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No: 72400-83-054

TO: (Name, Organization, Internal Address)
Holders of RHO-MA-139,
Environmental Protection Manual

FROM: (Name, Organization, Internal Address, Phone)
G. F. Boothe
Environmental Protection
Department
222B/200 East Area/3-2336

Subject: Revised Edition of RHO-MA-139, Environmental Protection Manual

The attached copy of RHO-MA-139, Environmental Protection Manual, has been revised to reflect changes in the Rockwell Hanford Operations organization and to make some changes in format. This edition replaces the entire contents of the manual and the old edition should be discarded.

G. F. Boothe, Manager
Environmental Protection
Department

GFB/VQH/sac

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RHO-MA-139

ENVIRONMENTAL PROTECTION MANUAL

Rockwell Hanford Operations
Health, Safety and Environment Function
Environmental Protection Department

July 1983

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Title: Environmental Protection Manual

Document Number RHO-MA-139

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Date 4/15/81

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Rockwell International

Rockwell Hanford Operations
Energy Systems Group

A-6000-054 (R-12-80)

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Title: Environmental Protection Manual

Document Number RHO-MA-139

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FOREWARD

The primary purpose of this manual is to establish environmental protection criteria, standards, and guidelines under which Rockwell Hanford Operations (Rockwell) will conduct its operations. It is the intent of this manual to provide assurance that U.S. Department of Energy (DOE) requirements are met.

The DOE has established requirements for Rockwell and other contractors in DOE Orders/Manual Chapters (MC) and DOE-Richland Operations Office (RL) Orders. It is the intent of this manual to be consistent and compatible with these requirements and to provide more detailed and specific criteria and standards that are usable by Rockwell functions and programs.

A principle mandate of DOE (DOE Order 5480.1A, Chapter XI) and Rockwell (RHO-MA-100, PM HE 060) is to reduce releases of radioactive materials to as low as reasonably achievable (ALARA). In addition, Rockwell policy specifies effluent releases of nonradioactive toxic materials be ALARA. This manual provides guidance to demonstrate compliance with DOE and Rockwell ALARA policies.

The user of this manual should pay particular regard to the definitions of "must", "shall", and "should" specified in Section A.35. The term "must" is used where the requirements are mandatory for operation. The term "shall" is used where the requirements are with respect to ALARA or are accepted by the industry as "good practice"; e.g., standards published by the American National Standards Institute (ANSI). The term "should" implies a guideline that is acceptable in most cases.

Questions frequently arise concerning the applicability of requirements of governmental agencies other than DOE. The DOE Order 5480.1, Change 1, and Executive Order 12088 require federal agencies to comply "with applicable pollution control standards" and to the same "substantive, procedurals, and other requirements that would apply to a private person." Nevertheless applicability of these various regulations can become confusing at times and are often subject to agreements between DOE and other agencies. For guidance on a specific regulation, the reader should contact the Health, Safety and Environment (HS&E) Function. Depending on whether a precedent has been established, HS&E will respond directly to the request or will solicit interpretation from DOE-RL.

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Subject	Approved by
PART A - GENERAL PROVISIONS	Gary F. Bothi

Section A.10 Purpose. The purpose of this manual is to define criteria, standards, and guidelines to be used by Rockwell Hanford Operations (Rockwell) in order to: (1) protect the environment from radioactive materials and other hazardous substances under Rockwell jurisdiction; (2) protect people from radionuclides in the environment; and (3) ensure that Rockwell operations are in compliance with Department of Energy (DOE) and DOE-directed state, federal and local laws, rules, or regulations.

The criteria and standards contained in this manual should be utilized in Rockwell standard operating procedures, operator instructions, operation manuals, and other documents that pertain to environmental releases or environmental protection.

The purpose of Part A is to describe general requirements pertaining to Rockwell organizations and personnel relative to environmental protection.

Section A.20 Scope. The requirements of this manual apply to Rockwell facilities and organizations that have responsibilities or duties involving the generation, handling, processing, possession, transfer, storage, disposal, or release of radioactive materials or hazardous substances.

Section A.25 Authority. This manual has been written pursuant to the Policy Manual (RHO-MA-100), Section HE 3-060. The provisions and requirements of this manual shall be enforced in accordance with RHO-MA-100.

Section A.35 Definitions. As used in this manual, these terms have the definitions set forth below:

"Airborne radioactive effluents" means radioactive particles, mists, vapors, fumes, and/or gases contained or entrained in airborne effluents.

"Alarm system" means instrumentation which provides an audible and/or visible indication whenever a predetermined value of a parameter (such as concentration of a contaminant or stream flow) of an airborne or liquid waste or processing stream is exceeded. The system includes a detector which is placed into the stream or a part of the stream and associated readout components. A "radiation alarm system" is a system in which radiation or radioactivity is the measured or detected parameter.

"ALARA" means "as low as reasonably achievable". The implementation of ALARA is described in RHO-MA-100, Section HE 3-060.

"Anisokinetic" means a condition which prevails when the velocity of the medium entering a sampling probe is different from the velocity of the medium being sampled.

"ANSI" means the American National Standards Institute.

"Appraisal" means a scheduled examination of a facility or operation to determine compliance with specific requirements and to determine if administrative controls are adequate and are being maintained.

"Asbestos trench" means that Central Landfill trench that is dedicated to the disposal of asbestos and other insulating material.

"Areal contamination" means contamination generally confined to less than the first centimeter of soil. Numerically, the areal contamination is the radioactivity content averaged over a suitable area.

"Audit" means an announced examination of a facility or operation to determine compliance with specific requirements.

"Average soil contamination" means contamination generally dispersed through soil. Numerically, the average soil contamination is the radioactivity content averaged over a suitable mass of soil.

"Backfill soil" means the soil used as a plant growth medium between the depths of 30-120 cm as measured at the restabilization site. Backfill soil will fall within the range of the following limiting characteristics:

(a) Less than 25% gravel

(b) pH less than 9

(c) 0-4 mmhos/sq cm electrical conductivity of soluble salts

(d) 0-15 sodium adsorption ratio

See also Appendix E.

"Beneficial Use Date" means the date a facility or system is placed in operation.

"Calibration" means determining the deviations of an instrument from a standard and reporting and/or eliminating the deviations by adjustment.

"CASS" means Computerized Automatic Surveillance System.

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"Central Landfill" means that Rockwell-operated, DOE-owned disposal site used for trash, hazardous wastes, and other nonradioactive wastes.

"Chemical trench" means that Central Landfill trench dedicated for disposal of chemicals, hazardous wastes, and hazardous substances.

"Chem-Security Systems site" means the site south of Arlington, Oregon, that is approved by the U.S. Environmental Protection Agency (EPA) for disposal of hazardous and extremely hazardous wastes.

"Crib" means an underground structure into which liquid wastes are discharged so that most radionuclides are sorbed on the soil before the liquid reaches the groundwater.

"Contamination limit" means that concentration limit or activity limit for radioactive materials below which posting restrictions and environmental controls are not necessary to protect personnel or the environment.

"Continuous monitoring system" (see "Monitoring System").

"Continuous sampling system" (see "Sampling System").

"Criteria" means general requirements.

"Detection limit" means the smallest concentration of radionuclide material in a sample that will yield a net count (above system background) that will be detected with 95% confidence.

$$DL = \frac{(4.66 s_b + 2.72/T)}{EV\ (2.22\ E{+}06)\ Y \times \exp(-\lambda \Delta t)} \qquad (1)$$

where

DL is the detection limit as defined above (Ci per unit mass or volume)

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

T is the sample count time in minutes

E is the counting efficiency (counts per disintegration)

V is the sample size (in units of mass or volume)

2.22 E+06 is the number of disintegrations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting.

(References: (a) U.S. Nuclear Regulatory Commission Guide 4.16, "Measuring, Evaluating, and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Airborne Effluents from Nuclear Fuel Processing and Fabrication Plants," March 1978, (b) J. K. Hartwell, "Detection Limits for Radioisotopic Counting Techniques," ARH-2537, June 1972) .

"Deviation" means a departure from Rockwell internal requirements where economical, technological, or risk considerations forestall compliance in the near future.

"Directive" means a statement from the Health, Safety and Environment Function that must be carried out to either prevent noncompliance with applicable standards or to protect the environment from an undue hazard.

"Dispersible" means capable of being spread widely.

"Disposal" means the release of radioactive materials or other waste with the intent not to recover the waste in the same chemical form and/or concentration.

"DOE" means the U.S. Department of Energy.

"Effluent" means an airborne or liquid discharge from a facility after all engineered waste treatment and effluent controls have been effected. The term includes onsite discharges to the atmosphere, lagoons, ponds, cribs, injection wells, french drains, or ditches. The term does not include solid wastes stored or removed for disposal or wastes which are contained in retention basins or tanks prior to treatment and/or disposal.

"Environmental sampling and monitoring" means collection and analysis of environmental samples and other measurements from Hanford environs under the jurisdiction of Rockwell.

"EP" means the Environmental Protection Department.

"EPA" means the U.S. Environmental Protection Agency.

"Exhaust system" means a stack, gaseous effluent system, building ventilation system, or any system which vents air or gaseous material to the atmosphere.

"Extremely hazardous waste" means any hazardous waste or substance as described in Chapter 70.105 of the Revised Code of Washington, "Hazardous Waste Disposal."

"Facility" means processing plant, shops, laboratory, powerhouse, laundry, disposal or storage site, and specific Rockwell activities that could result in the release of hazardous substances or radioactive materials to the environment.

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"Flow totalization" means the cumulative measurement over time of the total quantity of effluent in terms of mass or volume.

"French drain" means a covered or rock-filled encasement with the bottom end open to allow liquids to seep into the ground.

"Grab sample" means a randomly taken, single sample removed from a stream over a short time interval.

"Hazardous substance" means a nonradioactive chemical or biological agent which may present a hazard to personnel or the environment if improperly used.

"Hazardous waste" means a nonradioactive material as designated by 40 CFR 261.3, "Hazardous Waste and Consolidated Permit Regulations."

"HEPA" means high efficiency particulate air filter. The filter is designed to achieve an efficiency of 99.97% in the removal of airborne particulates of greater than 3E-05 cm (0.3 micron) in size.

"HS&E" means the Health, Safety and Environment Function.

"Inspection" means examination or measurement to determine compliance with specific requirements.

"Integrating monitoring system" (see "Monitoring System").

"Isokinetic" means a condition which prevails when the velocity of medium entering a sampling probe is identical to the velocity of the medium being sampled.

"Mixed Waste" means any waste that is both a "radioactive solid waste" and an "extremely hazardous" or a "hazardous waste."

"Monitored sample" means a sample collected in a monitoring system and used to alert operations to nonroutine releases and provide process control.

"Monitoring system" means instrumentation which provides the real-time measurement of an airborne or liquid waste or process stream parameter. The system includes a detector which is placed into the stream or a part of the stream and associated readout components. A "continuous monitoring system" measures the stream parameter continuously. A "radiation monitoring system" is a system in which radiation or radioactivity is the measured parameter. An "integrating monitoring system" integrates the instantaneously measured parameter over some time period. A sampling system is distinct from a monitoring system in that a sampling system does not measure and read out an instantaneous stream parameter.

"Must" refers to a minimum requirement that is to be met in order to operate and comply with DOE and DOE-directed state, federal, or local requirements.

"Near isokinetic" means a condition in which the velocity of medium

entering a sampling probe is within ± 20% of the isokinetic condition.

"New facility" means a facility with Beneficial Use Date after October 13, 1977.

"Noncompliance with RHO-MA-139" means that the facility, system, equipment, or procedure does not conform to the "must" or "shall" requirements of this manual.

"Nonhazardous waste" means any material (solid, liquid, or gas) which meets the following criteria:

- The waste is not a hazard to public health or the environment.
- The waste is not listed on the EPA lists of hazardous wastes as recorded in the May 19, 1980, Federal Register (Subpart D).
- The waste does not demonstrate any of the four characteristics (ignitability, corrosivity, reactivity, toxicity) recorded by the EPA in the May 19, 1980, Federal Register (Subpart C).

"Nonradioactive solid waste" means any solid or sorbed liquid material which contains concentrations of radioactive materials not exceeding those concentrations specified in Column 1 of the "Standards for Surface Soil Contamination" presented in Part I of this manual. For the purpose of this definition, a gram of solid material is equivalent to a ml of liquid. For solids containing mixtures of radionuclides the sum of the ratios of the concentrations of the radionuclides to the appropriate values for those radionuclides listed in Part I, Table I.1, shall not exceed unity.

"Normally contaminated airborne effluent" means an airborne effluent from a facility or area that contains dispersible or unsealed radioactive materials in quantities sufficient to cause releases of radioactive materials in excess of 10% of Table II, Appendix A, concentrations averaged over one year (i.e., the total activity present times a reasonable suspendable fraction divided by the total annual flow exceeds 10% of Table II, Appendix A, concentrations).

"Old facility" means a facility with Beneficial Use Date prior to October 13, 1977.

"Open burning" means the combustion of material, in the open or in a container, with no provisions for the control of the emission of combustion products.

"Pond" means a surface impoundment of water enclosed by a dike or natural land contour used for liquid waste disposal.

"Potentially contaminated airborne effluent" means an airborne effluent from a facility or area that contains nondispersible or sealed radioactive materials in quantities sufficient to cause

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releases of radioactive materials in excess of 10% of Table II, Appendix A, concentrations averaged over one year (i.e., the total activity present times a reasonable suspendable fraction divided by the annual flow exceeds 10% of Table II, Appendix A, concentrations). Contamination in potentially contaminated effluents is not expected except in upset conditions.

"Proportional sampling or monitoring" means:

(a) for continuous airborne effluents, that the ratio of the sample flow rate (e.g., the flow through the filter) to the discharge flow rate is constant within acceptable variability Part D.60(b) ;

(b) for continuous liquid effluents, that the ratio of the sample volume to the discharge volume is constant;

(c) for batch releases, that the ratio of sample volume to batch volume is constant from batch to batch. (This applies only to the final volumetric composition of the record sample as analyzed by the laboratory.)

"Quality Assurance" means all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.

"Radiation alarm system" (see "Alarm System").

"Radiation area" means a designated area in which radiation exposure rates or radioactive contamination levels exceed prescribed standards.

"Radiation monitoring system" (see "Monitoring System").

"Radioactive liquid effluent" means a liquid effluent that has a reasonable potential for containing radioactive materials in quantities such that the annual average concentration is equal to or greater than 10% of Table II, Appendix A, concentrations.

"Radioactive solid waste" means any solid or sorbed liquid material which contains concentrations of radioactive materials exceeding those concentrations specified in Column 1 of the "Standards for Surface Soil Contamination" presented in Part I of this manual. For the purpose of this definition, a gram of solid material is equivalent to a ml of liquid. For solids containing mixtures of radionuclides, the sum of the ratios of the concentrations of the radionuclides to the appropriate values for those radionuclides listed in Part I, Table I.1, shall not exceed unity.

"Record sample" means a representative sample collected in a sampling system for laboratory analysis and is used as the basis for reporting the amount and concentration of radionuclides released to the environment.

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"Representative sample" means that the average stream parameter being measured occurs in the sample in the same average proportion that it occurs in the environmental discharge.

"Rockwell" means Rockwell Hanford Operations.

"Sampling and analytical schedule" means a document which establishes schedules for monitoring and evaluating process performance, feed and product quality, effluent releases, and waste and chemical stream compositions.

"Sampling system" means instrumentation and equipment which remove a part of a liquid or airborne waste or processing stream for subsequent quantitative determination of a stream parameter. The system generally employs such devices as filters, other sample collection media, or effluent traps of some kind. A "continuous sampling system" removes a part of the stream continuously except during sample change, maintenance, repair, or other necessary outages. A "grab sampling system" removes an instantaneous part of the stream or removes a part of the stream over a time period.

"Sealed" means in a container or having a bonded cover, the container or cover being strong enough to prevent contact with and dispersion of the contents under conditions of use and wear for which it was designed.

"Shall" refers to a requirement that is to be met in order to comply with the ALARA requirement specified in DOE Order 5480.1A, Chapter XI, and the ALARA policy of RHO-MA-100, Section HE 3-060. As an ALARA requirement, consideration may be given to cost versus benefit in determining compliance with a "shall" requirement. A Rockwell facility that does not meet a "shall" requirement contained in this manual may operate or start up provided there is a plan to achieve compliance or there is a deviation to the requirement per Section A.70. "Shall" also refers to requirements that are based on generally accepted "good practice", especially as documented in various national or international standards.

"Should" refers to a guideline only and not a requirement. A Rockwell facility that does not meet "should" guidelines contained in this manual may nevertheless be in compliance.

"Specification" means a detailed description of the parts of a whole; a statement or enumeration of particulars as to actual or required size, quality, or performance.

"Spot contamination" means: (1) a spot or mass of contamination less than 1 cu cm in volume or (2) areal contamination less than 15 sq cm in area.

"Standard" means a specified set of rules or conditions concerned with the classification of components; delineation of procedures; definition of terms; designation of materials, performance, design, or operations; or measurements of quality in describing materials, products, systems, services, or practices. A standard is more general than a procedure or specification and more specific than a criterion.

"Suitable surface area" means that area over which contamination may be averaged in determining areal contamination. A suitable area should be 15 sq cm.

"Suitable mass" means a mass of soil which is representative of radioactive contamination and over which contamination can be averaged to determine concentration. A suitable mass should be at least 1 kg.

"Survey" means an evaluation of the release, disposal, or presence of radioactive materials or hazardous substances under a specific set of conditions to determine actual or potential hazards. Such an evaluation may include, but is not limited to, tests, physical examinations, and measurements of radiation or concentrations of materials.

"Suspendable fraction" means the fraction of material that may become airborne.

"Table I value" means the maximum permissible concentration of a radionuclide specified in Table I, Appendix A, of this manual. Appendix A is identical with DOE Order 5480.1A.

"Table II value" means the maximum permissible concentration of a radionuclide specified in Table II, Appendix A of this manual. Appendix A is identical with DOE Order 5480.1A.

"Test" means the performance of a procedure to determine the status or condition of equipment, components, radioactive sources, or of hazardous material.

"Threshold limit value" (TLV) means one of a set of standards established by the American Conference of Governmental Industrial Hygienists for concentrations of airborne substances in work-room air. The TLVs are time-weighed averages based on conditions which it is believed workers may be repeatedly exposed to day after day without adverse effects.

"Topsoil" means the soil used as a plant growth medium at the surface to a depth of 30 cm as measured at the restabilization site. Topsoil will fall within the range of the following limiting characteristics:

(a) Less than 15% gravels

(b) pH between 6 and 8.2

(c) 0-1 mmhos/sq cm electrical conductivity of soluble salts

(d) 0-5 sodium adsorption ratio

See also Appendix E.

"Transuranic radionuclide" means uranium-233 or a transuranium alpha-emitting radionuclide with a half-life of greater than 100 years.

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"Transuranic waste" means those wastes which contain transuranium alpha-emitting radionuclides with a half-life greater than 100 years, and/or uranium-233 with daughter products, with greater than 10 nCi/g of waste matrix.

"Uncontaminated soil" means a soil or a land area which requires no controls or restrictions in any way for radiation protection purposes. Contamination limits are specified in Part A.

"Vector" means a vertebrate or invertebrate that can transmit toxic or infectious material from a disposal or storage site to uncontrolled areas. Examples: flies, birds, mice.

"WSDE" means Washington State Department of Ecology.

Section A.40 Relationships to Other Requirements and Documents. The requirements, procedures, and guidelines contained in this manual are derived from and in accordance with the requirements specified in DOE 5480.1A, Environmental Protection, Safety, and Health Protection Standards; DOE MC 0511, Radioactive Waste Management; DOE Order 5484.1, Environmental Protection, Safety and Health Protection Information Reporting Requirements; and DOE-RL Order 5820.2, Radioactive Waste Management. The intent of this manual is to be consistent and compatible with RHO-MA-100, Policy Manual; RHO-MA-220, Radiological Controls; RHO-MA-221, Accident Prevention Standards; RHO-MA-111, Emergency Plan; RHO-MA-150, Quality Assurance; RHO-MA-115, Engineering Procedures Manual; and other pertinent Rockwell manuals and documents.

Program plans, standard operating procedures, operator instructions, operation manuals, and other pertinent documents shall ensure compliance with the provisions of this manual.

