Release of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities.”

25. AHRI-410, “Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.”

26. AHRI 430, “Standard for Performance Rating of Central Station Air-handling Unit Supply Fans.”

27. ASCE 7-10, “Minimum Design Loads for Buildings and Other Structures.”

28. ASHRAE – Handbook, “Applications.”

29. ASHRAE – Handbook, “Fundamentals.”

30. ASHRAE – Handbook, “Systems and Equipment.”

31. ASHRAE 51- 07, “Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.”

32. ASHRAE DG-1, HVAC Design Guide for DOE Nuclear Facilities.

33. ASHRAE Standard 52.2-2007, “Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size.”

34. ASHRAE Std. 111, “Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.”

35. ASME AG-1-2017, “Code on Nuclear Air and Gas Treatment.”

36. ASME B16.34, “Valves – Flanged, Threaded, and Welding End.”

37. ASME B31.1, “Power Piping.”

38. ASME B31.3, “Process Piping.”

39. ASME Boiler & Pressure Vessel Code- 2011 and ERRATA 2012, Section IX, “Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.”

40. ASME N509-2002, “Nuclear Power Plant Air-Cleaning Units and Components.”

41. ASME N510-2007, “Testing of Nuclear Air Treatment Systems.”

42. ASME N511-2007, REAFFIRMED 2013, “In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air-Conditioning Systems.”

43. ASME NQA-1, “Quality Assurance Program Requirements for Nuclear Facilities.”

44. ASME-STS-1, “Steel Stacks.”

45. ASTM D6345, “Standard Test Method for Determination of Gaseous Compounds by Extracting Direct Interface Fourier Transform infrared (FTIR) Spectroscopy.”

46. AWS D1.1/D1.1M, “Structural Welding Code-Steel.”

47. AWS D1.3/D1.3M, “Structural Welding Code-Sheet Steel.”

48. AWS D1.6/D1.6M, “Structural Welding Code-Stainless Steel.”

49. AWS D9.1M/D9.1, “Sheet Metal Welding Code.”

50. DOE 5480.23, “Nuclear Safety Analysis Reports.”

51. DOE/RL-92-36, “Hanford Site Hoisting and Rigging Manual.”

52. DOE-HDBK-1169-2003, “Nuclear Air Cleaning Handbook: Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application,” fourth edition.

53. DOE-STD-1066, "Fire Protection."

54. DOE-STD-1189," Integration of Safety into the Design Process."

55. DOE-STD-3020, Specification for HEPA Filters Used by DOE Contractors."

56. MGT-ENG-IP-05, R3, "ORP Fire Protection Program."

57. ERDA 76-21, "Nuclear Air Cleaning Handbook."

58. HNF-12125, "222-S Laboratory Documented Safety Analysis."

59. HNF-14755, "Documented Safety Analysis for the 242-A Evaporator."

60. HNF-EP-0479, "Facility Effluent Monitoring Plan for the Tank Farms (FEMP)."

61. HNF-SD-WM-TSR-006, "Tank Farms Technical Safety Requirements."

62. IEC 60529, "Degrees of Protection Provided by Enclosures (IP Code)."

63. IEEE-112, "Standard Test Procedure for Polyphase Induction Motors and Generators."

64. IEEE 515, "Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications."

65. IEEE 841, "Standard for Petroleum and Chemical Industry."

66. MIL-STD-889B, Change Notice 3, "Dissimilar Metals."

67. MPIF, "Standard 35, Materials Standards for Metal Injection Molded Parts."

68. NEBB, "Procedural Standards for Whole Building Systems Commissioning for New Construction"

69. NEBB, "Procedural Standard for Measurement of Sound and Vibration."

70. NECA, 202-2006, "Standard for Installing and Maintaining Industrial Heat Tracing Systems."

71. NEMA ICS 6, "Industrial Controls and Systems."

72. NEMA MG-1, "Motors and Generators, National Electrical Manufacturers Association."

73. NFPA 70, "National Electrical Code," National Fire Prevention Association.

74. NFPA 79, 2012, "Electrical Standard for Industrial Machinery," National Fire Prevention Association.

75. NFPA 90A, 2012, "Installation of Air-Conditioning and Ventilation Systems," National Fire Prevention Association, National Fire Prevention Association.

76. NFPA 91, 2010, "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids."

77. RPP-13033, "Tank Farms Documented Safety Analysis."

78. RPP-16922, "Environmental Specification Requirements."

79. RPP-19233, "Technical Justification for Applicability of General WAC 246-247 Technology Standards for Tank Farm Facility Waste Tank Ventilation systems." **Not to be used for new design or modifications (See section 1 and Attachment B).**

80. RPP-22239, "Procurement Specification – Manual Operated Butterfly Valve 241-C Tank Farm Primary Ventilation."

81. RPP-22674, "Ventilation Systems Quality Assurance Level Evaluation and Determination."

82. RPP-36610, "Tank Farm Monitor and Control System Software Requirements Specification."

83. RPP-40431, "Technical Justification for Applicability of General WAC 246-247 Technology Standards for the 242A K1 Exhaust System Replacement."

84. RPP-ENV-56271, "Technical Basis Document for Air Emissions," Volume I: "Radioactive Air Emissions Compliance Summary for Air Emissions from TOC Facilities and Activities."

85. RPP-ENV-56271, "Technical Basis Document for Air Emissions," Volume II: Non-Radioactive Air Emissions Compliance Summary for Air Emissions from TOC Facilities and Activities."

86. RPP-RPT-49447, "Safety-Significant DST Primary Tank Ventilation Systems – Functions and Requirements Evaluation Document."

87. RPP-RPT-54544, "Evaluation of HEPA Filter Life Requirements and Impact to Tank Farm Operating Contractor."

88. RPP-SPEC-28675, "Radial HEPA Filter Procurement Specification."

89. RPP-SPEC-42592, "Procurement Specification Moisture Separator AP/SY Tank Farm Primary Ventilation."

90. RPP-SPEC-45605, "Double-Shell Tank Ventilation Subsystem Specification."

91. RPP-SPEC-56967, "Project T5L01 Low Activity Waste Pretreatment System Specification."

92. RPP-SPEC-60522, "General Procurement Specification for Standard Nuclear Grade High Efficiency Particulate Air (HEPA) Filters (For ASME AG-1, Section FC Compliant Filters)."

93. RPP-SPEC-60635, General Procurement Specification for Standard, Nuclear Grade, High Efficiency Particulate Air (HEPA) Filters (For Filters That Do Not Conform to ASME AG-1).