Section A.50 ALARA Requirement. All Rockwell facilities shall be designed and operated in a manner to assure that releases of radioactive materials or nonradioactive hazardous substances are ALARA.

Section A.60 Significant Hazards. Upon the determination of a significant hazard to safety or the environment, the HS&E Function may issue an order to cease or restrict operations until appropriate corrective action can be taken. (Ref. RHO-MA-100, PM HE 16-200)

Section A.70 Deviations. The EP Department may, upon application or upon its own initiative, grant deviations from requirements of this manual which it determines are not contrary to DOE or other applicable requirements and which will not result in an undue hazard to the environment. Deviations shall be in writing from the EP Department; shall be numbered in order of issue; and should contain pertinent conditions, specifications, and the timeframe under which the deviation is granted. All deviations shall be included in Appendix C of this manual. At the time of issue, a deviation shall be submitted to Document Control for distribution to holders of this manual.

Section A.80 Records, Surveys, and Tests. Each facility shall conduct required or appropriate surveys and tests that demonstrate compliance with requirements of this manual.

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Section A.90 Applicability and Compliance.

(a) "Must" Requirement. All Rockwell facilities must comply with the "must" requirements of this manual or with DOE-approved exemptions in order to operate. (See also the definition in Section A.35.)

(b) "Shall" Requirements. All Rockwell facilities shall comply with the "shall" requirements contained in this manual to the extent technically and economically practicable. In determining technical and economic practicability, evaluations shall be made by Research and Engineering or the Basalt Waste Isolation Program, as appropriate. The evaluation should have the concurrence of the appropriate facility manager and program office. The EP Department shall provide guidelines for making such evaluations on a case-by-case basis and the EP Department shall use the results of the evaluations for making decisions relative to compliance. In cases where the nonfeasiblity of compliance is obvious, an engineering study is not required; however, the EP Department shall document the decision. (See also the definition in Section A.35.)

(c) "Should" Guidelines. "Should" statements are provided as guidelines or recommendations. They do not preclude other, equally acceptable or better, methods for obtaining compliance with "must" and "shall" statements. (See also the definition in Section A.35.)

Section A.100 Violations of Regulations. Violations of federal, state, or local regulations shall be reported in accordance with RHO-MA-221, Accident Prevention Standards.

Section A.110 Manual Review. This manual shall be reviewed annually and updated on an ongoing basis. Revisions to this manual shall be reviewed and concurred to by all affected Rockwell organizations.

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Subject	Approved by
PART B - STANDARDS FOR RESPONSE TO NONROUTINE RADIOACTIVE RELEASES	Gary F. Boothe

Section B.10 Purpose and Scope. The purpose of Part B is to define the standards for response to an accidental release of radioactive materials in excess of those limits specified below. The provisions of this part shall be used by the facilities with radioactive effluents to write supplements to RHO-MA-111, Basic Emergency Plan, and to write appropriate operating procedures. The standards contained in RHO-MA-111 supplements and in operating procedures may be different from the standards of this part, provided that the emergency levels are at least as restrictive. The provisions of this part apply to all releases of radioactivity to the environment including airborne releases from facility stacks, tank farm vents or exhausts, field or weed burning, and liquid discharges to surface or subsurface areas.

Section B.20 Potential Unusual Occurrences.

(a) Concentrations. If any 168-hour average concentration of a radionuclide released to the environment in an airborne or liquid effluent exceeds the applicable value specified in Table B.1, the notification and corrective action specified in Sections B.20(b) and (c) shall be implemented. If effluent concentrations from a group of stacks are being averaged according to D.30(b)(5), then values in Table B.1 apply to the averaged concentrations of the group.

(b) Notification. The Plant Manager shall notify the HS&E representative in accordance with RHO-MA-221, Part 32. (Notifications required by this section do not replace or preclude other notifications that may be required by other Rockwell organizations.)

(c) Action. Determine cause and take steps to prevent annual release limits from being exceeded.

(d) Exemption. The provisions of Section B.20 do not apply to planned airborne releases of noble gases or naturally occurring radon and its daughter products or to planned liquid releases of tritium. There are no cost effective methods for removing these radionuclides from effluent streams.

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Section B.30 Immediate Response.

(a) Concentrations. If the concentration of a radionuclide released to the environment in an airborne or liquid effluent instantaneously exceeds the applicable value specified in Table B.2 (or if the effluent is causing a significant hazard), the notification and corrective action specified in Sections B.30(b) and (c) shall be implemented. If effluent concentrations from a group of stacks are being averaged according to D.30(b)(5), then values in Table B.2 apply to the averaged concentrations of the group.

(b) Notification. Notify the Emergency Director through telephone number 811 as soon as possible and in accordance with RHO-MA-111.

(c) Action. Shut down the offending stream immediately unless this action would result in a greater hazard to personnel than the release itself. Liquid releases above concentrations for an immediate response generally will not result in immediate hazards to personnel. Nevertheless, immediate corrective action is necessary to prevent significant environmental impact and/or the exceeding of annual average concentration limits.

(d) Exemptions. The provisions of this part do not apply to planned airborne releases of noble gases or naturally occurring radon or its daughter products or planned liquid releases of tritium.

Section B.40 Point of Release. For purposes of this part, the concentrations of radioactive materials in airborne or liquid effluents shall be determined at the point of release from the facility or upstream from the point of release.

Section B.50 Mixtures of Radionuclides. In the cases of known mixtures of radionuclides, the sum of the fractions of the release limits occurring in the effluent shall not exceed unity. (For clarification of this requirement, see Footnote 1 at the end of Appendix A.)

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TABLE B.1. Unusual Occurrence.

	Facilities with Beneficial Use Date Prior to 10/13/77	Facilties with Beneficial Use Date After 10/13/77
Airborne Release Concentrations (168-hr ave)		
Known Radionuclides	4 x Table I Appendix A (Air)	4 x Table II Appendix A (Air)
Gross Beta when I-129, Ra-228 are not present(1)(2)	4E-09 µCi/ml	1E-10 µCi/ml
Gross Beta when Ra-228 is not present(1)(2)	3E-09 µCi/ml	8E-11µCi/ml
Gross Alpha when Pu-239 is the only alpha emitter (1)(2)	8E-12 µCi/ml	2E-13 µCi/ml
Gross Alpha when alpha emitters are unknown(2)	2E-12 µCi/ml	8E-14 µCi/ml
Liquid Release Concentrations (168-hr ave)		
Known Radionuclides	4 x Table I Appendix A (Water)	4 x Table II Appendix (Water)
Gross Beta when I-129, Ra-228 are not present(1)(2)	4E-05 µCi/ml	1E-06 µCi/ml
Gross Beta when Ra-228 is not present(1)(2)	2E-05 µCi/ml	2E-07 µCi/ml
Gross Alpha when Pu-239 is the only alpha emitter (1)(2)	2E-05 µCi/ml	4E-06 µCi/ml
Gross Alpha when alpha emitters are unknown(2)	2E-06 µCi/ml	1E-07 µCi/ml

(1)Footnote 5 of Appendix A gives the criterion for determining when a radionuclide is not present.

(2)Specific radionuclide analyses are more accurate than gross analyses. When sample results exceed these limits for gross analyses, it is recommended that the sample be analyzed for specific radionuclides and the appropriateness of the occurrence be based on the latter.

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TABLE B.2. Immediate Response.

	Airborne Release Concentrations	
Known Radionuclides	5,000 x Table II Appendix A (Air)	
Gross Beta when I-129, Ra-228 are not present	1E-07	µCi/ml
Gross Beta when Ra-228 is not present	1E-07	µCi/ml
Gross Beta when Pu-239 is the only alpha emitter	3E-10	µCi/ml
Gross Beta when alpha emitters are unknown	1E-10	µ Ci/ml

	Liquid Release Concentrations	
Known Radionuclides	5,000 x Table II Appendix A (Water)	
Gross Beta when I-129, Ra-228 are not present	1E-03	µCi/ml
Gross Beta when Ra-228 is not present	3E-04	µCi/ml
Gross Alpha when Pu-239 is the only alpha emitter	2E-02	µCi/ml
Gross Alpha when alpha emitters are unknown	1E-04	µCi/ml

Footnote 5 of Appendix A gives the criterion for determining when a radionuclide is not present.

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Subject	Approved by
PART C - STANDARDS PERTAINING TO NONRADIOACTIVE AIRBORNE EMISSIONS	Guy F. Bowles

Section C.10 Purpose and Scope. The purpose of Part C is to define standards relative to airborne emissions of nonradioactive effluents. The provisions of this part apply to existing and planned Rockwell facilities.

Section C.20 General Requirements. Nonradioactive airborne effluents from Rockwell facilities must be in compliance with DOE requirements. Where specific DOE direction is lacking, the local, state, and federal regulations shall apply. Applicable government agencies and regulations are as follows:

- DOE Order 5480.1A, Chapter XII, "Prevention, Control, and Abatement of Environmental Pollution" (including Executive Order 12088 of October 13, 1978)
- Benton-Franklin-Walla Walla Counties Air Pollution Control Authority, General Regulation 80-7
- WSDE Washington State General Air Pollution Regulations (Chapter 173-400 WAC)
- WSDE Washington Emergency Episode Plan (Chapter 18-08 WAC)
- WSDE Washington Open Burning Regulations (Chapter 18-12 WAC)
- EPA Standards for Performance of New Stationary Sources (40 CFR 60)
- EPA National Emission Standards for Hazardous Air Pollutants (40 CFR 61)
- EPA Regulation X, "Approval of Application to Construct" (PSD-X80-14)

Section C.30 Maximum Permissible Emissions. The maximum permissible atmospheric emissions which have been established by government agencies are summarized in Table C.1.

Many contaminants do not, at present, have specified maximum permissible emission standards. Release of these contaminants must not be detrimental to the health, safety, or welfare of any person or cause damage to property.

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Release limits for such contaminants shall be determined by evaluating concentrations relative to the ambient air standards listed in Table C.2 of this part. The goal shall be to meet or be less than the ambient air standard at ground level.

Section C.40 Open Burning.

(a) Radiologically contaminated material shall not be disposed via open burning. (See also Section D.35)

(b) Permits for open burning must be obtained in advance from the Hanford Fire Chief. Open burning must not be done during any stage of an air pollution episode (i.e., forecast, alert, warning, or emergency stages).

(c) Open burning shall adhere to requirements in the Accident Prevention Bulletin No. F-3 (RHO-MA-221, Vol. I).

(d) The use of open burning as a disposal practice shall be minimized.

Section C.50 Dust Control.

(a) Measures shall be taken to minimize dust during dust-generating operations, such as clearing, grading, leveling, excavation, or construction. Examples of measures to be taken are application of water, use of windbreaks, or curtailment of operations on very windy, dry days.

(b) Measures for permanent dust control, such as revegetation or graveling, shall be taken upon completion of earth-moving operations.

Section C.60 Monitoring and Alarm System Requirements. Monitoring and alarm systems shall be used for airborne effluents which are contaminated or potentially contaminated with nonradioactive pollutants in concentrations or quantities which exceed 50% of any quantifiable release standard specified in Table C.1. For purposes of this section, the term "potentially contaminated" means that contamination could occur as the result of a credible accident or a credible change in operating conditions or other parameters. General definitions of monitoring and alarm systems are given in Section A.35.

Alarm annunciators for monitors shall be located in areas subject to continuous or frequent occupation during system operation.

The design of airborne nonradioactive effluent continuous air monitors (CAM) shall meet the performance criteria specified in Appendix B of 40 CFR 60.

Section C.70 Sampling System Requirements.

(a) General. Sampling systems shall be provided for airborne effluents which are contaminated or potentially contaminated with nonradioactive pollutants in concentrations or quantities which exceed 25% of any quantifiable release standard specified in Table C.1. (See Section C.60 for the definition of "potentially contaminated". The general definition of sampling systems is given in Section A.35.)

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(b) Particulates. Sampling for nonradioactive particulates shall be in accordance with EPA Reference Method 5 (40 CFR 60, Appendix A) with the following exception. Method 5 is not readily applicable to continuous sampling. An alternate design and method which is approved through normal design review procedures is acceptable.

(c) Gases. Gaseous effluent sampling shall be in accordance with EPA Reference Methods (40 CFR 60, Appendix A).

Section C.80 Analytical Methods. Analytical methods for use in conjunction with source sampling and performance testing are found in Appendix A of 40 CFR 60.

Other analytical methods for continuous monitoring of effluents may be used provided these methods are equivalent to EPA Reference Methods relative to the accuracy and reliability of determination.

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TABLE C.1. Standards for Nonradioactive Emissions.

Pollutant	Standard	Basis
Air Contaminants (general) and Water Vapor	Must not impact health, safety or welfare of any person or damage property	Chapter 173-400-040 WAC
Asbestos	No visible emissions. Minimize air suspension by wetting during handling	Chapter 173-400-075 WAC, 40 CFR 60
Beryllium	10 g over a 24-hour period	Chapter 173-400-075 WAC, 40 CFR 61
Odors	May not interfere with use of adjoining property. Must minimize by recognized good practice and procedure	Chapter 173-400-040 WAC
Opacity	20% for 3 minutes in any hour; more than 20% allowed for 15 minutes in 8 hours; more than 20% allowed if due to condensed water droplets and particulates less than standard	Chapter 173-400-040 WAC, General Regulations 80-7
Particulates	230 μg/cu m (0.1 grains/cu ft). No significant impact from deposition beyond plant site. Reasonable precaution to prevent airborne suspension of dust	Chapter 173-400-040, 050, 060 WAC
Surfur Dioxide	2.6E+06 μg/cu m (1000 ppm)	Chapter 173-400-040 WAC
Total Carbonyls	100 ppm	Chapter 173-400-050 WAC

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TABLE C.2 Ambient Air Standards for Nonradioactive Air Pollutants

Pollutant	Standard	Basis
Carbon Monoxide	1E+04 μg/cu m (9 ppm) average for 8-hour period where people exposed 8 hours or more (not to be exceeded more than once per calendar year)	Chapter 173-475 WAC
	4E+04 μg/cu m (35 ppm) average for 2 hours (not to be exceeded more than once per calendar year).	
Suspended Particulates	60 μg/cu m annual geometric mean	Chapter 18-40 WAC
	150 μg/cu m maximum 24-hour concentration (not to be exceeded more than once per year)	
Ozone	230 μg/cu m (0.12 ppm) average for 1 hour on no more than one day per calendar year	Chapter 173-475 WAC
Hydocarbons (non-methane gas phase)	160 μg/cu m (0.24 ppm) for the hours between 6 a.m. and 9 a.m. once per calendar year	40 CFR 50
Nitrogen Dioxide	100 μg/cu m (0.05 ppm) annual arithmetic mean	40 CFR 50
Fluorides	3.7 μg/cu m average for any 12 consecutive hours	Chapter 18-48 WAC
	2.9 μg/cu m average for any 24 consecutive hours	
	1.7 μg/cu m average for any 7 consecutive days	
	0.84 μg/cu m average for any 30 consecutive days	
	0.50 μg/cu m average for the period March 1 thru October 31	

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TABLE C.2. (Contd.)

Pollutant	Standard	Basis
Sulfur Dioxide	1E+03 µg/cu m (0.4 ppm) by volume average for 1 hour (exceed only once per calendar year)	Chapter 18-56 WAC
	650 µg/cu m (0.25 ppm) by volume average for 1 hour (exceed 2 times in 7 consecutive days)	
	260 µg/cu m (0.10 ppm) by volume average for 24 hours (exceed only once per calendar year)	
	52 µg/cu m (0.02 ppm) by volume average for 1 year (annual arithmetic mean)	
Lead	1.5 µg/cu m arithmetic mean, calendar quarter.	40 CFR 50

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Subject	Approved by
PART D - STANDARDS PERTAINING TO RADIOACTIVE AIRBORNE EMISSIONS	Guy F. Booth

Section D.10 Purpose and Scope. The purpose of Part D is to define standards relative to airborne emissions of radioactive materials to the environment. The provisions of this part apply to existing Rockwell facilities.

Section D.20 General Requirements. Atmospheric discharges of radioactive materials must be in compliance with all applicable DOE requirements, including but not limited to, the requirements specified in the following documents:

- o DOE MC 0511, "Radioactive Waste Management"
- o DOE-RL Order 5820.2, "Radioactive Waste Management"
- o DOE Order 5484.1, "Environmental Protection, Safety and Health Protection Information Reporting Requirements"
- o DOE Order 5480.1A, "Environmental Protection, Safety, and Health Protection Program for DOE Operations"

The operational objective for the management of Rockwell airborne effluents is to control concentrations of radionuclides released to the environment to ALARA.

Section D.30 Maximum Permissible Emissions.

(a) All Facilities. The annual average concentrations of radionuclides released to the environment in airborne effluents must not exceed the maximum permissible concentrations specified in Table II, Appendix A of this manual at the Hanford Site boundary. (Tables I and II, Appendix A of this manual are identical to DOE Order 5480.1A, Attachment XI-1.)

Requirements (b) and (c), as follows, are ALARA requirements.

(b) Facilities With Beneficial Use Date On Or Prior To October 13, 1977 (Old Facilities).

(1) Annual Average Concentrations. The annual average concentrations of radionuclides released to the environment in airborne effluents shall not exceed the maximum permissible concentrations specified in Table I, Appendix A of this manual at the point of release.

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(2) Weekly Average Concentrations. The 168-hour average concentrations of radionuclides released to the environment in airborne effluents shall not exceed four times the maximum permissible concentrations specified in Table I, Appendix A of this manual at the point of release. (See Section B.20 also.)

(3) Maximum Instantaneous Concentration. The maximum instantaneous concentrations of radionuclides released to the environment in airborne effluents shall not exceed 5,000 times the concentrations specified in Table II, Appendix A at the point of release. (See Section B.30 also.)

(4) Upgrade Requirement. All older facilities shall meet the requirements for newer facilities specified in Section D.30(c) as soon as technically and economically practicable. Upgrades to effluent treatment systems shall have the objective of meeting Section D.30(c) requirements. However, an addition to a facility should be considered as part of the old facility unless the addition creates a new discharge point.

(5) Averaging. For purposes of compliance with the requirements of this section, facilities may average the effluents from all points of radioactive discharge from a particular facility; i.e., concentration equals total activity emitted divided by total volume of contaminated air discharged, subject to the following restrictions:

- All stacks used in the averaging shall be physically located within 800 meters of each other
- Stacks whose discharge velocities are not vertical are excluded
- Stacks whose discharge heights are less than 10 meters from the normal ground level are excluded
- Stacks which are located near to structures or hills which significantly affect dispersion in a manner different from the other stacks of the facility are excluded
- No individual discharge point shall discharge radionuclides such that the maximum, ground-level, annual average concentrations exceed the concentrations specified in Table II, Appendix A of this manual. Compliance with this statement for low-flow-rate stacks is demonstrated if the annual average concentration at the point of discharge does not exceed SC, where SC is the concentration in Ci/ml given by

$$SC = \frac{(4E+05)(\text{Table II value})}{(\text{stack flow rate in cfm})}$$

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Note: The intent of D.30(b)(5) is to recognize that stacks with very low flow rates discharging at somewhat greater concentrations than the limits in D.30(b)(1-3) have much lower health or environmental consequences than stacks with large flow rates discharging at below those same limits.

(c) Facilities With Beneficial Use Date After October 13, 1977 (New Facilities).

(1) Annual Average Concentrations. The annual average concentrations of radionuclides released to the environment in airborne effluents shall not exceed the maximum permissible concentrations specified in Table II, Appendix A of this manual at the point of release. (See Section B.20 also.)

(2) Weekly Average Concentrations. The 168-hour average concentrations of radionuclides released to the environment in airborne effluents shall not exceed four times the maximum permissible concentrations specified in Table II, Appendix A of this manual at the point of release. (See Section B.20 also.)

(3) Maximum Instantaneous Concentrations. See D.30(b)(3).

(4) Averaging. See D.30(b)(5).

(d) Dilution. Nonradioactive airborne streams shall not be added to radioactive streams for the sole purpose of compliance with concentration limits in Section D.30(b) and (c).

(e) Additional Limits. In addition to the limits specified in Section D.30 (b) and (c) above, HS&E may direct facilities to limit total quantities of radioactive materials released to the environment in airborne effluents during a specified period of time if it appears likely that:

(1) Any DOE requirements would be violated;

(2) Any individual, other than radiation workers as specified in RHO-MA-220, would be exposed to concenrations of radionuclides in excess of Table II, Appendix A, values on a yearly average; or

(3) Long-term buildup of radionucludes in soil will exceed the soil standards specified in Part I of this manual.

Section D.35 Open Burning. Radiologically contaminated material shall not be disposed of via open burning. Deviations from this requirement may be granted by the EP Department provided that:

- there is no cost-effective alternative;
- a method is developed to estimate the radiological content of the effluent for reporting purposes; and
- the contaminated ashes are disposed of in the proper manner.

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Section D.40 Basis for Sampling and Monitoring Requirements.

- o ANSI N13.1-1969, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities"
- o ANSI N13.10-1974, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents"
- o DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements"

Section D.50 Monitoring and Alarm Requirements.

(a) General Requirements. Monitoring and alarm systems shall be provided for normally or potentially contaminated airborne effluents that have a potential for contamination at concentrations greater than those specified in Section D.50(c)(2). In determining "potential", consideration should be given to break-through of HEPA filters. This requirement does not apply to effluents for which it can be demonstrated that there is no reasonable potential for exceeding the annual average concentrations in Section D.30(b)(1) or D.30(c)(1), as applicable.

(b) Alarm Indications. Audible and/or visible indications shall be easily discernible to responsible personnel in continuously or frequently occupied areas.

(c) Monitoring Sensitivity.

(1) As-Low-As-Possible Requirement. Monitoring systems shall alarm at release concentrations as low as possible without resulting in an excessive number of alarms due to normal fluctuations in background or normal fluctuations in releases.

(2) Upper Limit. Monitoring systems shall alarm at four times Table I/Table II, Appendix A of this manual for old/new facilities, respectively, within the time that monitor filters are exchanged; e.g., within 24 hours if monitor filters are exchanged every 24 hours.

Discharge streams that are composed mostly of tritium, carbon-14, or krypton-85 shall meet only the as-low-as-possible requirement using reasonable equipment.

(d) Monitor Type. Effluent streams shall be monitored for each type of radiation or radionuclide (e.g., gross alpha, gross beta, radioiodine, Kr-85) that has a potential for exceeding the concentration in D.50(c)(2) above, unless unusual increases in one type of radioactivity or radionuclide are accompanied by increases in another type. For instance, if an effluent stream discharges both alpha-emitting radionuclides and beta-emitting radionuclides in concentrations that both increase during abnormal conditions, then either an alpha- or beta-detecting monitor may be used.

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(e) Monitoring Calibration Requirements. Continuous air monitors shall be calibrated annually with respect to air flow and sensitivity.

(f) Preventive Maintenance. Continuous air monitor readout devices should be inspected weekly to ensure proper functioning.

(g) Records. Record of maintenance, calibrations, system anomalies, etc., should be kept for each instrument.

(h) Design. Appendices D.1 and D.2 provide guidance on design of monitoring systems.

(i) Criteria. Radioactive effluent CAM design shall meet the criteria specified in ANSI N13.10-1974 and shall be powered from a source which has the same or equivalent emergency capability as the air mover for the effluent stream being monitored.

Section D.60 Sampling Requirements.

(a) General Requirements. Sampling systems shall be provided for all airborne effluents which are normally or potentially contaminated. For purposes of this part, an exhaust system is normally contaminated if any feeder stream or any part of the exhaust upstream of the filtration system is normally contaminated.

If an airborne effluent is not expected to discharge more than 1.5E+12 ml in any consecutive 12-month period and does not have a reasonable potential for discharging more than 0.01 microcuries during the same period, then the effluent is exempt from the requirement for sampling. In the case of tanks, the need for sampling shall be based on total releases from a tank or a group of tanks with interconnecting air pathways or a common plenum.

It is the intent of this requirement to provide the means for accurate measurement of all airborne releases of radioactive materials to the environment.

(b) Representative Sampling. Sampling systems shall provide accurate measurements of radioactivity by providing representative sampling. Representative sampling is defined in Section A.35. Errors in proportional sampling shall not exceed 20% on a continuous basis.

Example: If a normally contaminated stack has a normal flow rate of 50,000 cfm and the sample flow rate is 3 cfm, the proportion is 3/50,000 = 6.0E-05. If the stack flow rate occasionally increases to 62,500 cfm and the sample flow rate remains at 3 cfm, the proportion is 4.8E-05 which is within -20% of 6.0E-05. Hence, the proportionality requirement is not violated. However, if the stack flow rate varies to greater than 62,500 cfm or less than 41,700 cfm, the sample flow rate shall be regulated to maintain the proportion of 6.0E-05.

(c) Sample Identification. Each stack shall have a unique identification

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number and each sample point shall have a unique electronic data processing code (EDP).

(d) Sample Probe. Sample probes shall withdraw a near-isokinetic sample.

(e) Sample Flow Measurements. Stack record air samples shall be collected at a high enough sample flow rate and over a sufficient amount of time to allow the laboratory to achieve the analytical sensitivity requirements of Subsection (f) below.

The flow rate meter, or the flow volume totalizer when it is part of the system, shall be cleaned and calibrated to within 10% at 95% confidence relative to a standard traceable to the National Bureau of Standards (NBS) prior to installation and shall be recalibrated every six months thereafter.

Preventive maintenance on vacuum pumps shall be provided in accordance with the manufacturer's instructions or Production Support procedures. The frequency shall be according to the manufacturer's instructions or every six months if not specified by the manufacturer.

(f) Analytical Sensitivity. The analytical method used to measure the activity collected by record air samplers shall have a minimum detection limit (as defined in Section A.35) of 10% of concentrations specified in Table II, Appendix A of this manual. (For gross alpha and gross beta analyses, Table II concentrations for plutonium-239 and strontium-90 should be used, respectively.) (This requirement is based on a sample collection time of at least 168 hours. For shorter collection times, the requirement is met if the analytical procedures are used as for the 168-hour samples.) For specific radionuclide analyses, the requirement is based on a sample collection time of 90 days. The analytical sensitivity requirement does not apply to special samples that need a turnaround time of less than eight days.

(g) Analytical Precision. The precision of analytical data, excluding sample and stream volume measurements, shall be computed at the 95% confidence interval. For analytical measurement values well below the detection limit, the upper limit of the 95% confidence interval around that measurement value shall lie below the established release criteria. For analytical measurement values at or near the detection limit (i.e., detection limit $\pm$ 300%), the analytical precision should not exceed $\pm$ 100% of the estimated value at the 95% confidence interval. For analytical measurement values exceeding the detection limit by a factor greater than 3, the precision should not exceed +20% of the estimated value at the 95% confidence interval.

(h) Isotopic Analyses. Specific radionuclide analyses should be performed on quarterly composites of record samples in accordance with the following criteria:

- If stack flow is greater than 2.8E+05 l/min (10,000 cfm), analyze for appropriate specific radionuclides if the average total alpha or the average total beta exceeds 10% of Table II, Appendix A, concentrations for the most restrictive radionuclide expected to be present.

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o If stack flow is less than 2.8E+05 l/min (10,000 cfm), analyze for appropriate specific radionuclides if the average total alpha or the average total beta exceeds 50% of Table II, Appendix A, concentrations for the most restrictive radionuclide expected to be present.

(i) Quality Control. Analytical Laboratories shall conduct a quality control program to ensure accuracy and precision of effluent sample analyses.

(j) Design. Appendices D.1, D.2, and D.3 provide guidance on design of sampling systems.

Section D.70 Requirements for Filters and Filtration Systems.

(a) Filters. Final airborne particulate treatment systems shall use HEPA or equivalent filters.

(b) Stages. The number of exhaust filtration stages shall be sufficient to limit concentrations of airborne radioactive particulates released to the environment to less than the limits in Sections D.30 (b)(1) or D.30 (c)(1), as applicable, during normal and accident conditions. (For systems with more than one stage of filtration, this requirement shall not apply to breakthrough of the final stage of filtration.)

Plutonium facilities designed after March 25, 1977, must have an additional HEPA filter installed as close as practical to the source of contamination to minimize the contamination of ductwork. This filter does not count as the first stage of the airborne contamination cleaning system.

(c) Testing of HEPAs. Before installation, all HEPAs used by Rockwell shall be efficiency tested according to the Hanford Plant Standard HPS-151-M.

Section D.80 Filter In-Place Leak Testing.

(a) General Requirements. All stack filter systems operated by Rockwell that serve as the final means of gaseous effluent cleaning shall be in-place leak tested utilizing the dioctyl phthalate (DOP) method or equivalent described in Hanford Work Specification 10278.

(b) Schedule for Tests. All standby and on-line gaseous effluent filter systems shall have an in-place test before initial startup, after each filter change, and at least annually.

Those systems which handle high levels of radioactivity and/or are exposed to extreme hostile environments, such as high moisture loadings, chemical fumes, or high temperatures, shall be tested on a semiannual, quarterly, or monthly basis as dictated by the operational requirements of the system.

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The schedule for tests is maintained by the Maintenance Engineering Department.

(c) Performances of Tests. Each filter stage should be tested individually.

A copy of the results of each test shall be sent to the Radiological Engineering and Effluent Controls (RE&EC) Group of the Radiation Protection Department.

(d) Filter In-Place Leak Test Requirements. All filters required under Section D.70 shall remove at least 99.95% of DOP particles, or equivalent, ranging in size from 0.1 micron to 3.0 microns with a mean particle size of 0.5 micron.

Section D.90 Requirements for Stack Flow Measurements. Each stack shall have its flow rate measured prior to hot startup and at least quarterly thereafter. Stacks that have integrating flow meters that are calibrated annually do not need quarterly flow rate measurements provided that the stack volume data are transmitted to the RE&EC Group. A new stack flow reading shall be taken at the completion of each in-place leak test.

Section D.100 Notification of Shutdown or Other Change Pertinent to Release Data. The RE&EC Group shall be notified, within one working day, of any exhaust shutdown, relocation of a portable exhauster, shutdown of any stack sampling or monitoring systems, or any other change which affects the measurement of airborne radioactive discharges to the environment. Notification should be directly from facilties to the RE&EC Group.

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Subject	Approved by
PART E - STANDARDS FOR NONRADIOACTIVE LIQUID DISCHARGES	Gary F. Bartlett

Section E.10 Purpose and Scope. The purpose of Part E is to define standards relative to liquid nonradioactive effluents. The provisions of this part apply to existing and planned Rockwell facilities.

Section E.20 General Requirements. Nonradioactive liquid discharges from Rockwell facilities must be in compliance with DOE requirements and prescribed non-DOE requirements. Where specific DOE direction is lacking, the local, state, and federal regulations shall apply.

Section E.30 Release Limits.

(a) Basis.

- o DOE Order 5480.1A, Chapter XII, "Prevention, Control, and Abatement of Environmental Pollution" (including Executive Order 12088 of October 13, 1978)
- o DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements"
- o Washington Water Quality Control Standards
- o Federal Water Pollution Control Act Amendments of 1972, Section 402, "National Pollutant Discharge Elimination System (NPDES)"

(b) Discharges: General.

(1) Environmental Surveillance and Control (ES&C) Group must be notified as soon as possible in the event of an unplanned release of hazardous substances. Environmental Surveillance and Control Group shall initiate necessary action upon evaluation of the release.

(2) Discharges of hazardous substances through liquid effluents shall be controlled to ALARA levels.

(c) Discharges to Navigable Waters.

(1) All industrial liquid waste discharges to the Columbia River fall under the authority of the NPDES and, as such, must be in compliance with the Washington State Water Quality Control the Washington Water Quality Control Standards and applicable

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discharge permit limitations. Rockwell facilities must not discharge to the Columbia River since the Company does not have an NPDES permit.

(2) Any Rockwell facility proposing to discharge to the Columbia River must coordinate permit efforts with HS&E. (Expect a minimum lead time of six months.)

(d) Discharges to Subsurface Systems.

(1) All sanitary wastes shall be disposed in an environmentally acceptable manner and in adherence with Benton County Health Department Guidelines.

(2) New disposal systems for sanitary wastes shall be approved in writing by ES&C. This approval shall be based on design reviews and on inspection of installation prior to burial.

(3) Addition of new facilities or whichever is the larger of (a) ten persons or (b) 20% increase in the number of persons using an existing sewage system shall be approved by ES&C.

Section E.40 Sampling and Monitoring System.

(a) Basis.

- o DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements"
- o "Standard Methods for the Examination of Water and Wastewater" - latest edition
- o "1976 Annual Book of ASTM Standards, Part 31 - Water"
- o "Methods for Chemical Analysis of Water and Waste, 1974", USEPA
- o "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities", USEPA, 1977.

(b) General Requirements.

(1) pH Monitor. Normally nonradioactive liquid discharges which terminate in radioactively contaminated or potentially contaminated systems shall have a continuous pH monitor and alarm system. Shift-wise checking of a strip chart readout may be used in lieu of an alarm system unless there is a potential for large, short-time releases of acidic or basic material. If several streams combine before final discharge, the monitor is only needed on the final discharge stream.

(2) Representative Sampling. Sampling of liquid effluent streams where required for nonradioactive pollutants shall be performed in a manner that provides representative measurements of the volume and concentration of pollutants released to the environment as a

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basis for:

- o Determining compliance with applicable discharge and effluent control guidelines.
- o Evaluating the adequacy and efficacy of waste treatment and control efforts towards achieving levels of releases to ALARA.
- o Compiling an annual inventory of the nonradioactive pollutants in liquid discharges to the environment.

(3) Sampling Point. The measurement of volume, flow rate, pollutant concentrations, etc., shall be made at a point which most closely represents that which is being released to the environment.

(4) Automatic Sampling. Automatic flow proportional sampling shall be warranted on all liquid effluent streams where the flow rate fluctuates greater than 20%. Grab sampling shall be acceptable in cases of a batch discharge or where the nonradioactive pollutant discharge is due to a nonroutine condition.

(c) Ponds. Surface ponds shall be sampled quarterly for the following parameters:

- o pH
- o Specific conductivity
- o Nitrates
- o Suspected deleterious chemicals

(d) Analytical Methods. Methods for the analysis of liquid samples for nonradioactive pollutants shall be one of the standard analytical methods found in references cited in Section E.40(a).

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Subject	Approved by
PART F - STANDARDS PERTAINING TO RADIOACTIVE LIQUID DISCHARGES	Gary F. Barth

Section F.10 Purpose and Scope. The purpose of Part F is to define standards relative to radioactive liquid discharges. The provisions of this part apply to existing Rockwell facilities.

Section F.20 General Requirements. Radioactive liquid discharges must be in compliance with all applicable DOE requirements, including but not limited to, the requirements specified in the following documents:

- o DOE MC 0511, "Radioactive Waste Management"
- o DOE-RL Order 5820.2, "Radioactive Waste Management"
- o DOE Order 5480.1A, "Environmental Protection, Safety and Health Protection Program for DOE Operations"

The objective of radioactive liquid effluent control is to limit the release of radionuclides to the environment to ALARA levels.

Section F.30 Maximum Permissible Concentrations.

(a) Facilities With Beneficial Use Date On or Prior to October 13, 1977.

(1) Annual Average Concentrations. The annual average concentration of radionuclides released to the environment in liquid effluents shall not exceed the maximum permissible concentration specified in Table I, Appendix A of this manual at the point of release (i.e., the end of the pipe), except that effluents to surface ponds shall meet the requirements of F.30(b)(1).

(2) Weekly Average Concentrations. The 168-hour average concentration of radionuclides released to the environment in liquid effluents shall not exceed four times the maximum permissible concentration specified in Table I, Appendix A of this manual at the point of release, (See also Section B.20.), except that effluents to surface ponds shall meet requirements of F.30(b)(2).

(3) Maximum Instantaneous Concentrations. The maximum instantaneous concentrations of radionuclides released to the environment in liquid effluents shall not exceed 5,000 times the concentration specified in Table II, Appendix A of this manual at the point of release. (See also Section B.30.)

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(4) Upgrade Requirement. All older facilities shall meet the requirements for newer facilities specified in Section F.30(b) as soon as techically and economically practicable. Upgrades to effluent treatement systems shall have the objective of meeting Section F.30(b) requirements. However, an addition to an old facility should be considered as part of the old facility unless the addition creates a new discharge point.

(b) Facilities With Beneficial Use Date After October 13, 1977.

(1) Annual Average Concentrations. The annual average concentrations of radionuclides released to the environment in liquid effluents must not exceed the maximum permissible concentration specified in Table II, Appendix A of this manual at the point of release (i.e., the end of the pipe).

(2) Weekly Average Concentrations. The 168-hour average concentration of radionuclides released to the environment in liquid effluents shall not exceed four times the maximum permissible concentration specified in Table II, Appendix A of this manual at the point of release. (See also Section B.20)

(3) Maximum Instantaneous Concentrations. See F.30(a)(3).

(c) Dilution. Nonradioactive liquid streams shall not be added to radioactive streams for the sole purpose of compliance with concentration limits in Sections F.30(a) and (b).

Section F.35 Additional Requirements.

(a) Radioactive liquid discharges to the ground shall be as low as practicable and for new facilities must be below Table II Concentration Guides on an annual average.

(b) Radioactive liquid wastes containing transuranic radionuclides in annual average concentrations greater than Table II Concentration Guides must not be discharged to the ground.

(c) Radioactive liquid organic waste must not be discharged to the ground unless a study shows that the organics will not adversely change the solubility or sorption of the radioactive materials.

Section F.36 Diversion Systems. Adequate diversion or retention systems shall be provided to assure that normally releasable streams which as a consequence of acident or operational upset exceeds values specified in Section F.50(c)(2) are diverted or held until treatment or suitable disposal can be accomplished.

(a) Diversion/retention systems must be provided for those liquid waste discharges which exceed the annual average release limits specified in Sections F.30(a)(1), F.30(b)(1).

(b) Diversion/retention systems shall be provided for those liquid waste

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discharges which have the potential to exceed the limits specified in Sections F.30(a)(1), F.30(b)(1) or E.30 unless it can be demonstrated that the plant, process, or waste stream can be shut down, eliminated, or reduced in such a manner that the annual average limits will not be exceeded.

(c) A diversion/retention system is not required for waste discharges with batch release systems (i.e., a facility or system for regulating batch releases which possess sampling, analytical, and procedural capabilities to permit detection of permissible release limits prior to release to the environment).

(d) A management control system should be provided for all liquid waste discharges to prevent exceeding annual average limits. The management control system should provide for:

(1) A summation of release-to-date totals in comparison to annual limits;

(2) Written procedures providing direction to operating personnel on what to do when a limit may be exceeded and including an expeditious waste discharge procedure; and

(3) Detection capabilities sufficiently sensitive to meet the requirements of Section F.50.

(e) Where diversion/retention systems are required, monitoring and alarm systems per Sections F.50 and E.40 shall be provided. Upon detection, diversion of the waste discharge must occur before applicable limits are exceeded at the point of release to the environment. Retention capacity shall be adequate to retain the total waste discharge exceeding applicable limits prior to rerouting or termination. Materials used in construction shall be readily decontaminable, designed for adverse weather conditions and isolation from the environment if external to any facility, and compatible with the waste discharge to preclude undesirable chemical, physical, or biological reactions.

(f) Current diversion/retention systems shall be evaluated to determine their adequacy with respect to Section F.36(e). If these systems are found to be inadequate, funding for upgrading must be allocated and an effective date established for implementation.

Section F.40 Basis for Sampling and Monitoring Requirements.

- DOE MC 0511, "Radioactive Waste Management"
- DOE Order 5480.1A, "Environmental Protection, Safety and Health Protection Program for DOE Operations"
- "Standard Methods for the Examination of Water and Wastewater", American Public Health Association, latest edition
- "Annual Book of ASTM Standards, Part 31 - Water"

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Section F.50 Monitoring and Alarm Requirements.

(a) General Requirements. Monitoring and alarm systems shall be provided for all continuously discharged liquid effluent streams that have a potential for contamination at concentrations greater than those specified in Section F.50(c)(2). This requirement does not apply to effluents for which it can be demonstrated that there is no reasonable potential for exceeding the annual average concentrations in Sections F.30(a)(1) or F.30(b)(1), as applicable.

Monitoring and alarm systems are not required for batch releases provided that the batch is retained until laboratory analyses indicate that the batch is releasable.

It is the intent of this requirement to provide the means for preventing undue release of radioactive materials to the environment.

(b) Alarm Indications. Audible and/or visible indications shall be easily discernible to operations or responsible personnel in continuously or frequently occupied areas. A guideline for "frequently occupied" is once per half hour during normal work shifts.