94. RPP-SPEC-61094, "General Equipment Procurement Specification for a Moisture Separator."

95. RPP-SPEC-61095, "General Equipment Procurement Specification for a Fan."

96. RPP-SPEC-61096, "Filter Housing General Equipment Procurement Specification."

97. SMACNA, "Accepted Industry Practice for Industrial Duct Construction."

98. SMACNA, "Fibrous Glass Duct Construction Standards."

99. SMACNA, "Guide for Free Standing Steel Stack Construction."

100. SMACNA, "HVAC Air Duct Leakage Test Manual."

101. SMACNA, "HVAC Duct Construction Standards – Metal and Flexible System Codes and Standards."

102. SMACNA, "HVAC Systems Duct Design."

103. SMACNA, "Industrial/Duct Construction (Class I)."

104. SMACNA, "Rectangular Industrial Duct Construction Standards."

105. SMACNA, "Round Industrial Duct Construction Standards."

106. SMACNA, "Seismic Restraint Manual – Guidelines for Mechanical Systems."

107. TFC-BSM-IRM-STD-01, "Software Life Cycle Standard."

108. TFC-ENG-DESIGN-C-10, "Engineering Calculations."

109. TFC-ENG-DESIGN-C-18, "Testing Practices."

110. TFC-ENG-DESIGN-C-45, "Control Development Process for Safety-Significant Structures, Systems, and Components."

111. TFC-ENG-DESIGN-C-52, "Technical Reviews."

112. TFC-ENG-DESIGN-C-57, "Development and Maintenance of Code of Record."

113. TFC-ENG-DESIGN-D-29, "Guidance for Inclusion of Human Factors in Design."

114. TFC-ENG-DESIGN-D-13.2, "Guidance for Applying Engineering Codes and Standards to Design."

115. TFC-ENG-DESIGN-P-17, "Design Verification."

116. TFC-ENG-DESIGN-P-43, "Control Development Process for Safety-Significant Safety Instrumented Systems."

117. TFC-ENG-DESIGN-P-44, "Safety Instrumented System Functional Safety & Performance Assessment Process."

118. TFC-ENG-STD-01, "Human Factors In Design."

119. TFC-ENG-STD-02, "Environmental/Seasonal Requirements for TOC Systems, Structures, and Components."

120. TFC-ENG-STD-06, "Design Loads for Tank Farm Facilities."

121. TFC-ENG-STD-13, "Ignition Source Controls for Work Controls in Potentially Flammable Atmospheres."

122. TFC-ENG-STD-14, "Setpoint Standard."

123. TFC-ENG-STD-19, "Alteration and Repair of ASME-Coded Pressure Systems."

124. TFC-ENG-STD-23, "Human-Machine Interface for Process Control Systems."

125. TFC-ENG-STD-36, "Hardware for ABB Process Control Systems."

126. TFC-ENG-STD-41, "Electrical Installations."

127. TFC-ENG-STD-45, "Design and Installations for Potentially Flammable Atmospheres."

128. TFC-ESHQ-ENV-STD-03, "Air Quality – Radioactive Emissions."

129. TFC-ESHQ-ENV-STD-05, "Radioactive Airborne Effluent Sampling."

130. TFC-ESHQ-FP-STD-02, "Fire Protection Design Criteria."

131. TFC-ESHQ-FP-STD-06, "Fire Hazard Analysis and Fire Protection Assessment Requirements."

132. TFC-ESHQ-Q_ADM-C-01, "Graded Quality Assurance."

133. TFC-ESHQ-S_IH-C-48, "Managing Tank Chemical Vapors."

134. TFC-ESHQ-S-STD-21, "Machine Guarding."

135. TFC-PLN-02, "Quality Assurance Program Description."

136. TFC-PLN-09, "Human Factors Program."

137. TFC-PLN-26, "Test Program Plan."

138. TFC-PLN-112, Graded Approach to Quality."

139. TFC-PRJ-SUT-C-01, "Test Plan Preparation."

140. TOC-PRES-16-2055, "Use of ASME B31.3 Piping as ASME AG-1 Duct."

141. UL 508A, "UL Standard for Safety Industrial Control Panels," 2010.

142. UL-586, "Standard for High-Efficiency, Particulate, Air Filter Units."

143. WAC 173 Ecology, Department Of; Chapter 303 – "Dangerous Waste Regulations", Chapter 400 – "General Regulations for Air Pollution Sources", Chapter 401, "Operating Permit Regulation", Chapter 460 – "Controls For New Sources of Toxic Air Pollutants", and Chapter 480 – "Ambient Air Quality Standards and Emission Limits for Radionuclides."

144. WAC 246-247-120 - Appendix B, "BARCT Compliance Demonstration."

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS

Attachment A contains the following information:

- Table A-1. Ventilation System Codes, Standards and Handbooks for Design/Procurement of Safety Significant and General Service Components.

- Table A-2. Applicable Implementing ASME AG-1 DIV II Articles for HVAC Design Requirements.

- Table A-3. Ventilation System Quality Assurance Clauses.

ATTACHMENT A– IMPLEMENTING CODES AND STANDARDS (cont.)

Attachment A, Table-1 identifies a list of implementing standards for design and modification of ventilation system SSCs. The implementation and maintenance of the design standards shall comply with the TFC-ENG-DESIGN-C-57 requirements. The design and installation of the ventilation system are impacted by legal or code requirements governing many aspects of design in accordance with TFC-ENG-DESIGN-D-13.2, "Guidance for Applying Engineering Codes and Standards to Design." When multiple codes apply, it is recommended to implement the most stringent requirements to ensure worker and public safety. The prescribed codes listed in Table 1 identify the minimum standards. The design agent may use engineering analysis and professional judgment for exceeding minimum design standards in order to ensure safety of workers and public; loss of life; or property are not compromised. Attachment B of this document provides clarification for applicability of the implementing codes.

Table A-1. Ventilation System Codes, Standards and Handbooks for Design/Procurement of Safety Significant and General Service Components.

Implementing Standards for HVAC and Nuclear Treatment Systems (NATS)			
Function/Component	**Non-Nuclear Facilities**	**Radiological or other Hazard Confinement**	**Safety Significant/Safety Class SSCs**
Ductwork	SMACNA Standards, ACGIH	IMC; SMACNA or ASME AG-1/ASME B31.3, ACGIH, DOE-STD-1066	ASME AG-1/ASME B31.3/ACGIH; DOE-STD-1066, ASME N 511
Fans	ASHRAE Handbook, ACGIH, ; AMCA 204; AMCA 210	ASME AG-1; Reference only: or ASHRAE Handbooks; AMCA 204; AMCA 210; NEMA MG1	ASME AG-1, ASME N 511; Reference only: , , ASHRAE Handbooks, AMCA 204, AMCA 210; IEEE 841
Tube & Fin Heating Coils or Cooling Coils	AHRI* 410; ASHRAE 33	AHRI-410; ASHRAE 33; ASME AG-1	ASME AG-1, ASME N 511,
Refrigeration Equipment	AHRI Standards	AHRI Standards or ASME AG-1	ASME AG-1, ASME N 511,
Air Heaters (electric only)	NFPA 70; NFPA 90A; NFPA 90B	NFPA 70, NFPA 90A, NFPA 90B, UL 1996; or ASME AG-1, NEC Article 500-516	ASME AG-1, ASME N 511,

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-1. Ventilation System Codes, Standards and Handbooks for Design/Procurement of Safety Significant and General Service Components.

Implementing Standards for HVAC and Nuclear Treatment Systems (NATS)			
Function Component	**Non-Nuclear Facilities**	**Radiological or other Hazard Confinement**	**Safety Significant/Safety Class SSCs**
Process Gas Treatment Equipment and Balancing	ASHRAE; AMCA; NEBB, TABB	ASHRAE, AMCA, NEBB, TABB	ASHRAE, AMCA, NEBB, TABB
Local Exhaust	ACGIH: AIHA Z9.2; ASHRAE Application Handbook Industrial local Exhaust System	ACGIH; AIHA Z9.2; ASHRAE Application Handbook Industrial local Exhaust System	ASME AG-1, ASME N 511
Moisture Separators	ASHRAE & Industrial Standards	ASHRAE & Industrial Standards or ASME AG-1, ASME N 511	ASME AG-1;, ASME N 511
Housings	NFPA 90A; AHRI Standards	NFPA 90A; AHRI; or ASME AG-1,	DOE-STD-1066; NFPA 90A, ASME AG-1, ASME N 511
Filtration	ASHRAE Standards 52.2	ASHRAE Standards 52.2	ASHRAE Standards 52.2
HEPA Filters	N/A	ASME AG-1; DOE-STD-3020; NFPA 90A; UL-586	ASME AG-1, ASME N 511, DOE-STD-3020;NFPA 90A; UL 586
Function/Component	Non-Nuclear Facilities	Radiological or other Hazard Confinement	Safety Significant/Safety Class SSCs
Prefilters (Medium Efficiency Filters)	ASHRAE Standard 52.2	ASHRAE Standard 52.2	ASME AG-1
Carbon Filters	N/A	ASME AG-1, Sections FD, FF & FF	ASME AG-1, ASME N 511
Filter Frames	ASHRAE & Industrial Standards	ASME AG-1	ASME AG-1
Dust Collectors	ANSI/ASHRAE 199	ANSI/ASHRAE 199	ANSI/ASHRAE 199
Dampers	SMACNA; NFPA 90A; UL 555/555S; NFPA 801; AMCA 500	DOE-STD-1066, NFPA 90A, ASHRAE & Industrial Standards or ASME AG-1; AMCA 500	ASME AG-1, ASME N 511, DOE-STD-1066; NFPA 90A
Condensate/Seal pot drain lines/Plumbing Equipment	IPC	IPC/ASME B31.3	IPC/ ASME B31.3

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-1. Ventilation System Codes, Standards and Handbooks for Design/Procurement of Safety Significant and General Service Components.

Implementing Standards for HVAC and Nuclear Treatment Systems (NATS)			
Function Component	**Non-Nuclear Facilities**	**Radiological or other Hazard Confinement**	**Safety Significant/Safety Class SSCs**
Electrical Power and I&C Circuits	NFPA 70/70E; NEMA ICS 6; UL 508/508A	NFPA 70/70E; NEMA ICS 6; UL 508/508A	NFPA 70/70E; NEMA ICS 6; UL 508/508A
Electrical Heat Tracing	IEEE 515; NECA 202: NFPA 70	IEEE 515; NECA 202: NFPA 70	IEEE 515; NECA 202; NFPA 70
Refrigeration Units	AHRI Standards	AHRI Standards; ASME AG-1	ASME AG-1
Control Valves	NFPA 90A; ISA 20	NFPA 90A; ISA 20; ASME B16.34	NFPA 90A ISA 20, ASME B16.34
Lab Ventilation/Local Exhaust	AIHA Z9.5, NFPA 45 and 91. Reference only: ASHRAE Application Handbook, 'Laboratories', ACGIH	AIHA Z9.5 or ASME AG-1, NFPA 45 and 91. Reference only: ASHRAE Applications Handbook, 'Laboratories', ACGIH	ASME AG-1, ACGIH
Instrumentation and Controls	UL 508-A; ASHRAE 135; ISA 5.1/5.4; NFPA 70E	ASHRAE, Industrial Standards, ISA 5.1/5.4, NFPA 70E, UL 508-A	ASHRAE, Industrial Standards, ISA 5.1/5.4, ANSI/ISA-84.00.01; NFPA 70E; UL 508-A
Structural Supports and Requirements	ASCE 7; IBC; SMACNA STANDARDS; MSS SP58/59	ASCE 7; IBC; SMACNA; or ASME AG-1	ASME AG-1
Stack	SMACNA "Guide for Free Standing Steel Stack Construction", ASHRAE Handbook NFPA 780	ASME STS-1; SMACNA "Guide for Free Standing Steel Stack Construction", ASHRAE Handbook - Applications, Chapter 45; DOE-HDBK-1169; NFPA 780	ASME STS-1; DOE-HDBK-1169; NFPA 780
Effluent Monitoring System	N/A	ANSI/HPS N13.1	ANSI/HPS N13.1
Function/Component	Non-Nuclear Facilities	Radiological or other Hazard Confinement	Safety Significant/Safety Class SSCs
Lifting Devices and Components	DOE/RL-92-36; ASME B30.20/BTH-1	DOE/RL-92-36; ASME B30.20/BTH-1	DOE/RL-92-36; ASME B30.20/BTH-1
Lightning Protection	NFPA 780	NFPA 780	NFPA 780
Thermal Insulation	NFPA 255; UL 723	NFPA 255; UL 723	NFPA 255; UL 723

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

AIHA-American Industrial Hygiene Assoc.
Z9.2, Fundamentals Governing the Design and Operation of Local Exhaust Systems
Z9.5, Laboratory Ventilation

AMCA-Air Movement and Control Assoc.
99, Standards Handbook
261, Directory of Products Licensed to Bear the AMCA Certified Ratings Seal

ANS-American Nuclear Society
59.2, Safety Criteria for HVAC Systems Located Outside Primary Containment

AHRI-Air-Conditioning, Heating, and Refrigeration Institute
410, Forced-Circulation Air-Cooling and Air-Heating Coils
430, Central-Station Air-Handling Units
450, Water-Cooled Refrigerant Condensers, Remote Type

ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
DG-1, "Heating, Ventilating, and Air-Conditioning Design Guide for Department of Energy Nuclear Facilities."
Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

DOE Directives http://www.directives.doe.gov/
Guide 420.1-1A, Nonreactor Nuclear Safety Design Criteria and Explosive Safety Criteria Guide for use with DOE O 420.1C Facility Safety
DOE-HDBK-1169, Nuclear Air Cleaning Handbook
DOE-STD-1132, Design Considerations
DOE-STD-3020, Specification for HEPA Filters used by DOE Contractors

NFPA – National Fire Protection Assoc.
45, Fire Protection for Laboratories Using Chemicals
90A, Installation of Air Conditioning and Ventilation Systems [use vice UMC for smoke detection and fire dampers]
91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids (National Fire Codes, vol. 4)
801, Standard for Fire Protection for Facilities Handling Radioactive Materials (National Fire Codes, vol. 11)

UL – Underwriters Laboratories
555, Safety - Fire Dampers
555S, Safety - Smoke Dampers

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Attachment A, Table A-2 identifies a list of applicable ASME AG-1 Articles for designing ventilation system systems, structures, components (SSCs) in the TOC Nuclear facilities. ASME AG-1 Code applies only to individual components in a system. ASME AG-1 does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. The design and procurement specifications delineate the design, qualification, and quality assurance requirements appropriate for the application for meeting the AG-1 component requirements.