(c) Monitoring Sensitivity.

(1) As-Low-As-Possible Requirement. Monitoring systems shall alarm at release concentrations as low as possible without resulting in an excessive number of alarms due to normal fluctuations in background or normal fluctuations in releases.

(2) Upper Limit. Monitoring systems shall alarm at release concentrations not exceeding:

- Ten times Table I/Table II, Appendix A of this manual for old/new facilities, respectively, that has at least daily laboratory analysis of samples, or

- Four times Table I/Table II, Appendix A of this manual for old/new facilities, respectively, that have laboratory analysis of samples less frequent than daily.

Discharge streams that are composed mostly of tritium, carbon-14, or strontium-90 need only meet the as-low-as-possible requirement specified in F.50(c)(1) using reasonable equipment.

(d) Monitor Type. Effluent streams shall be monitored for each type of radiation or radionuclide (e.g., gross alpha, gross beta, radioiodine, Kr-85) that has a potential for exceeding the concentrations in F.50(c)(2) above, unless unusual increases in one type of radioactivity or radionuclide are accompanied by increases in another type. For instance, if an effluent stream discharges both alpha- and beta-emitting radionuclides in concentrations that both increase during abnormal conditions, then either and alpha- or beta-detecting monitor may be used.

(e) Calibration Guidelines. Monitoring systems should be calibrated in accordance with RHO-MA-100, PM QA 3-100, and with ANSI N13.10-1974, Section 5.4.10, "Calibration." (See Appendix B.) The exact conditions of calibration should be specified, including the calibration point(s), range, and traceability to the NBS. The primary calibration should encompass the entire system, including the detector and sample collector, and should be performable after the system has been installed. Secondary calibration and periodic maintenance of the partial system should be possible without using primary calibration techniques.

Old facilities with missing or inadequate records of primary calibration should reproduce and document the required tests.

Periodic correlations should be made during operation to relate monitor readings to the concentrations and/or release rates of radioactive material in the monitored release path. These correlations should be based on the results of analyses for specific radionuclides in grab samples from the effluent stream.

The alarm/diversion initiating setpoints should be established with sufficient margin between the release limits (Section F.30) and the nominal trip setpoints to allow for: (a) the inaccuracy of the instrument; (b) uncertainties in the calibration; and (c) the instrument drift that could occur in the interval between calibrations. (This margin is inherent in the sensitivity requirements of Section F.50(c).)

(f) Design. Appendix D.1 provides guidance on design of monitoring systems.

Section F.60 Record Sampling Requirements.

(a) General Requirements. Record sampling systems shall be provided for all liquid effluents that routinely exceed or have the potential for exceeding 10% of Table II, Appendix A, concentrations on a yearly average.

It is the intent of this requirement to provide for accurate measurement of all releases of radioactive materials to the environment.

(b) Proportional Sampling. Sampling systems shall provide for accurate measurement of radioactivity by taking proportional samples. (Proportional sampling is defined in Section A.35.) For batch releases, if components of the effluent are not completely soluble, the batch shall be as homogeneous as practical before the sample is taken.

(c) Effluent Flow Measurements. Effluent flow shall be measured.

Electronic systems shall be checked annually to ensure proper electronic functioning. Other systems shall be calibrated and/or checked for proper functioning, as practical, annually.

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(d) Type and Frequency of Sampling. The type and frequency of sample collection shall be determined by joint consideration of the flow and radionuclide concentration characteristics of the effluent stream and the purpose for which the data are being obtained.

(e) Sampling Locations. Measurement of volume, flow rate, radionuclide concentrations, etc., shall be made at a point which most closely represents that which is being released to the environment from a given facility.

(f) Sampler Maintenance. The sampling system shall be maintained in accordance with manufacturer recommendations to minimize out-of-service time.

(g) Sampling Sensitivity and Laboratory Analysis.

(1) Overall Measurement System. The overall measurement system shall be such that the reported values of the total quantities of radionuclides discharged to the environment are representative of the actual releases.

(2) Sampling. Samples shall be of sufficient volume to allow the laboratory to perform all required analyses of the material with the desired precision and concentration detection limits.

(3) Analytical Sensitivity. The laboratory methods used for the record analyses of liquid radioactive discharges shall have a minimum detection limit of 10% of concentrations specified in Table II, Appendix A of this manual. This requirement does not apply to samples that need a turnaround time of less than seven days.

(4) Analytical Precision. The precision of analytical data, excluding sample and stream volume measurements, shall be computed at the 95% confidence interval on the mean. For analytical measurement values below the detection limit, as defined in part (3) of item (g), the 95% confidence interval on the mean around the measurement value shall lie below the established release criteria. For analytical measurement values exceeding the detection limit, the analytical precision shall not exceed 95% of the estimated value at the 95% confidence interval on the mean.

(5) Quality Control. Analytical Laboratories shall conduct a quality control program to ensure accuracy and precision of effluent sample analyses.

(h) Sampling Guidelines. It is the intent of this section to provide guidelines for adequate sampling of radioactive liquid effluents.

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(1) Periods of collection for composites should be as short as practicable to preclude the loss of radioactive material by deposition on walls of the sample container. Periodic checks should be performed to identify any such losses in composite samples. The use of plastic- or Teflon-lined sample bottles is recommended to minimize loss by deposition on walls.

(2) Because radiation dose is dependent on the radionuclide(s) to which the individual is exposed, monitoring and sampling programs should provide accurate information on the identity and quantity of specific radionuclides in the effluents. Gross radioactivity measurements alone are generally not acceptable for showing compliance with effluent release limits.

Gross radioactivity measurements are acceptable for the purpose of quantifying radioactivity only when:

- o Gross total radioactivity concentrations are a small fraction of the maximum permissible concentrations for unidentified mixtures as specified in Note 2 of Appendix A of this manual; or

- o Gross radioactivity measurements are documented to be truly indicative of the actual quantity and/or concentration of radionuclides released.

(i) Design. Appendix D.1 provides guidance on design of sampling systems.

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Subject	Approved by
PART G - STANDARDS FOR NONRADIOACTIVE NONHAZARDOUS WASTE DISPOSAL	Gary F. Bartho

Section G.10 Purpose and Scope. The purpose of Part G is to establish requirements and guidelines for the disposal of solid wastes that are considered nonradioactive and nonhazardous under the definitions specified in A.35. The provisions of this part apply to waste generators and to Central Landfill operations.

Section G.20 Basis.

- o Federal Regulation 40 CFR 241, "Guidelines for the Land Disposal of Solid Wastes"
- o "Minimum Functional Standards - Solid Waste Disposal Sites", Washington Administrative Code 173-301.

Section G.30 General Requirements.

(a) Waste Generators. Waste generators should make efforts to minimize the volume of wastes disposed at the Central Landfill.

(b) Landfill Operations. All landfills shall be operated in accordance with the requirements specified in EPA regulation 40 CFR 241, "Guidelines for the Land Disposal of Solid Wastes" and the State regulation WAC 173-301, "Minimum Functional Standards - Solid Waste Disposal Sites."

Section G.40 Specific Criteria.

(a) Routine nonradioactive, nonhazardous wastes generated by Hanford contractors or their subcontractors shall be disposed of at the Central Landfill.

(b) Wastes generated by other than Hanford contractors or their subcontractors shall not be disposed of at the Central Landfill without approval of DOE-RL.

(c) The disposal site shall be utilized consistent with federal, state, and local air, water, and solids quality standards.

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(d) The land disposal site must be operated in such a manner as to protect public health and ensure the safety of the personnel associated with the operation.

(e) The site shall be identified by a sign which shall include the hours of operation, a Rockwell contact phone number, and those principal wastes which are unacceptable.

(f) If necessary, adequate protection must be provided to ensure that ground and surface water are not contaminated by the operation of the landfill.

(g) Radioactive waste must be excluded from the Central Landfill. Facility managers and/or waste handlers have the responsibility to assure that radioactive wastes are not disposed of at the landfill.

(h) Open burning must not be conducted at the landfill.

(i) Litter fencing shall be installed and maintained to ensure the containment of blowing litter in the area.

(j) Fence litter shall be collected on an as-needed basis and disposed of to avoid unsightly accumulation or blowing from the landfill.

(k) Conditions shall be maintained which are unfavorable for the harboring, feeding, and breeding of vectors.

(l) The solid waste shall be covered with earth at the end of each operating day, or when deemed necessary, to minimize detrimental environmental effects due to combustion and/or wind-scattering.

(m) Deactivated trenches shall be covered with not less than 60 cm (2 feet) of backfill soil and graded to meet the natural contour of the land or to provide good water drainage.

(n) Backfilled trenches shall be revegetated as soon as practical and should be revegetated annually if needed.

(o) The Environmental Surveillance and Control Group shall inspect the Central Landfill site at least annually.

(p) The landfill shall be fenced and locked during nonoperating hours (i.e., 4 p.m. - 8 a.m. daily and all weekend hours).

(q) For the convenience of portable toilet and septic tank pumpers, a small pit should be maintained for disposal of such wastes. It shall be covered as soon as possible after all liquid has percolated.

Section G.50 Monitoring and Records. Radiation Monitoring (RM) service shall be performed on an "as needed" basis at the Central Landfill. Operators at the site shall be alert to suspicious material and shall notify RM when there may be radioactive material entering the landfill.

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Records of operating and monitoring data shall include the following:

(a) Receipts of unusual wastes

(b) Major operational problems and dates

(c) Dust control efforts

(d) Vector and litter control efforts

(e) Complaints

(f) Radiation survey data, if any.

Section G.60 Central Landfill Liquid Disposal:

(a) Sanitary Wastes.

(1) All sanitary liquid waste disposal at the Central Landfill shall be disposed in designated pits used only for that purpose.

(2) At least 12 inches of "freeboard" shall be maintained on all pits which exceed 75% of capacity.

(3) New pits shall be excavated when the only other available pits exceed 75% of capacity.

(4) Regardless of capacity, no pit shall remain open for any period exceeding six months.

(5) After use, all pits shall be covered within one week.

(b) Other Liquid Wastes.

(1) All hazardous liquids in excess of 10 gallons per primary container shall be either totally absorbed in another/other container(s) or provided with a second barrier with absorbent material in the annulus.

(2) All nonsanitary liquids disposed at the Central Landfill shall be buried the day of receipt.

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Subject	Approved by
PART H - STANDARDS FOR RADIOACTIVE SOLID WASTE DISPOSAL	

Section H.10 Purpose and Scope. Rockwell receives, stores, and/or disposes of radioactive solid wastes for all Hanford Site contractors and a number of offsite government agencies. The purpose of this standard is to ensure the maximum possible protection of the public health and environment from solid waste effluents. This part applies to active burial grounds. See Part J for deactivated burial ground criteria and standards.

Section H.20 Basis. References which provide the basis for these criteria and standards are as follows (for specific technical guidance, see the last reference):

- o DOE MC 0511, "Radioactive Waste Management"
- o DOE RL Order 5820.2, "Radioactive Waste Management"
- o RHO-MA-220, "Radiological Controls"
- o RHO-MA-222, "Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements"

Section H.30 General Requirements.

(a) The solid waste generator shall be primarily responsible for minimizing the volume of waste and the radioactive content of the waste.

(b) Radioactive waste packages shall remain free of smearable contamination during the transport and placement into burial sites.

(c) Burial grounds facilities shall minimize wind resuspension of dispersible radioactive wastes to assure that dispersion of radionuclides occur only within specified burial areas.

(d) Solid wastes generated in radiation zones where unsealed radioactive materials are used shall be considered to be radioactive unless surveyed and unconditionally released by RM.

(e) Waste containers specifically marked for radioactive application (e.g., standard waste cartons), shall not be used for nonradioactive purposes.

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(f) All radioactive solid wastes shall be disposed of in the 200 Areas. Any radioactive solid waste inadvertently dumped outside the 200 Areas shall be removed to the appropriate burial ground as soon as practical.

(g) All new or proposed burial grounds shall be located within the 200 Area Plateau and be fenced for security.

(h) New burial grounds shall be approved by HS&E, and the Waste Management Program Office.

(i) The EP Department shall be notified within five working days of any surface contamination resulting from accidental releases due to unabsorbed liquids, failed containers, etc.

Section H.40 Waste Characterizaton.

(a) Transuranic waste with concentrations greater than 10 nCi/g of waste matrix must be segregated into combustible and noncombustible constituents to the extent technically and economically practicable and must be packaged, labeled, and stored such that (a)intact, contamination-free retrieval, identification, and onsite transportation can be readily implemented up to 20 years after emplacement in storage, and (b) packages of combustible waste can be retrieved separately from packages of non-combustible waste.

(b) The following waste characteristics shall be assessed to determine the necessity for segregation for burial: (See specific packaging directives in RHO-MA-222.)

(1) Liquid organic content (e.g., type, flash point, etc.)

(2) Combustible and noncombustible content

(3) Chemical reactivity (e.g., strong oxidizers)

(4) Poisonous or carcinogenic materials content

(5) Gas generating capability of the waste as possible producer of pressure, fire, or toxic fumes.

(c) Health, Safety and Environment shall have concurrence approval for disposal of unusual forms of wastes which are in a chemical or physical matrix such that they do not conform to existing burial ground requirements.

(d) Liquids, gases, and unstable solids shall be converted into stable forms or surrounded by sufficient absorbent to prevent radionuclide migration in the event of breach of containment. (See RHO-MA-222 for details.)

(e) To prevent the spread of contamination, backfilling of subsurface facilities (i.e., trenches) and stabilization of earth cover shall proceed as soon as practical.

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Subject	Approved by
PART I - STANDARDS FOR SURFACE SOIL CONTAMINATION	Gary F. Barth

Section I.10 Purpose. The purpose of Part I is to define surface soil radioactive contamination limits for 200 Area surface soils. Working criteria are specified and guidelines for posting or controlling contaminated areas are given.

Section I.20 Scope. The surface soil contamination standards specified here are only applicable to the 200 Areas. It is assumed that access to these areas will always be restricted and that restrictions on the use of land will be maintained. (Questions about soil standards for the 600 Area should be directed to the EP Department.)

Section I.30 Basis. The surface soil contamination standards defined in this part are derived from:

Surface Soil Contamination Standards, RHO-CD-782, June 1979.

Section I.40 Contamination Limits.

(a) Average Soil Contamination Limits. External radiation levels from uncontaminated soils shall not exceed 50 μR/hr (net) at 1 m above the surface, and shall not contain concentrations of radionuclides greater than those concentrations specified in Table I.1, Column I of this part.

(b) Areal Contamination Limits. Uncontaminated soil surfaces shall not contain surface concentrations of a radionuclide greater than those surface concentrations specified in Table I.1, Column II of this part.

Areal contamination limits only apply in cases where the concentrations in a thin layer of soil on the surface greatly exceed the concentrations averaged down to a depth of 1 cm.

(c) Spot Contamination. Uncontaminated soils shall not contain spots with activities greater than those activities specified in Table I.1, Column III of this part.

Section I.50 Working Criteria. The surface soil contamination limits for beta and gamma emitters specified in Section I.40 may be assumed to be met provided that:

(a) General. The exposure rate at one meter above the

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surface is measured and found to be less than the limit specified in Section I.40(a). The instrumentation used to determine the exposure rate should be (1) a Reuter-Stokes pressurized ionization chamber or (2) any equivalent (in terms of sensitivity and energy response) exposure rate measuring system.

(b) Beta-Emitting Contaminants.

(1) Beta-emitting contaminants with a maximum beta energy greater than 0.15 MeV are known to be present and direct measurements are 200 cpm (net above background) or less at 8 cm above the contaminated plane for a dry soil condition using either an Eberline P-11 probe or any similar G-M probe with a 10% counting efficiency for strontium-90/yttrium 90, a 15 sq cm effective counting area, and a window thickness of 1.4 mg/sq cm or less.

(2) Beta-emitting contaminants with a maximum energy less than 0.15 MeV are known to be present or alpha-emitting contaminants are known to be present and Table I.1 values are not exceeded as determined by: (1) routine laboratory analysis; (2) field measurements of dry soil samples (only) by the Mobile Radiological Analysis Laboratory (MRAL I); or (3) any sufficiently sensitive technique.

(c) Wet Soil Conditions. For wet soil conditions meeting Table I.1 criteria of the standard may be demonstrated only by laboratory analysis.

(d) Implementation Guidelines. Guidelines for implementing surface soil contamination limits are contained in RHO-HS-EV-14, "Guidelines for Application of RHO-MA-139 Standards for Surface Soil Contamination."

Section I.60 Posting Areas. Posting of areas shall be in accordance with RHO-MA-220, "Radiological Controls."

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TABLE I.1. Surface Soil Contamination Limits.

Isotope	Column I Avg. Soil Contamination Limits (pCi/g)	Column II Areal Contamination Limits (pCi/sq cm)	Column III Spot Activity Limits (pCi)
Americium-241	300	50	720
Antimony-125	1,000	160	2,400
Bismuth-207	500	100	1,400
Cadmium-109	2,000	320	4,800
Carbon-14	8,000	1,300	19,000
Cesium-137	400	60	960
Cobalt-60	300	50	720
Europium-152	800	130	1,900
Europium-154	200	30	480
Europium-155	200	30	480
Hydrogen-3	30,000	4,800	70,000
Iodine-129	2,000	320	4,800
Iron-55	20,000	3,200	48,000
Nickel-63	7,000	1,100	17,000
Plutonium-238	60	10	150
Plutonium-239	60	10	150
Plutonium-240	60	10	150
Promethium-147	2,000	320	4,800
Sodium-22	300	50	720
Strontium-90	400	60	960
Technetium-99	2,000	320	4,800

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TABLE I.1. Surface Soil Contamination Limits.

Isotope	Column I Avg. Soil Contamination Limits (pCi/g)	Column II Areal Contamination Limits (pCi/sq cm)	Column III Spot Activity Limits (pCi)
Thallium-204	600	100	1,400
Thorium-232	62	10	150
Uranium-233	250	40	600
Uranium-234	250	40	600
Uranium-235	250	40	600
Uranium-238	300	50	750
Other - Emitters	10 times the maximum permissible concentration specified in Table II Appendix A (Water-insoluble), where one ml of water is equivalent to one gram of solid material.	0.16 (g/sq cm) times the limit specified in Column I of this table.	15 (sq cm) times the limit specified in Column II of this table.
Other Emitters	6.25E+07 times the maximum permissible concentration specified in Table II Appendix A (Air-insoluble).	0.16 (g/sq cm) times the limit specified in Column I of this table.	15 (sq cm) times the limit specified in Column II of this table.

1. A suitable mass over which contamination may be averaged shall be representative of the contamination (e.g., a 1 kg composite).

2. A suitable area over which contamination may be averaged should be 15 sq cm.

3. For soil contaminated with more than one radionuclide the following condition applies:

$$\sum_i \frac{\text{Concentration of radionuclide "i"}}{\text{Soil Standard for radionuclide "i"}} \quad 1$$

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Subject	Approved by
PART J - INACTIVE RADIOACTIVE TERRESTRIAL SITES	Gary F. Boothe

Section J.10 Purpose and Scope. The purpose of Part J is to establish standards for the monitoring and maintenance of inactive radioactive sites such as burial grounds, cribs, ditches and ponds, and other contaminated areas. The requirements of this part do not apply to the operations of new or current burial grounds. Criteria and standards for new or current burial operations are specified in Part H.

Section J.20 Basis.

- o Hanford Standards, "Architectural - Civil Standards", AC-5-40 and AC-3-25
- o RHO-MA-220, "Radiological Controls"
- o RHO-MA-222, "Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements"

Section J.30 General Requirements.

(a) A barrier shall be provided which prevents radionuclide transport to the surface that could cause surface contamination in excess of limits in Section I.40.

(b) Process lines to inactive sites shall be isolated to preclude an accidental release to the site.

(c) Surface radiation levels shall be less than 1 mrem/hr. The surface shall be uncontaminated; i.e., less than limits in Section I.40.

(d) A minimum of 1.2 m (4 ft) of earth, or equivalent barrier, shall be provided between the contaminated material and the ground surface. Less than 1.2 m of cover may be used on a case-by-case basis for sites that are not primary disposal sites and are slightly contaminated above the limits in Section I.40. In such cases, the depth of cover needed will depend on the actual level of contamination and the expected mobility of the contamination through transport pathways (e.g., uptake by plants is greater for strontium-90 than plutonium-239). (See Appendix E.)