This table lists applicable components used in the ventilation systems. Components listed as “Not used” have not been identified in current TOC ventilation system designs for the purpose of determining the extent of ASME AG-1 Section applicability , e.g., safety Related Systems. Under each Article, specific paragraph and subparagraphs are identified for further clarification as they are pertinent to specific component function requirements. For example, Article BA Section BA- 4000 identifies BA-4124 environmental and seismic qualification needs further clarification by using Note 7. Note 7 states based on the service levels, i.e., Service Level A (retrieval) or Service Level B designer established the requirements of AA-4441 (DVR) in the design specification. The designer then can use the AA-4443 design verification by comparative evaluation report to meet the DVR. Note 7 also identifies that AA-4442 design verification test is not required when DVR is done by either analysis or comparative means.

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-2. Applicable Implementing ASME AG-1 Articles for HVAC Design Requirements.

AG-1	1000 Introduction	2000 Referenced Document	3000 Materials	4000 Design	5000 Inspection and Testing	6000 Fabrication	7000 Packaging and Shipping	8000 Quality Assurance	9000 Nameplates	Mandatory/ Non-Mandatory Appendix (20)
SECTION AA (1,7) Common Article	X AA-1120	X	X	X (1,4,7,13,15)	X (1,4,7,13,15, 21)	X (21)	X (5,13, 15, 21)	X (5,21)	X (13,21)	AA-10000 (5,13,15) AA-A-1000 (16), AA-A-2000 (1,7,16), AA-A-3000, AA-A-4000 (7), AA-A-5100 (1, 7), AA-A-6000 (1, 7), AA-A-7000 (1,7), AA-B-1000 (1, 7), AA-B-2000 (1,7)
SECTION BA Fans and Blowers	X	X	X	X BA-4122 (7), BA-4124 (7), BA-4132 (1), 4140 (13), BA-4342.1 (3). BA-4343.6 (3) BA-4431 (13, 16), BA-4432 (13)	X BA-5112.3 (13), BA-5120 (13), BA-5143 (13), 5142(13),(BA-5150 (13)	X BA-6200 (5)	X (5, 13, 15)	X (5), (13) BA-8300e (17)	X(13)	BA-A/B
SECTION CA (7,17) (Not used) Conditioning Equipment	X (7)	X (7)	X (7)	X (7)	X (7)	X (7)	X (5, 13, 15,7)	X (5,7)	X (7, 13)	CA-I (7), CA-II, CA-II-2000 (7), CA-II-3000 (7), CA-II-4200 (7), CA-II-5000, CA-A, CA-B-1000 (7), CB-B-2000 (7),
SECTION DA Dampers and Louvers (9, 14)	X DA-1210 (14), DA-1350 (13), DA-1370 (13), DA-1390 (13, 15, 17)	X (13,15)	X (4,15)	X (7,13,14) DA-4110 (13), DA-4120 (1, 13, 17), (DA-4130 (7, 13, 14), DA-4450 (13,17)	X DA-5130 & DA-5140 (9, 13, 15)	X (9, 13,15)	X (5,13,15)	X (5, 13,15)	X (13)	DA-I (13,15), DA-II (13)

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-2. Applicable Implementing ASME AG-1 Articles for HVAC Design Requirements. (cont.)

AG-1	1000 Introduction	2000 Referenced Document	3000 Materials	4000 Design	5000 Inspection and Testing	6000 Fabrication	7000 Packaging and Shipping	8000 Quality Assurance	9000 Nameplates	Mandatory/ Non-Mandatory Appendix (20)
SECTION FA Moisture Separators	X	X	X (6)	X FA-4320 (7, 13), FA-4330 (7, 13), FA-5100 (7)	X FA-5100 (1,8)	X	X (5, 13, 15)	X (5,8)	X (6, 13))	FA-A
SECTION FC HEPA Filters	X	X	X FC-3200 (6)	X (7) FC-4300 (1)	X FC-5100, FC-5130 (1,18)	X	X (5, 13, 15)	X (5,13)	X (13)	FC-I, FC-A (5,13)
SECTION FD (Not used) TYPE II Adsorber Cells										
SECTION FE (Not used) TYPE III Adsorbers										
SECTION FF (Not used) Adsorbent Media										
SECTION FG (7) Mounting Frames for Air-Cleaning Equipment (Walk-in Style)	X	X	X	X (7)	X	X	X (5,13,15)	X (5)	X (13)	X

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-2. Applicable Implementing ASME AG-1 Articles for HVAC Design Requirements. (cont.)

AG-1	1000 Introduction	2000 Referenced Document	3000 Materials	4000 Design	5000 Inspection and Testing	6000 Fabrication	7000 Packaging and Shipping	8000 Quality Assurance	9000 Nameplates	Mandatory/ Non-Mandatory Appendix (20)
SECTION FH (Not used) Other Adsorbers										
SECTION FI (Not used) Metal Media Filters										
SECTION FJ (Not used) Low Efficiency Filters										
SECTION IA (Instrumentation and Controls)	X (13) IA-1120 (13)	X (13)	X (13)	X (1,13) IA-4120, IA-4140, IA-4200 (7) IA-4210, IA-4300 (22), IA-4420	X (1, 13)	X (13)	X (5,13)	X (5, 13, 22)	X (13)	IA-A, IA-B, IA-C, Table IA-C-1000
SECTION HA Housings	X	X	X	X (7) HA-4247 (13), HA-4248 (9) HA-4434 (9), HA-4533 (2) HA-4600 (13)	X	X	X (5, 13,15)	X (5)	X (13)	HA-A, HA-B, HA-C (10), HA-D (19) as applicable
SECTION RA (Not used) Refrigeration Equipment										
SECTION SA Ductwork	X	X	X (13, 15)	X (13) SA-4200 (1, 7), SA-4533*(d)* (12) SA-4540 (11, 12), SA-4600*(g)* (9)	X SA-5360 (10, 11)	X	X (5,13,15)	X (5)	X	SA-A, SA-B (SA-B-1310 & SA-B-1410) (2, 10, 11), SA-C

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-2. Applicable Implementing ASME AG-1 Articles for HVAC Design Requirements. (cont.)

Clarification Notes:

1. Design qualification is required for items designed to or natural phenomena hazard categories commensurate to their safety functions as described in the documented safety analysis (NDCs, and SS/SC Seismic).
2. Typical ventilation scheme for contaminated and interspace space under negative pressure at TOC facilities. Other schemes need further evaluation for determination of functional and operational requirements.
3. Variable inlet vanes for reducing the rated volume flow should be considered per facility design requirements.
4. Design verification per normal operation as required by the system functional requirements. Service level A SSCs or systems do not require seismic analysis consideration. Manufacturer datasheet may be used for allowable design pressures.
5. Apply Grading method (TFC-PLN-112) and documented in QAP to address the integrity of facility system and consequences of product failure or service. Perform QA grading based on various classification criteria and grading levels associated with risk, functional classification, quality levels. Requirements to impose appropriate technical and quality assurance program such as personnel qualification, process control to correct items, document and record, work process, performance and design, inspection and acceptance testing, S/CI, etc. (TFC-PLN-112 Attachment D Structure, system, component grading guide).
6. UL-900 (see Appendix B).
7. Design verification is required for service levels, i.e., Service Level A (retrieval), Service Level B. Design verification listed in AA-4441 is required. AA-4442 design verification test is not required. AA-4442 design verification test is not required when DVR is done by either analysis or comparative means Use of AA-4443 is permissible (if comparable designs are in accordance with AG-1).
8. Supplier's quality assurance program shall consider controls the supplier's processes. Certificate of Conformance shall include all applicable purchase order, i.e., material, process, procurement for repair and maintenance of equipment, deviations, applicable to items and services, acceptance testing, shipment, welding qualifications, item performance, including a SC/I, etc.
9. Exempt for SST/DST systems.
10. Per Construction Code of Record requirements.
11. Where ASME B31.3 piping is used in lieu of AG-1 ductwork, leakage shall comply with ASME B31.3 Pneumatic Leak Test per 345.5 requirements (shop test), and at pressure of 1.25% of the fan rated pressure for in-service testing.
12. EDL approval of technical justification is required.
13. Design specifications shall identify specific requirements based on the functional and operational requirements, i.e., Service Levels, internal and external environmental condition, leakage rates, installations to name a few.
14. ASME B16.34 is an acceptable substitute for in-line dampers associated with ductworks designed to ASME B31.3.
15. Evaluated on a case-by-case basis depending on safety function. A) Damper torqueing requirements shall be required for systems that have an active safety function. The DSA for SST, DSTs, 242-A, and 222-S active ventilation system do not currently identify active safety features that would require damper qualification. A review of the project safety basis or hazard analysis must be performed when making a determination on damper qualification during the design. B) CMTR is required based on the safety function. C) Certificate of Compliance is required.
16. Design and qualification by Analysis per AG-1 Non-mandatory Appendix AA-A, Article AA-A-1000. Project specifications shall provide specific instructions regarding the modeling techniques per the required component conditions.
17. SS/SC only – Ventilation system components that are required to perform their safety functions shall comply with the applicable AG-1 Service level B requirements.
18. See RPP-SPEC-60522.
19. Performance test for qualification of sampling manifolds shall be provided for unique sampling manifolds array of filters.
20. Non-mandatory appendices are identified for considerations in design as applicable
21. See component sections for applicability.
22. Per TFC-ENG-DESIGN-P-43.

ATTACHMENT A – IMPLEMENTING CODES AND STANDARDS (cont.)

Table A-3. Ventilation System Quality Assurance Clauses.

Component	Item	* Quality Clause(s) (1, 2)
AHU Train	HEPA Filters	B01, B04, B32, B33, B43, B52, B76, B85
	HEPA Filter Frames	B01, B04, B25, B28, B32, B33, B52, B76, B85
	Housing	B01, B04, B25, B28, B49, B52, B85
	Prefilters	B32, B33, B79
	Fan	B49*, B52, B76, B79, B85*
	Motors	B65, B66, B76
	Stack	B25, B28, B49, B76
	Moisture Separator	B25, B28, B49*, B79
	Differential Pressure Indicator	B61, B79
Components	Butterfly Valves	B32, B49*, B52, B76, B79
	Globe & Gate Valves	B32, B49*, B52,B76, B79,
	Gaskets	B32, B43, B79
	Insulation	B32, B79
	Condensate collection	B49*, B79
	Heat Trace	B32, B65/B66, B79
	Miscellaneous Small Fittings, Fasteners	B73/B76, B79
Ductwork	Permanent Ductwork	B25/B28/B49*, B79
	Flanges	B25/B28/B49*, B79
	Duct Fittings	B25/B28/B49*, B79
	Expansion Joints	B49*, B79
	In-Line Flow Controllers	B25/B28/B49*, B32, B52, B76, B79
	Vacuum Dampers/ Devices	B25/B28/B49*, B32, B52, B73, B79
	Fittings & Fasteners, Swagelok Fittings	B32, B49*, B76, B79
	Ductwork Supports	B32, B49*, B79
Instrumentation & \Controls	Wiring components (breakers)	B32, B65, B66, B76, B79
	I&C items	B14, B15, B32, B33, B79
Stack Sampling & Monitoring	CAM	B32, B76, B79
	Record Sampler	B76, B79
	Flow Control Valves	B76, B79
	Vacuum Pump	B32, B76, B79
Glycol Heating	Tank, pipe, pumps	B32, B79
	Emersion heater	B32, B65/B66
	Spec. Assembly	B65/B66, B76, B79

*

1. CMTR is required for components and items exposed to internal system corrosive chemical media. DST inline component replacements may require CMTR in lieu of C of C based on the functionality and risk (Refer to DSA RPP-13033 Chapter 4, Table 4.4.10-1 and RPP-22674).
2. Include QA clauses B32, B33, B34, B37, or B43 when upgrading SSCs to SS classification.