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(e) Site boundaries shall be accurately and permanently marked with concrete posts as specified in Hanford Standard AC-5-40. Posting shall be in accordance with RHO-MA-220, "Radiological Controls." Records shall be kept per Section J.40 below.

Section J.40 Surveying and Records.

(a) Deactivated solid and liquid waste disposal sites shall be periodically (at least annually) surveyed and inspected by the EP Department and Radiation Monitoring to ensure that the above radiological conditions are being maintained. Deficiencies noted upon inspection shall be corrected by the appropriate operating group. The EP Department shall be responsible for notifying the operating group of any deficiencies.

(b) The EP Department shall be notified by the operating group as to modifications, improvements, or changes in status of the site.

(c) The EP Department shall maintain permanent records on the status and characteristics of all sites.

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Subject	Approved by
PART K - HERBICIDE VEGETATION CONTROL	Guy F. Bartholomew

Section K.10 Purpose and Scope. The purpose of Part K is to establish standards for the safe use, storage, and disposal of herbicides.

Section K.20 Basis.

(a) DOE 5480.1A - "Environmental Protection, Safety, and Health Protection Program for DOE Operations".

(b) 40 CFR 162 - Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.

(c) 40 CFR 165 - "Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for Disposal and Storage of Pesticides and Pesticide Containers".

(d) 40 CFR 171 - "Certification of Pesticide Applicators."

(e) Washington Administrative Code (various) as required above.

(f) Chapter 15.58 RCW - "Washington Pesticide Control Act".

(g) Chapter 17.21 RCW - "Washington Pesticide Application Act".

Section K.30 General Requirements.

(a) Rockwell shall maintain at least one licensed Commerical Pesticide Applicator (CPA) who shall be knowledgeable in all facets of pesticide application and who shall be responsible for all audit and herbicide coordination activities.

(b) Each spray crew must have in attendance at least one licensed Commercial Pesticide Operator (CPO). The crew shall be routinely trained (i.e., within six months of employment and each two years thereafter).

(c) Only herbicides registered for use by the EPA and the State of Washington shall be used.

(d) All herbicide-contaminated equipment shall be thoroughly decontaminated according to label directions prior to other nonherbicide uses.

(e) Herbicides shall be contained in nonleaking, clearly labelled containers.

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(f) All herbicides and herbicide-contaminated containers must be used, disposed and/or stored in compliance with the label.

(g) Herbicide and herbicide containers shall be disposed only in the chemical trench of the Central Landfill (Exception: External containers protected by inner liners and containers that are triple-rinsed with a diluent volume of at least one-third of the orginal volume.)

(h) Residue and rinse liquids should be added to spray mixtures in the field or solidified and disposed per K.30 (f).

(i) All herbicides other than those labelled for "home and garden use" shall be stored in a facility with the following characteristics:

(1) Secured by either a climb-proof fence and locked gate, or locked building;

(2) Warning signs to identify the hazardous nature of the stored substance and prohibiting unauthorized entry;

(3) Dry, well-ventilated, segregated covered area where fire protection is provided; and

(4) Inert absorbents kept near the facility.

(j) Herbicide containers should be checked monthly for leakage and appropriate action taken at the direction of the CPA.

(k) Herbicide storage adjacent to feed, food, or eating area is prohibited.

(l) Use of herbicides shall follow all standards of good practice (e.g., Material Data Safety Sheets).

(m) Personnel handling herbicides shall be provided access to a wash basin, shower, or other source of potable water.

(n) An annual herbicide spray program plan shall be prepared for the Company. The lead for preparation of this plan will be coordinated through the CPA with input from all appropriate functions. Actual spray operations shall be appraised for consistency with the plan and overall effectiveness.

(o) Herbicide spray drift to non-DOE property and other nontarget areas shall be precluded by adherence to all label requirements and state regulations.

Section K.40 Records.

(a) An accurate record of all herbicide spray operations shall be kept by the CPA for a minimum of three years from the date of application. After each application, a report will be sent to the appropriate facility manager.

(b) At a minimum, records shall conform with WAC Section 16-228-190 and will contain the following information:

1. Location of area sprayed;

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2. Time of day and date;

3. Direction and estimated velocity of the wind;

4. Herbicide used with dilution ratio and solvent used;

5. Rates of application; and

6. Name of licensed CPO in attendence.

(c) A current record of the inventory of all stored herbicide shall be posted at each storage facility. The responsible CPO shall update the record each time materials are removed.

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Subject	Approved by
APPENDIX A - MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIONUCLIDES IN AIR AND WATER	Gary F. Bartlett

Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Actinium(89)	Ac-227	S	2E-12	6E-05	8E-14	2E-06
		I	3E-11	9E-03	9E-13	3E-04
	Ac-228	S	8E-08	3E-03	3E-09	9E-05
		I	2E-08	3E-03	6E-10	9E-05
Americium(95)	Am-241	S	6E-12	1E-04	2E-13	4E-06
		I	1E-10	8E-04	4E-12	3E-05
	Am-242m	S	6E-12	1E-04	2E-13	4E-06
		I	3E-10	3E-03	9E-12	9E-05
	Am-242	S	4E-08	4E-03	1E-09	1E-04
		I	5E-08	4E-03	2E-09	1E-04
	Am-243	S	6E-12	1E-04	2E-13	4E-06
		I	1E-10	8E-04	4E-12	3E-05
	Am-244	S	4E-06	1E-01	1E-07	5E-03
		I	2E-05	1E-01	8E-07	5E-03
Antimony(51)	Sb-122	S	2E-07	8E-04	6E-09	3E-05
		I	1E-07	8E-04	5E-09	3E-05
	Sb-124	S	2E-07	7E-04	5E-09	2E-05
		I	2E-08	7E-04	7E-10	2E-05
	Sb-125	S	5E-07	3E-03	2E-08	1E-04
		I	3E-08	3E-03	9E-10	1E-04
Argon(18)	A-37	Sub	3E-03		1E-04	
	A-41	Sub	2E-06		4E-08	
Arsenic(33)	As-73	S	2E-06	1E-02	7E-08	5E-04
		I	4E-07	1E-02	1E-08	1E-04
	As-74	S	3E-07	2E-03	1E-08	5E-05
		I	1E-07	2E-03	4E-09	5E-05
	As-76	S	1E-07	6E-04	4E-09	2E-05
		I	1E-07	6E-04	3E-09	2E-05
	As-77	S	5E-07	2E-03	2E-08	8E-05
		I	4E-07	2E-03	1E-08	8E-05

Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (µCi/ml)	TABLE I Controlled Area Column 2 Water (µCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (µCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (µCi/ml)
Astatine(85)	At-211	S	4E-09	2E-05	2E-10	2E-06
		I	3E-08	2E-03	1E-09	7E-05
Barium(56)	Ba-131	S	1E-06	5E-03	4E-08	2E-04
		I	4E-07	5E-03	1E-08	2E-04
	Ba-140	S	1E-07	8E-04	4E-09	3E-05
		I	4E-08	7E-04	1E-09	2E-05
Berkelium(97)	Bk-249	S	9E-10	2E-02	3E-11	6E-04
		I	1E-07	2E-02	4E-09	6E-04
	Bk-250	S	1E-07	6E-03	5E-09	2E-04
		I	1E-06	6E-03	4E-08	2E-04
Beryllium(4)	Be-7	S	6E-06	5E-02	2E-07	2E-03
		I	1E-06	5E-02	4E-08	2E-03
Bismuth(83)	Bi-206	S	2E-07	1E-03	6E-09	4E-05
		I	1E-07	1E-03	5E-09	4E-05
	Bi-207	S	2E-07	2E-03	6E-09	6E-05
		I	1E-08	2E-03	5E-10	6E-05
	Bi-210	S	6E-09	1E-03	2E-10	4E-05
		I	6E-09	1E-03	2E-10	4E-05
	Bi-212	S	1E-07	1E-02	3E-09	4E-04
		I	2E-07	1E-02	7E-09	4E-04
Bromine(35)	Br-82	S	1E-06	8E-03	4E-09	3E-04
		I	2E-07	1E-03	6E-09	4E-05
Cadmium(48)	Cd-109	S	5E-08	5E-03	2E-09	2E-04
		I	7E-08	5E-03	3E-09	2E-04
	Cd-115m	S	4E-08	7E-04	1E-09	3E-05
		I	4E-08	7E-04	1E-09	3E-05
	Cd-115	S	2E-07	1E-03	8E-09	3E-05
		I	2E-07	1E-03	6E-09	4E-05
Calcium(20)	Ca-45	S	3E-08	3E-04	1E-09	9E-06
		I	1E-07	5E-03	4E-09	2E-04
	Ca-47	S	2E-07	1E-03	6E-09	5E-05
		I	2E-07	1E-03	6E-09	3E-05
Californium(98)	Cf-249	S	2E-12	1E-04	5E-14	4E-06
		I	1E-10	7E-04	3E-12	2E-05
	Cf-250	S	5E-12	4E-04	2E-13	1E-05
		I	1E-10	7E-04	3E-12	3E-05
	Cf-251	S	2E-12	1E-04	6E-14	4E-06
		I	1E-10	8E-04	3E-12	3E-05
	Cf-252	S	6E-12	2E-04	2E-13	7E-05
		I	3E-11	2E-04	1E-12	7E-05
	Cf-253	S	8E-10	4E-03	3E-11	1E-04
		I	8E-10	4E-03	3E-11	1E-04
	Cf-254	S	5E-12	4E-06	2E-13	1E-07
		I	5E-12	4E-06	2E-13	1E-07

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (µCi/ml)	TABLE I Controlled Area Column 2 Water (µCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (µCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (µCi/ml)
Astatine(85)	At-211	S	4E-09	2E-05	2E-10	2E-06
		I	3E-08	2E-03	1E-09	7E-05
Barium(56)	Ba-131	S	1E-06	5E-03	4E-08	2E-04
		I	4E-07	5E-03	1E-08	2E-04
	Ba-140	S	1E-07	8E-04	4E-09	3E-05
		I	4E-08	7E-04	1E-09	2E-05
Berkelium(97)	Bk-249	S	9E-10	2E-02	3E-11	6E-04
		I	1E-07	2E-02	4E-09	6E-04
	Bk-250	S	1E-07	6E-03	5E-09	2E-04
		I	1E-06	6E-03	4E-08	2E-04
Beryllium(4)	Be-7	S	6E-06	5E-02	2E-07	2E-03
		I	1E-06	5E-02	4E-08	2E-03
Bismuth(83)	Bi-206	S	2E-07	1E-03	6E-09	4E-05
		I	1E-07	1E-03	5E-09	4E-05
	Bi-207	S	2E-07	2E-03	6E-09	6E-05
		I	1E-08	2E-03	5E-10	6E-05
	Bi-210	S	6E-09	1E-03	2E-10	4E-05
		I	6E-09	1E-03	2E-10	4E-05
	Bi-212	S	1E-07	1E-02	3E-09	4E-04
		I	2E-07	1E-02	7E-09	4E-04
Bromine(35)	Br-82	S	1E-06	8E-03	4E-09	3E-04
		I	2E-07	1E-03	6E-09	4E-05
Cadmium(48)	Cd-109	S	5E-08	5E-03	2E-09	2E-04
		I	7E-08	5E-03	3E-09	2E-04
	Cd-115m	S	4E-08	7E-04	1E-09	3E-05
		I	4E-08	7E-04	1E-09	3E-05
	Cd-115	S	2E-07	1E-03	8E-09	3E-05
		I	2E-07	1E-03	6E-09	4E-05
Calcium(20)	Ca-45	S	3E-08	3E-04	1E-09	9E-06
		I	1E-07	5E-03	4E-09	2E-04
	Ca-47	S	2E-07	1E-03	6E-09	5E-05
		I	2E-07	1E-03	6E-09	3E-05
Californium(98)	Cf-249	S	2E-12	1E-04	5E-14	4E-06
		I	1E-10	7E-04	3E-12	2E-05
	Cf-250	S	5E-12	4E-04	2E-13	1E-05
		I	1E-10	7E-04	3E-12	3E-05
	Cf-251	S	2E-12	1E-04	6E-14	4E-06
		I	1E-10	8E-04	3E-12	3E-05
	Cf-252	S	6E-12	2E-04	2E-13	7E-05
		I	3E-11	2E-04	1E-12	7E-05
	Cf-253	S	8E-10	4E-03	3E-11	1E-04
		I	8E-10	4E-03	3E-11	1E-04
	Cf-254	S	5E-12	4E-06	2E-13	1E-07
		I	5E-12	4E-06	2E-13	1E-07

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Carbon(6)	C-14	S	4E-06	2E-02	1E-07	8E-04
	(CO)	Sub	5E-05		1E-06	
Cerium(58)	Ce-141	S	4E-07	3E-03	2E-08	9E-05
		I	2E-07	3E-03	5E-09	9E-05
	Ce-143	S	3E-07	1E-03	9E-09	4E-05
		I	2E-07	1E-03	7E-09	4E-05
	Ce-144	S	1E-08	3E-04	3E-10	1E-05
		I	6E-09	3E-04	2E-10	1E-05
Cesium(55)	Cs-131	S	1E-05	7E-02	4E-07	2E-03
		I	3E-06	3E-02	1E-07	9E-04
	Cs-134m	S	4E-05	2E-01	1E-06	6E-03
		I	6E-06	3E-02	2E-07	1E-03
	Cs-134	S	4E-08	3E-04	1E-09	9E-06
		I	1E-08	1E-03	4E-10	4E-05
	Cs-135	S	5E-07	3E-03	2E-08	1E-04
		I	9E-08	7E-03	3E-09	2E-04
	Cs-136	S	4E-07	2E-03	1E-08	9E-05
		I	2E-07	2E-03	6E-09	6E-05
	Cs-137	S	6E-08	4E-04	2E-09	2E-05
		I	1E-08	1E-03	5E-10	4E-05
Chlorine(17)	Cl-36	S	4E-07	2E-03	1E-08	8E-05
		I	2E-08	2E-03	8E-10	6E-05
	Cl-38	S	3E-06	1E-02	9E-08	4E-04
		I	2E-06	1E-02	7E-08	4E-04
Chromium(24)	Cr-51	S	1E-05	5E-02	4E-07	2E-03
		I	2E-06	5E-02	8E-08	2E-03
Colbalt(27)	Co-57	S	3E-06	2E-02	1E-07	5E-04
		I	2E-07	1E-02	6E-09	4E-04
	Co-58m	S	2E-05	8E-02	6E-07	3E-03
		I	9E-06	6E-02	3E-07	2E-03
	Co-58	S	8E-07	4E-03	3E-08	1E-04
		I	5E-08	3E-03	2E-09	9E-05
	Co-60	S	3E-07	1E-03	1E-08	5E-05
		I	9E-09	1E-03	3E-10	3E-05
Copper(29)	Cu-64	S	2E-06	1E-02	7E-08	3E-04
		I	1E-06	6E-03	4E-08	2E-04
Curium(96)	Cm-242	S	1E-10	7E-04	4E-12	2E-05
		I	2E-10	7E-04	6E-12	2E-05
	Cm-243	S	6E-12	1E-04	2E-13	5E-06
		I	1E-10	7E-04	3E-12	2E-05
	Cm-244a	S	9E-12	2E-04	3E-13	7E-06
		I	1E-10	8E-04	3E-12	3E-05
	Cm-245	S	5E-12	1E-04	2E-13	4E-06
		I	1E-10	8E-04	4E-12	3E-05

Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Curium(96) (cont.)	Cm-246	S	5E-12	1E-04	2E-13	4E-06
		I	1E-10	8E-04	4E-12	3E-05
	Cm-247	S	5E-12	1E-04	2E-13	4E-06
		I	1E-10	6E-04	4E-12	2E-05
	Cm-248	S	6E-13	1E-05	2E-14	4E-07
		I	1E-11	4E-05	4E-13	1E-06
	Cm-249	S	1E-05	6E-02	4E-07	2E-03
		I	1E-05	6E-02	4E-07	2E-03
Dysprosium(66)	Dy-165	S	3E-06	1E-02	9E-08	4E-04
		I	2E-06	1E-02	7E-08	4E-04
	Dy-166	S	2E-07	1E-03	8E-09	4E-05
		I	2E-07	1E-03	7E-09	4E-05
Einsteinium(99)	Es-253	S	8E-10	7E-04	3E-11	2E-05
		I	6E-10	7E-04	2E-11	2E-05
	Es-254m	S	5E-09	8E-04	2E-10	2E-05
		I	6E-09	5E-04	2E-10	2E-05
	Es-254	S	2E-11	4E-04	6E-13	1E-05
		I	1E-10	4E-04	4E-12	1E-05
	Es-255	S	5E-10	5E-04	2E-11	3E-05
		I	4E-10	8E-04	1E-11	3E-05
Erbium(68)	Er-169	S	6E-07	3E-03	2E-08	9E-05
		I	4E-07	3E-03	1E-08	9E-05
	Er-171	S	7E-07	3E-03	2E-08	1E-04
		I	6E-07	3E-03	2E-08	1E-04
Europium(63)	Eu-152 (T/2=9.2 hrs)	S	4E-07	2E-03	1E-08	6E-05
		I	3E-07	2E-03	1E-08	6E-05
	Eu-152 (T/2=13 yrs)	S	1E-08	2E-03	4E-10	8E-05
		I	2E-08	2E-03	6E-10	8E-05
	Eu-154	S	4E-09	6E-04	1E-10	2E-05
		I	7E-09	6E-04	2E-10	2E-05
	Eu-155	S	9E-08	6E-03	3E-09	2E-04
		I	7E-08	6E-03	3E-09	2E-04
Fermium(100)	Fm-254	S	6E-08	4E-03	2E-09	1E-04
		I	7E-08	4E-03	2E-09	1E-04
	Fm-255	S	2E-08	1E-03	6E-10	3E-05
		I	1E-08	1E-03	4E-10	3E-05
	Fm-256	S	3E-09	3E-05	1E-10	9E-07
		I	2E-09	3E-05	6E-11	9E-07

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Fluorine(9)	F-18	S	5E-06	2E-02	2E-07	8E-04
		I	3E-06	1E-02	9E-08	5E-04
Gadolinium(64)	Gd-153	S	2E-07	6E-03	8E-09	2E-04
		I	9E-08	6E-03	3E-09	2E-04
	Gd-159	S	5E-07	2E-03	2E-08	8E-05
		I	4E-07	2E-03	1E-08	8E-05
Gallium(31)	Ga-72	S	2E-07	1E-03	8E-09	4E-05
		I	2E-07	1E-03	6E-09	4E-05
Germanium(32)	Ge-71	S	1E-05	5E-02	4E-07	2E-03
		I	6E-06	5E-02	2E-07	2E-03
Gold(79)	Au-196	S	1E-06	5E-03	4E-08	2E-04
		I	6E-07	4E-03	2E-08	1E-04
	Au-198	S	3E-07	2E-03	1E-08	5E-05
		I	2E-07	1E-03	8E-09	5E-05
	Au-199	S	1E-06	5E-03	4E-08	2E-04
		I	8E-07	4E-03	3E-08	2E-04
Hafnium(72)	Hf-181	S	4E-08	2E-03	1E-09	7E-05
		I	7E-08	2E-03	3E-09	7E-05
Holmium(67)	Ho-166	S	2E-07	9E-04	7E-09	3E-05
		I	2E-07	9E-04	6E-09	3E-05
Hydrogen(1)	H-3	S	5E-06	1E-01	2E-07	3E-03
		I	5E-06	1E-01	2E-07	3E-03
		Sub	2E-03		4E-05	
Indium(49)	In-113m	S	8E-06	4E-02	3E-07	1E-03
		I	7E-06	4E-02	2E-07	1E-03
	In-114m	S	1E-07	5E-04	4E-09	1E-05
		I	2E-08	5E-04	7E-10	2E-05
	In-115m	S	2E-06	1E-02	8E-08	4E-04
		I	2E-06	1E-02	6E-08	4E-04
	In-115	S	2E-07	3E-03	9E-09	9E-05
		I	3E-08	3E-03	1E-09	9E-05
Iodine(53)**	I-125	S	3E-09	2E-05	8E-11	2E-07
		I	2E-07	6E-03	6E-09	2E-04
	I-126	S	4E-09	3E-05	9E-11	3E-07
		I	3E-07	3E-03	1E-08	9E-05
	I-129	S	8E-10	5E-06	2E-11	6E-08
		I	7E-08	6E-03	2E-09	2E-04
	I-131	S	4E-09	3E-05	1E-10	3E-07
		I	3E-07	2E-03	1E-08	6E-05

Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Iodine(53)** (Continued)	I-132	S	1E-07	8E-04	3E-09	8E-06
		I	9E-07	5E-03	3E-08	2E-04
	I-133	S	2E-08	1E-04	4E-10	1E-06
		I	2E-07	1E-03	7E-09	4E-05
	I-134	S	3E-07	2E-03	6E-09	2E-05
		I	3E-06	2E-02	1E-07	6E-04
	I-135	S	5E-08	4E-04	1E-09	4E-06
		I	4E-07	2E-03	1E-08	7E-05
Iridium(77)	Ir-190	S	1E-06	6E-03	4E-08	2E-04
		I	4E-07	5E-03	1E-08	2E-04
	Ir-192	S	1E-07	1E-03	4E-09	4E-05
		I	3E-08	1E-03	9E-10	4E-05
	Ir-194	S	2E-07	1E-03	8E-09	3E-05
		I	2E-07	9E-04	5E-09	3E-05
Iron(26)	Fe-55	S	9E-07	2E-02	3E-08	8E-04
		I	1E-06	7E-02	3E-08	2E-03
	Fe-59	S	1E-07	2E-03	5E-09	6E-05
		I	5E-08	2E-03	2E-09	5E-05
Krypton(36)	Kr-85m	Sub	6E-06		1E-07	
	Kr-85	Sub	1E-05		3E-07	
	Kr-87	Sub	1E-06		2E-08	
	Kr-88	Sub	1E-06		2E-08	
Lanthanum(57)	La-140	S	2E-07	7E-04	5E-09	2E-05
		I	1E-07	7E-04	4E-09	2E-05
Lead(82)	Pb-203	S	3E-06	1E-02	9E-08	4E-04
		I	2E-06	1E-02	6E-08	4E-04
	Pb-210	S	1E-10	4E-06	4E-12	1E-07
		I	2E-10	5E-03	8E-12	2E-04
	Pb-212	S	2E-08	6E-04	6E-10	2E-05
		I	2E-08	5E-04	7E-10	2E-05
Lutetium(71)	Lu-177	S	6E-07	3E-03	2E-08	1E-04
		I	5E-07	3E-03	2E-08	1E-04
Manganese(25)	Mn-52	S	2E-07	1E-03	7E-09	3E-05
		I	1E-07	9E-04	5E-09	3E-05
	Mn-54	S	4E-07	4E-03	1E-08	1E-04
		I	4E-08	3E-03	1E-09	1E-04
	Mn-56	S	8E-07	4E-03	3E-08	1E-04
		I	5E-07	3E-03	2E-08	1E-04

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Mercury(80)	Hg-197m	S	7E-07	6E-03	3E-08	2E-04
		I	8E-07	5E-03	3E-08	2E-04
	Hg-197	S	1E-06	9E-03	4E-08	3E-04
		I	3E-06	1E-02	9E-08	5E-04
	Hg-203	S	7E-08	5E-04	2E-09	2E-05
		I	1E-07	3E-03	4E-09	1E-04
Molybdenum(42)	Mo-99	S	7E-07	5E-03	3E-08	2E-04
		I	2E-07	1E-03	7E-09	4E-05
Neodymium(60)	Nd-144	S	8E-11	2E-03	3E-12	7E-05
		I	3E-10	2E-03	1E-11	8E-05
	Nd-147	S	4E-07	2E-03	1E-08	6E-05
		I	2E-07	2E-03	8E-09	6E-05
	Nd-149	S	2E-06	8E-03	6E-08	3E-04
		I	1E-06	8E-03	5E-08	3E-04
Neptunium(93)	Np-237	S	4E-12	9E-05	1E-13	3E-06
		I	1E-10	9E-04	4E-12	3E-05
	Np-239	S	8E-07	4E-03	3E-08	1E-04
		I	7E-07	4E-03	2E-08	1E-04
Nickel(28)	Ni-59	S	5E-07	6E-03	2E-08	2E-04
		I	8E-07	6E-02	3E-08	2E-03
	Ni-63	S	6E-08	8E-04	2E-09	3E-05
		I	3E-07	2E-02	1E-08	7E-04
	Ni-65	S	9E-07	4E-03	3E-08	1E-04
		I	5E-07	3E-03	2E-08	1E-04
Niobium (Columbium)(41)	Nb-93m	S	1E-07	1E-02	4E-09	4E-04
		I	2E-07	1E-02	5E-09	4E-04
	Nb-95	S	5E-07	3E-03	2E-08	1E-04
		I	1E-07	3E-03	3E-09	1E-04
	Nb-97	S	6E-06	3E-02	2E-07	9E-04
		I	5E-06	3E-02	2E-07	9E-04
Osmium(76)	Os-185	S	5E-07	2E-03	2E-08	7E-05
		I	5E-08	2E-03	2E-09	7E-05
	Os-191m	S	2E-05	7E-02	6E-07	3E-03
		I	9E-06	7E-02	3E-07	2E-03
	Os-191	S	1E-06	5E-03	4E-08	2E-04
		I	4E-07	5E-03	1E-08	2E-04
	Os-193	S	4E-07	2E-03	1E-08	6E-05
		I	3E-07	2E-03	9E-09	5E-05
Palladium(46)	Pd-103	S	1E-06	1E-02	5E-08	3E-04
		I	7E-07	8E-03	3E-08	3E-04
	Pd-109	S	6E-07	3E-03	2E-08	9E-05
		I	4E-07	2E-03	1E-08	7E-05
Phosphorus(15)	P-32	S	7E-08	5E-04	2E-09	2E-05
		I	8E-08	7E-04	3E-09	2E-05

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Platinum(78)	Pt-191	S	8E-07	4E-03	3E-08	1E-04
		I	6E-07	3E-03	2E-08	1E-04
	Pt-193	S	1E-04	3E-02	9E-03	9E-04
		I	3E-07	5E-02	1E-03	2E-03
	Pt-193m	S	7E-06	3E-02	2E-07	1E-03
		I	5E-06	3E-02	2E-07	1E-03
	Pt-197m	S	6E-06	3E-02	2E-07	1E-03
		I	5E-06	3E-02	2E-07	9E-04
	Pt-197	S	8E-07	4E-03	3E-08	1E-04
		I	6E-07	3E-03	2E-08	1E-04
Plutonium(94)	Pu-238	S	2E-12	1E-04	7E-14	5E-06
		I	3E-11	8E-04	1E-12	3E-05
	Pu-239	S	2E-12	1E-04	6E-14	5E-06
		I	4E-11	8E-04	1E-12	3E-05
	Pu-240	S	2E-12	1E-04	6E-14	5E-06
		I	4E-11	8E-04	1E-12	3E-05
	Pu-241	S	9E-11	7E-03	3E-12	2E-04
		I	4E-08	4E-02	1E-09	1E-03
	Pu-242	S	2E-12	1E-04	6E-14	5E-06
		I	4E-11	9E-04	1E-12	3E-05
	Pu-243	S	2E-06	1E-02	6E-08	3E-04
		I	2E-06	1E-02	8E-08	3E-04
	Pu-244	S	2E-12	1E-04	6E-14	4E-06
		I	3E-11	3E-04	1E-12	1E-05
Polonium(84)	Po-210	S	5E-10	2E-05	2E-11	7E-07
		I	2E-10	8E-04	7E-12	3E-05
Potassium(19)	K-42	S	2E-06	9E-03	7E-08	3E-04
		I	1E-07	6E-04	4E-09	2E-05
Praseodymium(59)	Pr-142	S	2E-07	9E-04	7E-09	3E-05
		I	2E-07	9E-04	5E-09	3E-05
	Pr-143	S	3E-07	1E-03	1E-08	5E-05
		I	2E-07	1E-03	6E-09	5E-05
Promethium(61)	Pm-147	S	6E-08	6E-03	2E-09	2E-04
		I	1E-07	6E-03	3E-09	2E-04
	Pm-149	S	3E-07	1E-03	1E-08	4E-05
		I	2E-07	1E-03	8E-09	4E-05

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Protactinium(91)	Pa-230	S	2E-09	7E-03	6E-11	2E-04
		I	8E-10	7E-03	3E-11	2E-04
	Pa-231	S	1E-12	3E-05	4E-14	9E-07
		I	1E-10	8E-04	4E-12	2E-05
	Pa-233	S	6E-07	4E-03	2E-08	1E-04
		I	2E-07	3E-03	6E-09	1E-04
Radium(88)	Ra-223	S	2E-09	2E-05	6E-11	7E-07
		I	2E-10	1E-04	8E-12	4E-06
	Ra-224	S	5E-09	7E-05	2E-10	2E-06
		I	7E-10	2E-04	2E-11	5E-06
	Ra-226	S	3E-11	4E-07	3E-12	3E-08
		I	5E-11	9E-04	2E-12	3E-05
	Ra-228	S	7E-11	8E-07	2E-12	3E-08
		I	4E-11	7E-04	1E-12	3E-05
Radon(86)	Rn-220	S	3E-07		1E-08	
	Rn-222	S	1E-07		3E-09	
Rhenium(75)	Re-183	S	3E-06	2E-02	9E-08	6E-04
		I	2E-07	8E-03	5E-09	3E-04
	Re-186	S	6E-07	3E-03	2E-08	9E-05
		I	2E-07	1E-03	8E-09	5E-05
	Re-187	S	4E-06	4E-02	3E-07	3E-03
		I	5E-07	4E-02	2E-08	2E-03
	Re-188	S	4E-07	2E-03	1E-08	6E-05
		I	2E-07	9E-04	6E-09	3E-05
Rhodium(45)	Rh-103m	S	8E-05	4E-01	3E-06	1E-02
		I	6E-05	3E-01	2E-06	1E-02
	Rh-105	S	8E-07	4E-03	3E-08	1E-04
		I	5E-07	3E-03	2E-08	1E-04
Rubidium(37)	Rb-86	S	3E-07	2E-03	1E-08	7E-05
		I	7E-08	7E-04	2E-09	2E-05
	Rb-87	S	5E-07	3E-03	2E-08	1E-04
		I	7E-08	5E-03	2E-09	2E-04
Ruthenium(44)	Ru-97	S	2E-06	1E-02	8E-08	4E-04
		I	2E-06	1E-02	6E-08	3E-04
	Ru-103	S	5E-07	2E-03	2E-08	8E-05
		I	8E-08	2E-03	3E-09	8E-05
	Ru-105	S	7E-07	3E-03	2E-08	1E-04
		I	5E-07	3E-03	2E-08	1E-04
	Ru-106	S	8E-08	4E-04	3E-09	1E-05
		I	6E-09	3E-04	2E-10	1E-05

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Samarium(62)	Sm-147	S	7E-11	2E-03	2E-12	6E-05
		I	3E-10	2E-03	9E-12	7E-05
	Sm-151	S	6E-08	1E-02	2E-09	4E-04
		I	1E-07	1E-02	5E-09	4E-04
	Sm-153	S	5E-07	2E-03	2E-08	8E-05
		I	4E-07	2E-03	1E-08	8E-05
Scandium(21)	Sc-46	S	2E-07	1E-03	8E-09	4E-05
		I	2E-08	1E-03	8E-10	4E-05
	Sc-47	S	6E-07	3E-03	2E-08	9E-05
		I	5E-07	3E-03	2E-08	9E-05
	Sc-48	S	2E-07	8E-04	6E-09	3E-05
		I	1E-07	8E-04	5E-09	3E-05
Selenium(34)	Se-75	S	1E-06	9E-03	4E-08	3E-04
		I	1E-07	8E-03	4E-09	3E-04
Silicon(14)	Si-31	S	6E-06	3E-02	2E-07	9E-04
		I	1E-06	6E-03	3E-08	2E-04
Silver(47)	Ag-105	S	6E-07	3E-03	2E-08	1E-04
		I	8E-08	3E-03	3E-09	1E-04
	Ag-110m	S	2E-07	9E-04	7E-09	3E-05
		I	1E-08	9E-04	3E-10	3E-05
	Ag-111	S	3E-07	1E-03	1E-08	4E-05
		I	2E-07	1E-03	8E-09	4E-05
Sodium(11)	Na-22	S	2E-07	1E-03	6E-09	4E-05
		I	9E-09	9E-04	3E-10	3E-05
	Na-24	S	1E-06	6E-03	4E-08	2E-04
		I	1E-07	8E-04	5E-09	3E-05
Strontium(38)	Sr-85m	S	4E-05	2E-01	1E-06	7E-03
		I	3E-05	2E-01	1E-06	7E-03
	Sr-85	S	2E-07	3E-03	8E-09	1E-04
		I	1E-07	5E-03	4E-09	2E-04
	Sr-89	S	3E-08	3E-04	3E-10	3E-06
		I	4E-08	8E-04	1E-09	3E-05
	Sr-90	S	1E-09	1E-05	3E-11	3E-07
		I	5E-09	1E-03	2E-10	4E-05
	Sr-91	S	4E-07	2E-03	2E-08	7E-05
		I	3E-07	1E-03	9E-09	5E-05
	Sr-92	S	4E-07	2E-03	2E-08	7E-05
		I	3E-07	2E-03	1E-08	6E-05

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Sulfur(16)	S-35	S	3E-07	2E-03	9E-09	6E-05
		I	3E-07	8E-03	9E-09	3E-04
Tantalum(73)	Ta-182	S	4E-08	1E-03	1E-09	4E-05
		I	2E-08	1E-03	7E-10	4E-05
Technetium(43)	Tc-96m	S	8E-05	4E-01	3E-06	1E-02
		I	3E-05	3E-01	1E-06	1E-02
	Tc-96	S	6E-07	3E-03	2E-08	1E-04
		I	2E-07	1E-03	8E-09	5E-05
	Tc-97m	S	2E-06	1E-02	8E-08	4E-04
		I	2E-07	5E-03	5E-09	2E-04
	Tc-97	S	1E-05	5E-02	4E-07	2E-03
		I	3E-07	2E-02	1E-08	8E-04
	Tc-99m	S	4E-05	2E-01	1E-06	6E-03
		I	1E-05	8E-02	5E-07	3E-03
	Tc-99	S	2E-06	1E-02	7E-08	3E-04
		I	6E-08	5E-03	2E-09	2E-04
Tellurium(52)	Te-125m	S	4E-07	5E-03	1E-08	2E-04
		I	1E-07	3E-03	4E-09	1E-04
	Te-127m	S	1E-07	2E-03	5E-09	6E-05
		I	4E-08	2E-03	1E-09	5E-05
	Te-127	S	2E-06	8E-03	6E-08	3E-04
		I	9E-07	5E-03	3E-08	2E-04
	Te-129m	S	8E-08	1E-03	3E-09	3E-05
		I	3E-08	6E-04	1E-09	2E-05
	Te-129	S	5E-06	2E-02	2E-07	8E-04
		I	4E-06	2E-02	1E-07	8E-04
	Te-131m	S	4E-07	2E-03	1E-08	6E-05
		I	2E-07	1E-03	6E-09	4E-05
	Te-132	S	2E-07	9E-04	7E-09	3E-05
		I	1E-07	6E-04	4E-09	2E-05
Terbium(65)	Tb-160	S	1E-07	1E-03	3E-09	4E-05
		I	3E-08	1E-03	1E-09	4E-05
Thallium(81)	Tl-200	S	3E-06	1E-02	9E-08	4E-04
		I	1E-06	7E-03	4E-08	2E-04
	Tl-201	S	2E-06	9E-03	7E-08	3E-04
		I	9E-07	5E-03	3E-08	2E-04
	Tl-202	S	8E-07	4E-03	3E-08	1E-04
		I	2E-07	2E-03	8E-09	7E-05
	Tl-204	S	6E-07	3E-03	2E-08	1E-04
		I	3E-08	2E-03	9E-10	6E-05

Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Thorium(90)	Th-227	S	3E-10	5E-04	1E-11	2E-05
		I	2E-10	5E-04	6E-12	2E-05
	Th-228	S	9E-12	2E-04	3E-13	7E-06
		I	6E-12	4E-04	2E-13	1E-05
	Th-230	S	2E-12	5E-05	8E-14	2E-06
		I	1E-11	9E-04	3E-13	3E-05
	Th-231	S	1E-06	7E-03	5E-08	2E-04
		I	1E-06	7E-03	4E-08	2E-04
	Th-232	S	3E-11	5E-05	1E-12	2E-06
		I	3E-11	1E-03	1E-12	4E-05
	Th-natural***					
		S	3E-11	3E-05	1E-12	1E-06
		I	3E-11	3E-04	1E-12	1E-05
	Th-234	S	6E-08	5E-04	2E-09	2E-05
		I	3E-08	5E-04	1E-09	2E-05
Thulium(69)	Tm-170	S	4E-08	1E-03	1E-09	5E-05
		I	3E-08	1E-03	1E-09	5E-05
	Tm-171	S	1E-07	1E-02	4E-09	5E-04
		I	2E-07	1E-02	8E-09	5E-04
Tin(50)	Sn-113	S	4E-07	2E-03	1E-08	9E-05
		I	5E-08	2E-03	2E-09	8E-05
	Sn-125	S	1E-07	5E-04	4E-09	2E-05
		I	8E-08	5E-04	3E-09	2E-05
Tungsten(74)	W-181	S	2E-06	1E-02	8E-08	4E-04
		I	1E-07	1E-02	4E-09	3E-04
	W-185	S	8E-07	1E-03	3E-08	1E-04
		I	1E-07	3E-03	4E-09	1E-04
	W-187	S	4E-07	2E-03	2E-08	7E-05
		I	3E-07	2E-03	1E-08	6E-05
Uranium(92)	U-230	S	3E-10	7E-05	1E-11	2E-06
		I	1E-10	1E-04	4E-12	5E-06
	U-232	S	1E-10	2E-05	3E-12	8E-07
		I	3E-11	8E-04	9E-13	3E-05
	U-233	S	5E-10	1E-04	2E-11	4E-06
		I	1E-10	9E-04	4E-12	3E-05
	U-234	S	6E-10	1E-04	2E-11	4E-06
		I	1E-10	9E-04	4E-12	3E-05
	U-235	S	5E-10	1E-04	2E-11	4E-06
		I	1E-10	8E-04	4E-12	3E-05
	U-236	S	6E-10	1E-04	2E-11	5E-06
		I	1E-10	1E-03	4E-12	3E-05

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)		TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Uranium (92) (Continued)	U-238	S	7E-11	2E-05	3E-11	6E-07
		I	1E-10	1E-03	5E-12	4E-05
	U-240	S	2E-07	1E-03	8E-09	3E-05
		I	2E-07	1E-03	6E-09	3E-05
	U-natural***					
		S	7E-11	2E-05	3E-12	6E-07
		I	6E-11	5E-04	2E-12	2E-05
Vanadium(23)	V-48	S	2E-07	9E-04	6E-09	3E-05
		I	6E-08	8E-04	2E-09	3E-05
Xenon(54)	Xe-131m	Sub	2E-05		4E-07	
	Xe-133	Sub	1E-05		3E-07	
	Xe-133m	Sub	1E-05		3E-07	
	Xe-135	Sub	4E-06		1E-07	
Ytterbium(70)	Yb-175	S	7E-07	3E-03	2E-08	1E-04
		I	6E-07	3E-03	2E-08	1E-04
Yttrium(39)	Y-90	S	1E-07	6E-04	4E-09	2E-05
		I	1E-07	6E-04	3E-09	2E-05
	Y-91m	S	2E-05	1E-01	8E-07	3E-03
		I	2E-05	1E-01	6E-07	3E-03
	Y-91	S	4E-08	8E-04	1E-09	3E-05
		I	3E-08	8E-04	1E-09	3E-05
	Y-92	S	4E-07	2E-03	1E-08	6E-05
		I	3E-07	2E-03	1E-08	6E-05
	Y-93	S	2E-07	8E-04	6E-09	3E-05
		I	1E-07	8E-04	5E-09	3E-05
Zinc(30)	Zn-65	S	1E-07	3E-03	4E-09	1E-04
		I	6E-08	5E-03	2E-09	2E-04
	Zn-69m	S	4E-07	2E-03	1E-08	7E-05
		I	3E-07	2E-03	1E-08	6E-05
	Zn-69	S	7E-06	5E-02	2E-07	2E-03
		I	9E-06	5E-02	3E-07	2E-03
Zirconium(40)	Zr-93	S	1E-07	2E-02	4E-09	8E-04
		I	3E-07	2E-02	1E-08	8E-04
	Zr-95	S	1E-07	2E-03	4E-09	6E-05
		I	3E-08	2E-03	1E-09	6E-05
	Zr-97	S	1E-07	5E-04	4E-09	2E-05
		I	9E-08	5E-04	3E-09	2E-05

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Element (atomic number)	Isotope,* soluble (S); insoluble (I)	TABLE I Controlled Area Column 1 Air (μCi/ml)	TABLE I Controlled Area Column 2 Water (μCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (μCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (μCi/ml)
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours.	Sub	1E-06		3E-08	
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours.		3E-09	9E-05	1E-10	3E-06
Any single radionuclide not listed above which decays by alpha emission or spontaneous fission.		6E-13	4E-07	2E-14	3E-08

+These values apply to individuals in uncontrolled areas. One-third of these values will be used for a suitable sample of the population.

*"Sub" means that the values are given for submersion in a hemisperical infinite cloud of airborne material.

**In the derivation of the concentration guides for soluble forms of iodine in Table II, a 2-gram thyroid (infants) and daily intakes of 3E+06 ml of air and 1E+03 ml of water (fluid water plus water contents of foods) is assumed.

***A curie of natural thorium means the sum of 3.7E+10 dis/sec from Th-232 plus 3.7E+10 dis/sec from Th-288. One curie of natural thorium is equivalent to 9,000 kilograms or 19,850 pounds of natural thorium.

****A curie of natural uranium means the sum of 3.7E+10 dis/sec from U-238 plus 3.7E+10 dis/sec from U-234 plus 1.7E+09 dis/sec from U-235. One curie of natural uranium is equivalent to 3,000 kilograms or 6,615 pounds of natural uranium.

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NOTE: In any case where there is a mixture in air or water of more than one radionuclide, the guide values, for purpose of this appendix, should be determined as follows:

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: Determine for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the guide otherwise established in this appendix for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture will not exceed "1" (i.e., "unity").

EXAMPLE: If radionuclides A, B, and C are present in concentrations C_A, C_B, and C_C, and if the applicable CGs are CG_A, CG_B, and CG_C, respectively, then the concentrations should be limited so that the following relationship exists:

$$\frac{C_A}{CG_A} \quad \frac{C_A}{CG_B} \quad \frac{C_A}{CG_C} \quad 1$$

2. If either the identity or the concentration of any radionuclide in the mixture is not known, the guide values for purpose of this appendix will be:

a. For purposes of Table I, Col. 1, 6E-13

b. For purposes of Table I, Col. 2, 4E-07

c. For purposes of Table II, Col. 1, 2E-14

d. For purposes of Table II, Col. 2, 3E-08

3. If any of the conditions specified below are met, the corresponding values specified below may be used in lieu of those specified in Item 2, above.

a. If the identity of each radionuclide in the mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known, the concentration guide for the mixture is the guide specified in this appendix for the radionuclide in the mixture having the lowest concentration guide, or

b. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this appendix are not present in the mixture, the concentration guide for the mixture is the lowest concentration guide specified in this appendix for any radionuclide which is not known to be absent from the mixture, or

Element (atomic number)	Isotope,* soluble (S); insoluble (I)	TABLE I Controlled Area Column 1 Air (µCi/ml)	TABLE I Controlled Area Column 2 Water (µCi/ml)	TABLE II Uncontrolled Area+ Column 1 Air (µCi/ml)	TABLE II Uncontrolled Area+ Column 2 Water (µCi/ml)
If it is known that Sr-90, I-125, I-126, I-129, I-131, (I-133, Table II only) Pb-210, Po-210, At-211, Ra-223, Ra-224, Ra-226, Ac-227, Ra-228, Th-230, Pa-231, Th-232, Th-nat, Cm-248, Cf-254, and Fm-256 are not present			9E-05		3E-06
If it is known that Sr-90, I-125, I-126, I-129, (I-131, I-133, Table II only) Pb-210, Po-210, Ra-223, Ra-226, Ra-228, Pa-231, Th-nat, Cm-248, Cf-254, and Fm-256 are not present			6E-05		2E-06
If it is known that Sr-90, I-129 (I-125, I-126, I-131, Table II only) Pb-210, Ra-226, Ra-228, Cm-248, and Cf-254 are not present			2E-05		6E-07
If it is known that (I-129, Table II only), Ra-226 and Ra-228 are not present			3E-06		1E-07
If it is known that alpha-emitters and Sr-90, I-129, Pb-210, Ac-227, Ra-228, Pa-230, Pu-241, and Bk-249 are not present		3E-09		1E-10	
If it is known that alpha-emitters and Pb-210, Ac-227, Ra-228, and Pu-241 are not present		3E-10		1E-11	
If it is known that alpha-emitters and Ac-227 are not present		3E-11		1E-12	
If it is known that Ac-227, Th-230, Pa-231, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Cm-248, Cf-249, and Cf-251 are not present		3E-12		1E-13	

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4. If the mixture of radionuclides consists of uranium and its daughter products in ore duct prior to chemical processing of the uranium ore, the values specified below may be used in lieu of those determined in accordance with Item 1, above, or those specified in Items 2 and 3, above.

a. For purpose of Table I, Col. 1, 1E-10 µCi/ml gross alpha activity; or 2.5E-11 µCi/ml natural uranium; or 75 µg/cu m of natural uranium in air.

b. For purpose of Table II, Col. 1, 3E-12 µCi/ml gross alpha activity; or 8E-13 µCi/ml natural uranium; or 3 µg/cu m of natural uranium in air.

5. For purposes of this note, a radionuclide may be considered as not present in a mixture if (a) the ratio of the concentration of that radionuclide in the mixture (C_A) to the concentration guide for that radionuclide specified in Table II of this appendix (CG_A) does not exceed 1/10; i.e.,

$$\frac{C_A}{CG_A} \leq \frac{1}{10}$$

and (b) the sum of such ratios for all the radionuclides considered as not present in the mixture does not exceed 1/4; i.e.,

$$\frac{C_A}{CG_A} + \frac{C_B}{CG_B} + \ldots \leq \frac{1}{4}$$

6. Conversion from Ci/cc to pCi/cu m for air and pCi/l for water as follows:

a. Air - Ci/cc x E+12 = pCi/cu m

b. Water - µCi/cc x E+9 = pCi/l

7. Concentrations may be derived for unlisted radionuclides provided yearly dose limits in DOE Order 5480.1A, paragraphs 4b(1) and 4a(1), are used and the methods are consistent with those recommended by the Federal Radiation Council, National Council on Radiological Protection and the International Commission on Radiological Protection.

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Rockwell International

Subject	Approved by
APPENDIX C - DEVIATIONS	Guy F. Butler

Deviation 83-001 - "Open Burning of Contaminated Vegetation"

Deviation 83-005 - "Inactive Waste Sites"

Deviation 83-006 - "Samplers on B-Plant Exhausters 296-B-21 through 296-B-27"

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December 17, 1982 727-82-336

J. W. Patterson
Production Processing
2750E/200 East Area

D. L. Uhl
Environmental Analysis
and Monitoring Department
2704-S/200 West Area/3-3616

Deviation 83-001, Open Burning of Contaminated Vegetation

Ref: Letter 72700-82-316, D. L. Uhl to D. C. Bartholomew

The subject deviation has been revised in accordance with your comment on the previous draft. This corrected draft is being sent to those on the original distribution.

Dale L. Uhl
D. L. Uhl, Manager
Environmental Analysis
and Monitoring Department

DLU/VQH/abj

Att.

cc: L. K. Aldrich
D. E. Bihl
G. F. Boothe
J. D. Briggs
B. F. Campbell
M. A. Christie
J. L. Deichman
V. Q. Hale
W. F. Heine
R. L. Hibbard
A. N. Gallegos
B. E. Knight
P. G. Lorenzini
T. J. McLaughlin
K. J. Pascoe
W. H. Price
B. J. Saueressig
R. E. Wheeler

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Section in RHO-MA-139: Volume I: D. 35 Open Burning

"Radiologically contaminated material shall not be disposed of via Open Burning"

Issued to (Manager and Facility or Program):

J. W. Patterson, Director, Production Processing

Valid Until (Date)

January 1, 1984

Conditions of the Deviation:

1. Purposeful open burning of contaminated (i.e., greater than background levels) vegetation shall only be accomplished by Production Operations personnel.
2. All vegetation shall be surveyed by a radiation monitor prior to burning. Large accumulations of vegetation (>6 ft in diameter) shall be reduced to allow an adequate survey to be performed.
3. Vegetation to be burned shall not exceed 10,000 c/m (basis: Letter, April 15, 1981, D. E. Wood to R. E. Wheeler, "Airborne Contamination from Tumbleweed Burning").
4. In all cases where vegetation is contaminated, Environmental Surveillance and Control personnel should be called upon to take air samples during the burning and document the results as appropriate.
5. Ash from burning activities shall be surveyed within same burn day.
6. Ash found to be contaminated must be wetted for fixed, collected and disposed as radioactive waste, once found. Note: Ash may be disposed on the next working day if the ash is contained to preclude wind spread. In no case shall contaminated ash be allowed to remain at the burn site during nonwork days (holidays, weekends, etc.) and due to foul weather.
7. The area where the contaminated ash was removed shall be surveyed and declared free from contamination as part of the final cleanup.
8. A record of the approximate number or volume of vegetation items (i.e., tumbleweeds) burned shall be formally transmitted monthly to Environmental Analysis & Monitoring Department.
9. If warranted, Radiation Monitoring may request job termination based upon weather conditions (i.e., $\geq$ 10 mph winds).

Justification (See Attachment):

Approval:

Dale L. Uhl 12/17/82

Manager, Environmental Analysis and Monitoring Department Date

Approval by DOE-RL (Required for DOE Requirements)

Date

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Justification

This deviation is required to provide Operations with a cost effective method for disposing of vegetation found in marked radiation zones and found to contain low level contamination (less than 10,000 cpm) during approved Hanford burning period. The only other method currently available to Operations for disposing of contaminated or potentially contaminated vegetation is by compaction and land burial. This method is used during the non-burning period and is very costly due to the equipment involved and the land burial charges associated with bulky vegetation.

In summary, Production Operations requests that this deviation be approved and incorporated in the control manual (RHO-MA-139) for the reasons stated above.

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Internal Letter

Rockwell International

Date April 26, 1983

No. 72720-83-092

TO (Name, Organization, Internal Address)
. Holders of RHO-MA-139
. Environmental Protection
. Manual

FROM (Name, Organization, Internal Address, Phone)
. V. Q. Hale
. Environmental Evaluation
. and Regulation
. 222-B/200 East Area 3-9111

Subject . Deviation 83-005, Inactive Waste Sites

The attached subject deviation has been approved and is to be inserted in Appendix C of your copy of RHO-MA-139, Environmental Protection Manual.

V. Q. Hale, Senior Engineer
Environmental Regulation Group

VQH/abj

Att.

9212 7716667

Section in RHO-MA-139

Vol. I, Part B, Section B.30(a) and (c) as applied to inactive waste sites

Issued to (Manager and Facility or Program)

A. N. Gallegos - D&D
J. B. Shannon - D&D

Valid Until (Date)

May 1, 1984

Conditions of the Deviation

1. This deviation applies specifically to the inactive waste sites that are listed in Attachment A and will be re-evaluated annually.

2. Each site will be analyzed at least annually to assure that it is not a significant environmental threat. Any site that is found to be a significant threat to the environment because of cave-in, contaminated vegetative growth, increased soil contamination or other anomalies shall be removed from the list and corrective action will be required immediately.

3. New sites may be added to the list during the annual review if approved by the Environmental Protection Department.

4. Sites will be decontaminated and/or surface stabilized as budget and manpower permit.

Approval

Manager, Environmental Protection Department — Date 4/25/83

Approval by DOE-RL (Required for DOE Requirements)

Date

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JUSTIFICATION

Deviation to RHO-MA-139 Number 83-005
Volume II, Section B.30(a) and (c)

Reference: Letter, December 13, 1982, G. F. Boothe to A. N. Gallegos, "Deviation to RHO-MA-139, Part B, Sections B.30(a) and (c)"

This deviation exempts the Plutonium Operations Department, Decontamination and Decommissioning Group from complying with surface radiation level requirements of Part B, Section B.30(a) and (c) of RHO-MA-139. These requirements are the standards for monitoring and management of inactive terrestrial radioactive liquid waste disposal sites.

Attachment A to the deviation is a list of the sites specifically covered by this deviation. These sites are not in compliance with the requirements of Vol. II, Part B, Section B.30(a) and (c), however they "are determined not to be a significant threat to the surrounding environment at this time" (Reference letter). These sites are inactive, have no current unresolved inspection reports or audit findings and are not under investigation. In view of this and a lack of funds and manpower to place barriers on these sites, it is reasonable to not require corrective action at this time.

ATTACHMENT A

List of sites to be included on deviation request:

216-A-18 crib
216-A-34 crib
216-B-3-1 and 3-2 covered ditches
216-B-13 crib
216-B-43 thru 50 trenches
216-B-51 crib
216-C-1 crib
216-C-10 crib
216-S-1 crib
216-S-2 crib
216-S-5 crib
216-S-7 crib
216-S-8 crib
216-S-10 ditch
216-S-16 pond
216-S-13 crib
216-S-23 crib
216-T-5 crib
216-T-7 crib
216-T-20 crib
216-T-26 thru 28
216-T-35 crib
216-T-36 crib
216-U-1 crib
216-U-2 crib
216-U-8 crib
216-U-11 over flow
618-10
618-2 and 3
UN-216-E-14
UN-216-E-17
UN-216-E-23
UN-216-E-26
UN-216-W-7
UN-216-W-24
UN-216-W-26

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INCOMING LTR NO

ACTION

REPLY DUE

DIST:	LTR.	ENCL.	APPR.
Bartholomew, D.C.			
Bellefonte, M.			
Corey, J.M.			
Cockerom, D.J.			
Crawford, A.C.			
Deju, R.A.			
Deschman, J.L.			
Donahue, J.W.			
Freeman, R.A.			
Gimera, R.J.			
Gruke, R.S.			
Hammond, R.D.			
Heineman, R.E.			
Kinzer, J.E.			
Lorenzini, P.G.			
McDermott, R.J.			
Ogletree, L.R.			
Pitts, G.G.			
Roecker, J.H.			
Saline, C.M.			
Shaw, H.P.			
Weil, V.R.			
Zahn L.L.			
Contract Administrator			
Control Files			
DLUhl	X	X	

DATE

54-6000 117 (R 10-81)

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Internal Letter

Rockwell International

Date December 13, 1982

No. 72740-82-EMC-130

TO
A. N. Gallegos
Decontamination and
and Decommissioning
271-T/200 West Area

FROM
G. F. Boothe
Environmental Monitoring
and Control
202-S/200W/3-2336

Subject: Deviation to RHO-MA-139, Part B, Sections b.30 (a) and (c)

The inactive waste sites listed on Attachment A are those that are in noncompliance with RHO-MA-139, Part B, Sections B.30(a) and (c) (see Attachment B), but are determined not to be a significant threat to the surrounding environment at this time. It is understood that the lack of available funds and manpower preclude the possibility of corrective action for these sites in the immediate future. It is our recommendation, therefore, that you apply for a deviation to the above-mentioned standards in order to achieve compliance. You may not want to include some of the sites on Attachment A in the application. However, sites not in compliance and not included in the deviation will be subject to issuance of an Inspection Report (IR) or Audit Finding (AF) and the corrective action tracked. Such an application should be made to Mr. D. L. Uhl (2704-S/200W) of the Environmental Analysis and Monitoring Department.

We will recommend that this deviation include the following:

- o a time limitation of one year to allow for reevaluation of each site at least annually. A corrective action plan or appropriate justification will be required to extend the deviation beyond one year.
- o a clause stating that any site may be removed from the list if found to be a significant threat to the environment (e.g., a cave-in, growth of tumbleweeds, increased soil contamination, etc.)
- o the possibility of adding new sites to the list within that year

The list in Attachment A does not include the following:

- o sites that currently have an IR or AF outstanding or pending
- o sites that are considered active
- o sites known or suspected to be threats to the environment and/or are under investigation

Please contact Mr. Verle Hale (373-9111) of the Environmental Evaluation and Regulation Group; he will be glad to assist you with the development of the deviation request. If there are any questions concerning the

Rockwell International

list on Attachment A, please contact Mr. A. W. Conklin (373-3703) or Mr. R. E. Wheeler (373-1716).

G. F. Boothe, Manager
Environmental Monitoring
and Control Group

GFB/AWC/ck

Att. (2)

cc: A. W. Conklin
[redacted]
W. F. Heine
W. P. Kunkel
T. J. McLaughlin
R. M. Ruitenbeck
D. L. Uhl
R. E. Wheeler
EMC Off File

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ATTACHMENT A

List of sites to be included on deviation request:

216-A-18 crib
216-A-34 crib
216-B-3-1 and 3-2 covered ditches
216-B-13 crib
216-B-43 thru 50 trenches
216-B-51 crib
216-C-1 crib
216-C-10 crib
216-S-1 crib
216-S-2 crib
216-S-5 crib
216-S-7 crib
216-S-8 crib
216-S-10 ditch
216-S-16 pond
216-S-13 crib
216-S-23 crib
216-T-5 crib
216-T-7 crib
216-T-20 crib
216-T-26 thru 28
216-T-35 crib
216-T-36 crib
216-U-1 crib
216-U-2 crib
216-U-8 crib
216-U-11 over flow
618-10
618-2 and 3
UN-216-E-14
UN-216-E-17
UN-216-E-23
UN-216-E-26
UN-216-W-7
UN-216-W-24
UN-216-W-26

Internal Letter

Rockwell International

Date: June 30, 1983

No. 72400-83-051

TO: (Name, Organization, Internal Address)
R. L. Hibbard
Fission Products Operations
Department
271-B/200 East Area

FROM: (Name, Organization, Internal Address, Phone)
G. F. Boothe
Environmental Protection
Department
222B/200 East Area/3-2336

Subject: Deviation 83-006, Samplers on B-Plant Exhausters 296-B-21 through 296-B-27

The attached deviation is to replace the previously issued deviation of the same title. The previous deviation was conditional upon B Plant shutting down when the present cesium/strontium backlog is processed. The deviation became null and void when it was acknowledged by the Department of Energy - Richland Operations Office that B Plant will operate to process future PUREX waste. This new deviation removes that condition and imposes administrative controls to provide protection in the event of upset conditions.

If there are any questions, please contact V. Q. Hale, 3-9111 or T. P. Lynch, 3-1921.

G. F. Boothe, Manager
Environmental Protection
Department

GFB/VQH/sac

cc: V. Q. Hale
T. J. Lynch
G. G. Meade
P. F. Shaw

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Section in RHO-MA-139:

Vol. I, Part D.60(a) General Requirements — As applied to the 296-B-21 through 296-B-27 exhauster

Issued to (Manager and Facility or Program):

R. L. Hibbard, Manager Fission Products Operation Department
P. F. Shaw, Manager Waste Fractionization and Encapsulation Program

Valid Until (Date): September 1, 1986

Conditions of the Deviation:

1. The primary justification for this deviation is that the exhausters are HEPA filtered and administrative controls are in place to assure that, in the event of upset conditions, the intent of DOE Order 5484.1 Chapter 3 is met.

2. The latest revision to Standard Operating Procedure BO-001-015, Rev. B1 (221-B Airflow Control During Contamination Incident) shall be implemented in the event of contamination release.

Justification (See Attachment):

Approval:

Manager, Environmental Protection Department — Date 6/30/83

Approval by DOE-RL (Required for DOE Requirements):

Date

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JUSTIFICATION

Deviation to RHO-MA-139 Number: 83-006
Section D.60(a)

Reference: Letter, January 27, 1982, J. J. Schreiber to General Manager, Rockwell Hanford Operations, "Selection of Direct Neutralization of Handling PUREX Current Acid Waste (CAW)"

This deviation exempts the Fission Product Operations Department and the Waste Fractionization and Encapsulation Program from complying with airborne emission representative sampling requirements of Section D.60(a) of RHO-MA-139. The section is a requirement to be met in order to comply with As Low As Reasonably Achievable (ALARA) per Department of Energy (DOE) Order 5480.1A and Rockwell Hanford Operations (Rockwell) policy HE-3060 in RHO-MA-100. [Note: DOE-Richland Operations Office (RL) approval of the deviation is not required, however, since Rockwell has interpreted the case-in-point sampling and monitoring requirements as ALARA concerns].