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT

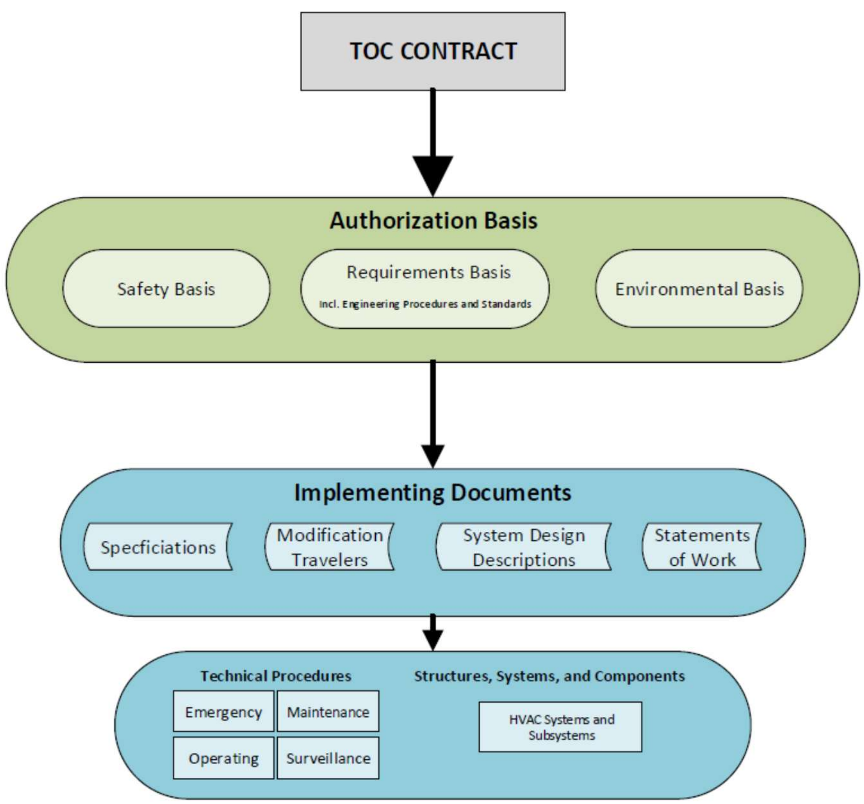
1.0 Scope

The purpose of this attachment is to provide clarifications for the graded use of the ASME AG-1 code in the current WRPS ventilation system components. Interpretations and clarifications of ASME AG-1 are established based on the preventive or mitigative strategy for current hazard analysis identified in the facility documented safety analysis coupled with WAC 246-247-120, Appendix B, “best available radionuclide control technology (BARCT) Compliance Demonstration.” This would be for devices that demonstrate the effectiveness of the abatement technology from entry of radionuclides into the ventilated vapor space to release to the environment.

2.0 Background

This standard provides requirements to the TOC and subcontract engineers on HVAC system design, material selection, fabrication, construction/installation, and construction acceptance testing requirements as required by the TOC Contract as illustrated by Figure B-1.

Figure B-1. Simplified Flow-Down of Requirements for Design of HVAC Systems.



ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

Figure 1 depicts a document hierarchy, which shows how requirements flow down from the Company's contract to TOC Authorization Basis (including Administrative Procedures and Standards), Implementing Documents, and TOC Technical Procedures and SSCs.

Attachment J.2 of the TOC Contract, DE-AC27-08RV14800, Modification Number 274, 329, and 364 requires compliance with all applicable federal and state regulations. Section J.2 of the TOC Contract also requires the TOC to uphold specific DOE Orders (DOE O) including DOE O 420.1C, "Facility Safety."

DOE O 420.1C, "Facility Safety" is both a Safety and Requirements Basis. The Safety Basis is the documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment. The Requirements Basis consists of the TOC Contract and specific Safety Basis documents that achieve protection for worker, public health, safety, the environment, and flow down into procedures.

Environmental statutory and regulatory requirements include federal and state regulations and permits, DOE Order requirements, and the requirements defined in the Tri-Party Agreement. In addition, the TOC complies with the tank farm environmental impact statement (DOE/EIS-0189), and Environmental Management System Description (TFC-PLN-123). ASME AG-1 is a comprehensive and detailed component based code covering all aspects of design, fabrication, delivery, installation, and testing of nuclear ventilation components. ASME AG-1 originally was published in 1985 as a new proposed code that covers essential ventilation, air cleaning and process off-gas treatment equipment for all types of nuclear facilities. ASME N511 was published in 2008 to cover in-service testing as a means to verify that the systems continue to perform their intended function, monitor performance and equipment, and establish system performance trends.

3.0 ASME AG-1 Applicability

ASME AG-1 applies to individual components in a system and does not cover any functional system design requirements or sizing of complete systems, or any operating characteristics of these systems. It is the owner or owner designee (WRPS) responsibility for meeting the requirements of ASME AG-1.

ASME AG-1 states that, "The requirements of ASME AG-1 for air and gas treatment components may be used for engineered safety features systems and normal systems in nuclear power generation facilities, and for air cleaning systems in other nuclear facilities. The design and procurement specifications shall delineate the design, qualification and quality assurance requirements appropriate for the application." (AG-1 AA-1120).

Design and testing verification of ventilation systems equipment shall be in accordance with methods identified in the applicable industry standards. Where there are conflicts between implementing standards, ASME AG-1 will take precedent. Seismic qualification testing shall not include dynamic test as stated in ASME AG-1, Article AA-4300.

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

4.0 Clarifications and Interpretations

This section of the standard provides clarifications for use of applicable ASME AG-1 components in design of new TOC facility ventilation systems or significant modifications of existing facilities, i.e., filter housing, ductworks, Moisture Separators, fans etc. Clarification and interpretations are needed in order to apply specific requirements in the design specification.

The Design specification includes Federal and state laws and regulations, DOE requirements, and specific design criteria defined by national codes and standards. This includes national codes and standards invoked through 10 CFR 830, "Nuclear Safety Management;" 10 CFR 851, "Worker Safety and Health Program;" the design criteria in DOE O 420.1C, "Facility Safety;" and applicable state and local building codes. While the standards listed in subsections of 10 FR 851 must be met, more recent editions of the standards may be used as long as the more recent standards are at least as protective as the edition specified in 10 CFR 851.

New facility construction must conform to both the national consensus industry standards and the strictest model building codes, (e.g., DOE-STD-1066, International Building Code (IBC) and National Fire Protection Association (NFPA), for the State of Washington. WAC 246-247-120 requires TOC comply with the requirements of the ASME AG-1, ASME N509, ASME N510, ASME N511, ERDA 76-21, ACGIH, NQA-1, etc.

Historically, documents such as RPP-19233 and RPP-40431were prepared for providing alternative approach to use of ASME AG-1 design incorrectly. Such documents represent a code of record for those components and systems. However, this standard is effective for new ventilation design projects as discussed in section 2.0 upon release of this document. The engineer using this revision of the standard may refer to the previous documents to ensure that alternatives used in the past will not conflict with the latest revision of the standard requirements. Conflict between the past and new requirements shall be identified and approved by the standard owner. For example, RPP-19233 identifies the component conditions associated with the SST ventilation retrieval systems based on Service Level A (NDC-0, no seismic analysis) because retrieval activities are considered temporary construction. In the later revision of the document, this alternative approach was extended to its applicability to DST ventilation systems that are designed to Service Level B (NDC-2/DC-2) requirements incorrectly. This alternative approach is no longer acceptable and DST ventilation system SSCs are required to meet NDC-2 seismic requirements as stated in TFC-ENG-STD-06.

Items below provide a list of clarifications for addressing the required applicable requirements for new TOC facility ventilation systems or significant modifications of existing Waste Tank Ventilation Systems:

- Ductwork design per ASME B31.3
- Clarification for use of ASME AG-1, TA-III pressure testing requirements for in-service for the piping system used in the ventilation systems
- Moisture Separator and Housing – ASME AG-1, Article FA and HA
- Pressure testing moisture separator housing per ASME AG-1, Article HA and requirement of TA-III
- Fans and blowers ASME AG-1, Article FA
- HEPA filter service life requirements

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

- Filter Housing fire protection requirement (DOE-STD-1066 – Fire Protection).

5.0 Ductwork – ASME AG-1, Section SA

The code on nuclear air and gas treatment ASME AG-1, Section AA-2000 includes use of American ASME, ASTM, ASHRAE, SMACNA design, construction, and testing of the ventilation systems components as either parent or daughter standards.

TOC ductwork are determined to be Duct Class 4 and 5 (Zero detectable leak at any pressure up to 20 in. w.g. per ERDA 76-21 Table 5.6). Design of ductwork per the requirements of ASME B31.3 piping is permissible per ERDA 76-21 and therefore requires no equivalency or deviation from ASME AG-1 Section SA. Furthermore, DOE HDBK-1169-2003, Section 5, "External Components," requires that ductwork to meet leak tightness requirements of zero detectable leak at any test pressure up to 20 in. w.g. (water gauge) for level five duct (Table 5.6), or pipe meeting requirements of American National Standard for pressure Piping, e.g. ASME B 31.1, ASME B31.3, ASME B31.5, ASME B31.9 to name a few. etc., or the ASME Boiler and Pressure Vessel Code (B&PV), Section VIII (TOC-PRES-16-2055-FP).

TOC has the responsibility to select the Code section(s) that apply to a proposed installation. The ASME B31 Code for Pressure Piping consists of a number of individually published Sections such as ASME B31.1, ASME B31.3, ASME B31.5, etc. The rules contained in each section reflect the kinds of piping installations that the responsible subcommittee had in mind during development of that section. Based on the waste tank contents, TOC has identified ASME B31.3 suitable for the waste transfer piping and ventilation ductwork at the tank farm facilities. It is also permissible to use the ASME B31.9, Building Service Piping and ASME B31.5 for Refrigeration piping and Heat Transfer Components in industrial, commercial, and public buildings, and in multi-unit residences.

ASME B31.3, Chapters II, "Design;" III, "Materials;" IV, "Standards For Piping Components;" V, "Fabrication, Assembly, and Erection;" VI, "Inspection, Examination, and Testing;" and VII, "Conditions for Normal Fluid;" are more stringent than ASME AG-1 AA/SA-3000, 4000, 5000, 6000, SA-A, SA-B, and SA-C, requirements. Design loads for use under B31.3 or ASME AG-1 are established in accordance with TFC-ENG-STD-06, including the need for seismic analysis.

The ductwork shall meet requirements of ASME N509, Section 5.10 and ASME AG-1, Section SA when designed to ASME AG-1. Ductwork meeting requirements for leakage Class I, shall meet requirements of the American National Standard for Pressure Piping or the ASME Boiler and Pressure Vessel Code.

Pipe and piping components used for ventilation systems shall be 300 series stainless steel and comply with ASME B31.3 as allowed by AG-1, AA-3000 Table AA-3100. ASME B 31.3, "Process Piping," Appendix A, listing of piping materials for the ventilation systems are equivalent to ductwork materials in ASME AG-1, AA-3000, SA, "Materials."

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

Guidelines for Autopipe analysis of pipe as ductwork:

1. ASME AG-1 allows ducting constructed using pipe welded and analyzed per ASME B31.3. This is typically done at Hanford for convenience: material availability, weld definition, strength, testing definition, etc. Individually fabricated duct sections are treated as pipe spools and are fabricated, inspected and hydrostatically tested per ASME B31.3 requirements.

2. The assembled/installed system is an ASME AG-1 Air Handling System, NOT an ASME B31.3 piping system. The differentiation becomes important due to the fact that a nuclear air and gas treatment system is ALLOWED to have calculated/specified leak rates (a piping system is not) and ASME AG-1 is referenced to determine the maximum test pressure of the system.

3. Autopipe performs code compliance calculations in gauge pressure, not absolute, just like the various pipe codes (ASME B31.1, B31.3, B31.9, etc.). Code compliance considers mechanical loads plus positive internal pressure. Pipe code stress calculations do not consider negative relative pressures.

4. The installed duct system will have a specified maximum positive internal pressure and maximum temperature specified in the specification documentation. Per ASME AG-1, Article TA-III-4000, pressure testing is required at 125% of the maximum operating pressure, not to exceed the structural capability of the system. This maximum positive pressure and elevated temperature is used in the Autopipe model for the pipe stress calculations. Reactions and nozzle loads from the Autopipe results are used for required design checks of interfacing equipment (supports, pressure vessels, etc.).

5. External pressure loads on the duct sections and components need to be checked independently to a pressure vessel code to verify the design wall thickness or stiffening requirements. The B31 Pipe codes point to the ASME BPVC, Section VIII, Division 1 for these requirements (UG-28, UG-29 and UG-30).

6. Within the Autopipe model, the negative pressure case is added as a second temperature case (a T2 case) with pressure analysis turned ON. The P2 case will generate the duct (pipe) displacements and associated reactions at the system supports and nozzle connections for other required design checks of interfacing equipment/components. The T2/P2 case pipe stresses are not considered for code compliance (per item #3).

Pipes (e.g., ASTM A312, etc.) used as ventilation system ducting shall be tested per ASME B31.3, Section 345.2, "General Requirements for Leak Tests." It is often easiest to specify leak testing of these duct sections/pipe spools during the manufacturing process so the maximum code required test pressure could be used during leak tests providing the greatest acuity in meeting quality assurance test thresholds and Code requirements.

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

Since TOC designed ventilation systems frequently operate under external pressure and typically include air and gas treatment components built per ASME AG-1 requirements, the AG-1 components will often be the limiting factor for the specification of the overall installed system design pressure. Therefore, leak testing of purchased ASMEAG-1 compliant equipment should likewise be specified during the manufacturing process, which will also allow testing to the maximum required test pressure defined in the ASME AG-1 Code on Nuclear Air and Gas Treatment.

If hydrostatic testing of the complete installed ventilation system is required, ASME B31.3, Section 345.4.3, “Hydrostatic Test of Piping with Vessels as a System,” should be referenced. ASME AG-1 test pressures will typically be limited to 125% of the system design pressure.