The potential for environmental release of radionuclides is low since exhausters service a routinely occupied gallery. There is a potential for accidental releases in upset conditions such as equipment pressurization (as occurred in April 1982). This infrequent occurrence does not result in a significant release to the environment since the only direct access to the environment is through these exhausters which are provided with HEPA filters. Operating and emergency procedures are specified in Standard Operating Procedure BO-001-015, Rev. B.1. In the event of a minor upset condition in the pipe and operating gallery, the exhauster nearest the source of contamination will be sampled while the other exhausters will be shut down. Airflow in a major contamination release can be routed to the canyon and would be sampled and monitored at the main stack. Correlation of the gallery constant air monitor (CAM) readings and high volume air sample analysis will meet the intent of DOE Order 5484.1, Chapter 3.

If the deviation were not granted, the Fission Product Operations Department would be required to install sampling equipment on 7 separate exhaust streams. This $1.0 + million effort would require several years to complete and would become operational about the same time B Plant operations are planned to be shutdown for upgrading. It is therefore believed that, per ALARA requirements, it is unreasonable to require major expenditures for such a short term benefit.

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Subject	Approved by
APPENDIX D.1 - MINIMUM DESIGN GUIDES FOR EFFLUENT TREATMENT AND MONITORING SYSTEMS FOR RADIOLOGICAL EFFLUENTS FOR SYSTEMS DESIGNED PRIOR TO SEPTEMBER 30, 1981	Gary F. Bartlett

Section D.1.10 Purpose The guides in Appendix D.1 are issued to describe methods acceptable to the EP Department for demonstrating compliance with requirements in Parts D and F of this manual.

Section D.1.20 Applicability These guides are not requirements. They are not intended to preclude design and use of systems that perform as well or better than the requirements in Parts D and F. However, for a system that is different from these guides, the EP Department may require justification and/or demonstration that the alternate design does, in fact, perform at least equivalently.

Because it is unlikely that any set of guides can be perfectly applicable in all cases, there may be special cases where strict adherence to the guides will not lead to compliance with the requirements in Parts D and F. Such cases are expected to be the exception rather than the rule.

Section D.1.30 Record Sampling of Airborne Particulates

D.1.30.1 Sample Probes

D.1.30.1.1 Location Sampling systems should be placed downstream of filters.

The sample probe should be placed at least five, but preferably eight to ten, duct diameters downstream of any major flow disturbance. It should also be at least two duct diameters upstream of any major flow disturbance.

The sample probe should be located as close to the effluent release point as is reasonably consistent with the above guide.

D.1.30.1.2 Design and Number The number of sampling points (probe nozzles) should depend on the physical dimensions of the stack in the following manner:

For round stacks:

Duct Diameter Centimeters	Duct Diameter Inches	Suggested Number of Points
<20	<8	1
20 - 33	8 - 13	2
33 - 48	13 - 19	3
48 - 74	19 - 29	4
74 -124	29 - 49	5
>124	>49	6

For rectangular stacks:

Duct Area sq. meter	Duct Area sq. feet	Suggested Number of Points
<0.093	<1	1
0.093 - 0.19	1 - 2	4
0.19 - 2.3	2 -25	6 - 12
>2.3	>25	20

Sample points in circular ducts should be centered in equal annular areas of size equal to the cross-sectional area of the stack divided by the number of probes.

Nozzles should have tapered knife edges (≤30 degree taper - outside edge of orifice) and face directly into the exhaust stream.

The orifice should be located on a straight portion of the nozzle. The length of the straight nozzle should be approximately five times the diameter of the orifice.

Each nozzle bend should have a radius of greater than or equal to five times the orifice diameter.

Nozzles should be sized to provide near-isokinetic sampling when the sample flow rate is at least 62 l/min (2.2 cfm). For systems where the sample flow rate varies to maintain isokinesis in a variable flow effluent rate, the average sample flow rate should be at least 62 l/min (2.2 cfm).

D.1.30.2 Transport Line

Tubing size should be selected to minimize particle deposition due to gravitational settling and/or impaction.

The transport line should be fabricated of stainless steel or other material not reactive to the effluent or conducive to electrostatic disposition.

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Total length of line between the sampling probe and the filter holder should be as short as practical.

Horizontal runs should be minimized.

The number and angle of bends should be minimized. Bends should have a radius of at least 10 times the inside diameter of the transport line. The sum of the bends should be less than 110 degrees.

Use of pipe or tubing fittings between the sample probe and filter holder should be minimized.

Condensation should be minimized. Thermostatically controlled electrical heat tracing should be used on transport lines where condensation is a potential problem.

D.1.30.3 Sample Filter Holder The sample filter holder should:

- o Be located as close as practical to the probe
- o Be fabricated of materials that are neither reactive to the effluent nor conducive to electrostatic deposition
- o Be sized for 47mm filter paper
- o Have tapered expansion and contraction cones upstream and downstream of the sample filter
- o Have a permanently mounted, porous filter backing free of sharp edges and protrusions
- o Have a compression sealing ring designed to provide an airtight and uniform seal around the filter paper
- o Be easily opened and closed.

Specifications for acceptable types of filter media can be obtained from the Applied Technology Group, Analytical Laboratories Department.

D.1.30.4 Flow and Flow Measurement The average sample flow rate should be at least 62 l/min (2.2 cfm) and the collection time should be 168 hours.

Measurements of sample flow rate or total flow should be made when the filter is placed in service and when it is removed from service. On samplers that do not have flow totalizers and the flow rate varies by more than $\pm$ 20% during sample periods, the flow rate should be adjusted at least once during the sample period.

Flow rate meters and/or flow volume totalizers should be located downstream of the filter holder.

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Flow rate or flow rate ranges to be maintained to ensure near-isokinetic sampling should be distinctly marked on the instrument.

If the vacuum system is routinely shut off during the normal sampling period (for instance, because the stack is shut off), a method to determine sample volume should be used; e.g., a timer or flow volume totalizer.

D.1.30.5 Vacuum System The vacuum system for sampling should:

- o Be capable of pulling flow rates high enough to facilitate near-isokinetic sampling conditions
- o Operate continuously whenever, and only if, air is being exhausted from the stack or duct. (NOTE: If the vacuum system is operated for contamination detection purposes when the stack is not exhausting air to the atmosphere, the sample collected shall not become part of the emission record.)
- o Have the same emergency power backup capabilities as the exhaust system
- o Have audible and visible alarms signaling the loss of sample air flow in an area subject to continuous or frequent occupancy.

D.1.30.6 Stack Flow Stack flow totalizers should be used wherever stack flow rates vary by more than ± 20%.

Section D.1.40 Monitoring of Airborne Particulates

D.1.40.1 Probe Monitor probes should meet the same design guides as sample probes (see D.1.30.1). Use of the same probe with a flow splitter in the transport line is acceptable. If the monitor probe is separate from the sample probe, it should be located at least two, but preferably five or more, duct diameters downstream of any major flow disturbance. Nesting of sample and monitor probes is preferred.

D.1.40.2 Transport Line The monitor transport line should meet the same design guides as the sample transport line (see D.1.30.2) except that it is recognized that the monitor will inherently have an additional 90-degree bend (total bends ± 200 degrees).

A sharp-edged flow splitter should be used to evenly divide the sample stream if multiple monitoring units are required or if sample stream is used by both sample and monitor.

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D.1.40.3 Monitor and Alarms The instrumentation should have:

- o Audible and visible high-level release alarms capable of alarming both locally and in an area subject to frequent or continuous occupancy
- o Audible and visible failure alarms capable of alarming both locally and in an area subject to frequent or continuous occupancy
- o These alarms should be independent of each other; e.g., a high-level release alarm should not also be used as a failure alarm
- o Continuous recording capability: e.g., strip chart
- o Capability to transmit data to a remote location.

Section D.1.50 Filtering of Airborne Particulates

D.1.50.1 Stages Normally contaminated airborne effluents should be filtered by at least two testable stages of HEPA filters, or equivalent, in series before being discharged to the atmosphere. (A filter equivalent to a HEPA is a filter having the same or greater efficiency as a HEPA.)

Potentially contaminated airborne effluents should be filtered by at least a single-stage HEPA, or equivalent, or shall have a HEPA filter, or equivalent, installed in the bypass mode. In cases where the filter is in the bypass mode, monitoring and alarm systems shall be able to alarm in accordance with the requirements in Part D.50(c).

Where practical, facilities with normally contaminated airborne effluents should have an additional HEPA filter installed as close as practical to the source of contamination to minimize the contamination of ductwork.

D.1.50.2 Design Standards Filter systems should generally be designed in accordance with the following references:

- o HWS-10278, "Standards for the In-Place Efficiency HEPA Filter Systems"
- o ANSI 510, 1980, "Testing of Nuclear Air Cleaning Systems"
- o DOE-76-21, "Nuclear Air Cleaning Handbook" (Design, Construction, and Testing of High-Efficiency Air Filtration Systems for Nuclear Application)
- o DOE MC Appendix 6301, "Facilities General Design Criteria".

D.1.50.3 HEPA Filter Specifications HEPA filters should meet the specifications contained in HPS-151-M, Standard Specifications for High Efficiency Particulate Air Filters, 1976.

D.1.50.4 Redundancy A normally contaminated effluent should have a redundant filter system which allows switching the total flow from one system to another unless the ventilation system can be safely shut down; e.g., in the event of filter failure or for filter changes.

D.1.50.5 Prefilters The first stage of HEPA filters should usually be preceded by a prefilter to reduce dust loading.

D.1.50.6 Mist Eliminators Provisions should be made to limit moisture from reaching HEPA filters.

D.1.50.7 Differential Pressure Differential pressure (DP) should be measured across each stage of filters.

HEPA filters should be changed when the DP becomes greater than 1,000 pascal (4" water gauge).

D.1.50.8 Fire Protection Consideration should be given to providing fire protection to flammable, highly contaminated filters, especially HEPA filters. The fire protection system should not apply water directly to the filters.

D.1.50.9 Standby Filters Standby filters should be ventilated on a regular basis to prevent deterioration from buildup of condensation and/or salts.

Section D.1.60 Record Sampling of Radioactive Liquid Effluents

D.1.60.1 Location Record sampling systems should be located downstream of liquid effluent control systems or should be designed to prevent sampling of diverted waste.

D.1.60.2 Continuous Discharge Systems Automatic samplers should operate on a flow proportional basis as controlled by a flow measurement system.

The sampler should have a sufficiently high transport velocity to assure accurate collection and transport of suspended solids to the sample collector.

The sampler should be equipped to minimize cross-contamination and assure a clean sample is taken; e.g., pre- and post-purge cycles.

Sampling probes should be suspended in the water so as not to pick up particulate matter from the bottom or top of the stream, pond, or basin.

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The flow metering device should be equipped with a flow totalizer for recording total effluent volume released from a given source.

The sampling system should ensure that no unsampled releases occur due to power failure; i.e., if the discharge will continue during power failure, then the sampler shall have backup power.

D.1.60.3 Batch Discharge Systems Mechanical mixing or other design should ensure reasonable homogeneity of batch prior to sampling.

The system should have the means for accurate determination of batch volumes to permit volume-weighted compositing of grab samples.

Where appropriate, design should allow flushing of the sample line (or other means) to prevent cross-contamination of subsequent batch samples.

Section D.1.70 Monitoring of Radioactive Liquid Effluents

D.1.70.1 Location Monitoring systems should be placed upstream from diversion systems and downstream of effluent treatment systems.

D.1.70.2 Design and Alarms Monitors should have:

- o Audible and visible high radiation alarms capable of alarming in an area subject to frequent or continuous occupancy
- o Audible and visible detector failure alarms capable of alarming in an area subject to frequent or continuous occupancy
- o Audible and visible loss-of-sample alarms capable of alarming in an area subject to frequent or continuous occupancy
- o Capability to transmit a real-time measurement to a remote location

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Subject	Approved by
APPENDIX D.2 - MINIMUM DESIGN GUIDES FOR EFFLUENT CAMS DESIGNED AFTER SEPTEMBER 30, 1982	

Section D.2.10 Purpose These guides describe methods acceptable to the EP Department for demonstrating compliance with requirements in Section D.1.50.

Section D.2.20 Applicability These guides are not requirements. They are not intended to preclude design and use of systems that meet or exceed the above-specified criteria; however, for a system that is different from these guides, the EP Department may require a justification and/or demonstration that the alternate design performs in an equivalent fashion.

Section D.2.30 Effluent CAMs

(a) Instrumentation

(1) Indicators. There should be indicators for: (a) the air flow through the monitor; (b) the operational status of all counting equipment; and (c) operational status of the sample vacuum systems.

(2) Alarm Systems. Audible and visible high-level release alarm and CAM system failure indicators should be placed as required. Each of these alarms should be capable of alarming locally and in an area subject to frequent or continuous occupancy by operations personnel. These alarms should be independent of each other; i.e., a high-level release alarm should not also be used as a failure alarm.

(3) Recording. Provisions should be made to record the relative levels of effluents sensed either electrically or electromechanically; e.g., a strip chart recorder. In addition, there should be the capability of transmitting data to a remote location.

(4) Special Provisions - Enclosed or Semi-enclosed Systems. All CAM systems that monitor effluents from enclosed systems (hot cells and glove boxes) or semi-enclosed systems (fume hoods) should be provided with an indicator panel which provides readout, annunciation, recording, and alarm indications. This indicator panel should be located such that the operator of the enclosed or semi-enclosed system can monitor it from the normal work station.

(5) Noneffluent and Extraneous Effluent Contributors Circuitry or shielding should be provided to mitigate the effects of noneffluent contributions (e.g., background), as well as extraneous contributions from the effluent. If this mitigation is accomplished by electronic means (e.g., background subtraction), then the effectiveness of this mitigation must be verified during calibration.

(b) Sample Probes

(1) Location. Sampling systems to measure release should be placed downstream of filters as close to the point of release as practical. Double-shell waste tank annulus CAMs will be placed upstream of the filter to detect leakage from the inner tanks.

The sample probe should be at least two, but preferably five or more, duct diameters or major duct dimensions downstream of any flow perturbation. It should also be located at least two duct diameters upstream of any major flow disturbance. The sample probe should be placed in a vertical run of the effluent duct in preference to a horizontal run of the duct. The probe should be installed in a vertical plane with the nozzle facing into the effluent stream.

(2) Design and Number. The number of sampling points (probe nozzles) should depend on the physical dimensions of the duct in the following manner:

Duct Diameter Centimeters	Duct Diameter Inches	Suggested Number of Points
<20	<8	1
20 - 33	8 - 13	2
33 - 48	13 - 19	3
48 - 74	19 - 29	4
74 - 124	29 - 49	5
>124	>49	6

For rectangular ducts:

Duct Area Sq. Meter	Duct Area Sq. Feet	Suggested Number of Points
<0.093	<1	1
0.093 - 0.19	1 - 2	4
0.19 - 2.3	2 -25	6 - 12
> 2.3	>25	20

Sample probe design and location should be based on flow profile information at the point of sample extraction to assure representative sampling. Probes should be spaced so as to intercept approximately equal rates of flow.

Nozzles should have tapered knife edges (≤30 degree taper - outside edge of orifice) and face directly into the exhaust stream.

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The orifice should be located on a straight portion of the nozzle. The length of the straight portion of the nozzle should be approximately five times the diameter of the orifice. The minimum inside diameter of the nozzle should be greater than 3.2mm to minimize clogging problems.

Each nozzle bend should have a radius of greater than or equal to five times the orifice diameter.

Nozzles should be sized to provide near-isokinetic extraction when monitoring particulates in the effluent stream.

Nesting of CAM system probes and record sampling probes is preferred.

(c) Transport Line. Tubing size should be selected to minimize particle deposition due to gravitational settling and/or impaction.

The transport line should be fabricated of material not reactive to the effluent or conducive to electrostatic deposition.

Total length of line between the sampling probe and the filter holder should be as short as practical.

Horizontal runs should be minimized.

The number and angle of bends should be minimized. Bends should have a radius of at least 10 times the inside diameter of the transport line. The sum of the bends should be less than 110°. Note that this requirement is exclusive of the 90° bend in the probe.

Use of pipe or tubing fittings between the sample probe and filter holder should be minimized.

Condensation should be minimized. Thermostatically controlled electrical heat tracing should be used on transport lines where condensation is a potential problem. The lines should be insulated.

If economically and technically feasible, each CAM should have a separate sampling probe. A sharp-edged flow splitter should be used to evenly divide the sample stream if one probe must serve multiple monitoring units. The flow splitter should divide the stream near-isokinetically.

(d) Air Movement System.

(1) Independence. The CAM air movement system should be powered from a source which has the same emergency backup capabilities as the air mover for the stream being monitored. If the emergency backup capability for the stream being monitored is from a non-electrical source, it is then necessary to provide backup electrical power for the CAM air movement system. Facility vacuum air systems meet this requirement.

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(2) Performance Characteristics. All CAM systems should be served with a vacuum system capable of providing a minimum negative gauge pressure of 20 inches of water when all units are in simultaneous use.

Central vacuum systems should have (a) two pumps of sufficient capacity to permit uninterrupted vacuum conditions in the event one pump is out of service, and (b) sufficient pump capacity to provide a negative gauge pressure of 20 inches of water when all units are in use plus a reserve capacity of 15 percent or more.

The vacuum system should be locally adjustable for each CAM system.

Either the vacuum system or the CAM system should have the means of providing a near constant flow rate.

(3) Flow Measurement. The air flow measuring device associated with the CAM system should have a range suitable for anticipated flow rates.

(4) Exhaust Routing. The exhaust stream from the vacuum system should be vented to effluent streams which are monitored for the requisite pollutants and noxious gases. Exhaust streams from outdoor installations which meet the requirements of RHO-MA-139, Part D.60, may be exhausted directly to the atmosphere.

(5) Operating Limits. The air flow through the CAM should not exceed 3 SCFM and the vacuum source should be no greater than 6 inches of mercury.

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Subject	Approved by
APPENDIX E - PLANT GROWTH MEDIUM DESCRIPTION	Guy F. Bartlett

Backfill Soil is the soil used as a plant growth medium between the depths of one and four feet as measured at the restabilization site. Backfill soil will fall within the range of the following limiting characteristics:

a. less than 25% gravels

b. pH less than 9

c. 0-4 millimhos/sq m electrical conductivity of soluble salts

d. 0-15 sodium adsorption ratio

Topsoil is the soil used as a plant growth medium at the surface to a depth of one foot as measured at the restabilization site. Topsoil will fall within the range of the following limiting characteristics:

e. less than 15% gravels

f. pH between 6 and 8.2

g. 0-1 millimhos/sq m electrical conductivity of soluble salts

h. 0-5 sodium adsorption ratio

The soils of the Hanford Site are very low in organic matter, generally less than 0.5%. Nitrogen, the most limiting of the plant nutrients, is also very low in the Hanford soils, therefore, the soils may be considered to be of very low fertility. The keys to establishing desirable vegetation on these soils are: (1) amount of available soil water; (2) soil fertility (mainly nitrogen); and (3) soil salt content.

The water holding capacity of soils is adversely affected by the presence of coarse fragments (i.e., gravel). Thus, with the very small amounts of rain Hanford receives in a year, the backfill soil and topsoil must be low in gravel content.

Soil fertility characteristics cannot be considered to be limiting factors. Soil nitrate levels can be manipulated by additions of nitrogen fertilizer. The absence of high levels of organic matter will not limit plant growth. The level of other plant nutrients; i.e., phosphorous, potassium, sulfur, and the micronutrients are generally supplied in adequate amounts by Hanford soils.

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Soil salts, pH, and sodium levels of Hanford soils will fall within the limits set for backfill soil and topsoil with only a few exceptions.

References

Soil Physics, Baver, L. D., W. H. Gardner, W. R. Gardner; John Wiley & Sons, 1979

Soil Chemistry, Bohn, H. L., B. L. McNeal, G. A. O'Conner; John Wiley & Sons, 1979

"Factors Affecting Choice of Revegetation Species on the Hanford Reservation", RHO-LD-155, Fuchs, M. R., G. R. Cox, June 1983

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