6.0 ASME B31.3 Design and Testing Guidelines

Guidance for appropriate structural design calculation requirements for meeting ASME B 31.3 load path elements:

1. Loads or reaction forces at interfacing equipment (nozzle loads) must be considered and established. This includes tank risers and previously installed interfacing equipment.

2. ASME B31.3 component qualification to listed material and component standards must be established in the calculation or documented in design drawings. Unlisted component qualification where applicable shall be performed within a calculation or report.

3. The design of flanged assemblies must consider the bolting and gaskets as a structural system and analyzed to B31.3 requirements. The acceptable range of bolt torque shall be stated on design drawings for dry and lubricated threads.

Guidelines for conducting acceptable leak rates for the ventilation systems comprising of ASME AG-1, ASME B31.3 Normal Fluid category pipe implementing codes:

1. Shop and post installation in-service of ASME B 31.3 duct piping normal fluid category leak rate shall be per 345.5 Testing requirements. Appendix F Guidance and Precautionary Considerations relating to particular fluid services and piping applications.

2. The tank riser flange connections post installation shall be tested in accordance to visual/audio inspection as allowed by both ASME B31.3 and/or ASME AG-1.

3. Normal Fluid Service piping shall be examined per ASME B31.3 section 341.4 “Extent of Required Examination”, unless otherwise stated in the specification.

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

Ductwork in-line components designed to other standards are included in the ventilation systems (i.e., moisture separator, filter housing, fans, etc.). The ASME AG-1 pneumatic pressure boundary-testing requirement of 1.25 times the design pressure of the system will take precedence in lieu of ASME B 31.3 testing requirements. The ductwork/pipe shall be pressure tested at1.25 times the design pressure to meet ASME AG-1 TA-III-4000, “Pressure Decay Test,” requirement or 15 psig, whichever is greater per ASME B31.3, section 345.5, “Leak Testing with Negative Pressure.”

7.0 ASME AG-1 Section HA, Housings, and FA - Moisture Separator

The housing and housing supports shall be designed in accordance with ASME AG-1 Section HA and AA. The design specification shall address the specific design requirements considering load combinations appropriate design and service limits for design of the equipment per IBC and ASCE 7 loads. IBC and ASCE 7 requirements bound the ASME AG-1 AA-4200 Design Criteria.

The housing shall meet pneumatic pressure testing of 1.25 times the design pressure of the system as stated in mandatory Appendix TA-III.

Design specification shall identify the required qualification testing for the moisture separators as stated in FA-5100. Design verification by comparative evaluation report based on the suppliers’ documented past performance and survey is acceptable per AA-4443.

The moisture separator housing shall meet pneumatic pressure testing of 1.25 times the design pressure of the system.

The defense against filter and duct fires is the design of the ventilation and air cleaning system. Because the loss of filters in the ESF systems may be the most serious consequence of a fire, the first decision must be to use fire-resistant filters, that is, HEPA filters that meet the requirements of UL-586 and prefilters that meet the requirements of UL-900. Moisture separator pads and pre-filters are typically made from fibrous media and may contain resins and epoxy systems, which can introduce any combustible materials to the ESF systems. However, moisture separator pads being used in the TOC facility ventilation systems, e.g., DST/SST ventilation systems, are made of corrosion resistant stainless steel wire mesh and are not combustible and therefore, do not have to meet the UL-900 requirements. Additionally, addition of the moisture separator to a complete air cleaning system is not covered by the ASME AG-1 FA section. WRPS uses applicable ASME AG-1 moisture separator requirements in the project specifications for consideration of design, fabrication, and testing for the TOC operating facilities.

TOC moisture separators are located outside the non-ESF (not safety related) High Efficiency Air Cleaning Systems and they are constructed of wire mesh pads and stainless steel housing including inlet and outlet stainless steel transition pieces to the piping in advance of the filter housing. ASME AG-1 strict requirements for meeting the UL-900 requirement is not applicable to the TOC process air stream ventilation systems moisture separator pads and because they are not credited for any post-accident cleanup systems.

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

8.0 ASME AG-1 – BA - Fans and Blowers

Ventilation system fans are required to comply with applicable ASME AG-1 (Section BA) with the following clarifications:

Fan Performance Ratings. Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating." Fan performance shall be based on AMCA 210 standard air (68 °F, 0.075 lbm/ft^3). Fans shall be certified as complying with AMCA 210. The ventilation fans shall be constructed of non-sparking materials per AMCA Standard 99-0401.

Fan shall be selected to provide stable operation at plus or minus 5 percent of airflow and plus or minus 10 percent of total pressure of design conditions as listed in the fan specification. Fan performance shall be certified as complying with AMCA 210.

The motor shall be a totally enclosed inverter duty motor designed for variable speed operation to allow for a constant air volume at changing pressure conditions. The motor shall be tested and rated in accordance with IEEE-112 and NEMA MG-1 as determined by the manufacturer. IEEE 841, "Standard for Petroleum and Chemical Industry," use should be considered for severe duty applications.

9.0 HEPA Filter Service Life

HEPA filters have a finite lifetime, and deteriorate more rapidly under harsh conditions. Factors such as temperature, humidity, dust loading, rough handling and very high radiation levels can adversely affect HEPA life. HEPA filters are marked with their date of manufacture. HEPA filters shall be stored per the requirements for level B items in accordance with TFC-PLN-02 (Part II – Chapter 2.2), TFC-BSM-CP_CPR-C-18 (Section 4.2.3) and ASME AG-1, Section FC HEPA filters or in accordance with the manufacturer's requirements, whichever is more restrictive. The recommended HEPA filter life for TOC ventilation systems are documented in RPP- RPT-54544, Rev. 2. This document has received DOE/ORP and WDOH concurrence. The recommended maximum storage life is 10 years and the recommended operating (in-service life) is 10 years. The total life of a HEPA filter from date of manufacture to disposal shall not exceed 20 years.

10.0 ASME AG-1 HA – Housing – Fire protection requirements (DOE-STD-l066, Fire Protection)

The DST ventilation systems are exempt from DOE-STD-1066-99 Chapter 14 (10-ESD-018, dated July 26, 2010).

The SST ventilation systems are exempt from DOE-STD-1066-99 Chapter 14 (16-TF-0024, dated March 4, 2016).

The 242-A Evaporator building ventilation system compliance with DOE-STD-1066-99 is documented in letter 10-ESD-028, dated July 26, 2010.

ATTACHMENT B – INTERPRETATION AND CLARIFICATION GUIDANCE FOR USE OF CODE ON NUCLEAR AIR AND GAS TREATMENT (cont.)

11.0 The ASME AG-1-2017 release with the Summary of Changes listed has no impact on the current revision of this standard, and therefore, no further gap evaluation is required. Changes are mostly editorial and a correction to the previous revision without affect to the design, fabrication, and testing of the components. Addition of the components and sections are considered for design of the items under the ASME AG-1 scope.