RADIATION PROTECTION PROGRAM *(RPP)*

This plan:

Implements the regulations contained in the most current revision of Title 10, Code of Federal Regulations, Part 835.

Comments and questions regarding this plan should be directed to the contact person listed below:

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Sign-off Record:

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Approved by: _____ Date: 11/3/10
Dr. Alexander H. King, Laboratory Director

Note: Original Sign-off Record with signatures is on file with ESH&A.

1.0 REVISION/REVIEW LOG

This document will be reviewed every three years as a minimum.

Revision Number	Effective Date	Contact Person	Pages Affected	Description of Revision
4	06/01/00	Hokel	selected	RPP revised based on DOE comments
5	06/01/03	Beckel	Section 3.0	Minor editorial changes
6	08/15/06	McGuigan	Section 3.0	G:\DOC&RECS\DCP\PLAN\Plan 10202.004 Rev 6 Radiation Protection Plan.doc
7	01/01/08	McGuigan	All	G:\DOC&RECS\DCP\PLAN\Plan 10202.004 Rev 7 revdesc.doc
8	01/01/11	McGuigan	Section 3.0 Section 5.0	G:\DOC&RECS\DCP\PLAN\Plan 10202.004 Rev 8 revdesc.doc

2.0 SUMMARY

This Radiation Protection Program (RPP) applies to the activities described in the Scope of Radiological Operations (see below) of the Ames Laboratory, which is operated under contract to the Department of Energy by Iowa State University. It constitutes Ames Laboratory's implementation plan for the requirements of 10 CFR Part 835, *Occupational Radiation Protection*. It contains a description of Ames Laboratory's current compliance status and the means by which the Laboratory intends to comply fully with all applicable requirements of 10 CFR 835. Implementation of the RPP does not significantly impact upon any programs or activities not included in the plan.

Each requirement and recommendation of 10 CFR 835 is explicitly addressed in this format. Justification is given for all instances in which it is determined that a requirement of the Regulation is not applicable to Ames Laboratory. Ames Laboratory is not exempt from any requirements of the Regulation. The table in Section 5 of this document summarizes Ames Laboratory's compliance status with the requirements of 10 CFR 835. Status of "Full" indicates full compliance to the reference requirement. Status of "NA" indicates that the reference text is not applicable.

3.0 SCOPE OF RADIOLOGICAL OPERATIONS

Ames Laboratory is a U.S. Department of Energy (DOE) Laboratory seeking solutions to energy-related problems through research involving the exploration of chemical, engineering, environmental, materials, mathematical, and physical sciences.

A limited number of Laboratory research activities utilize small quantities of radioactive materials and/or radiation produced by analytical x-ray systems. There are three general categories of ionizing radiation sources used at Ames Laboratory:

I. Very small quantities of source and special nuclear materials (i.e., thorium, uranium, depleted uranium, and low enriched uranium) are utilized for research. The source materials and special nuclear materials are maintained in individual Materials Balance Areas and reported to DOE. The Laboratory is currently specified as a category IV facility for purposes of the Materials Control and Accountability program. Research involving the use of these materials has been varied in the past, involving such projects as purification of isotopes for use at other research facilities, nebulization of materials and the study of laser-ablated materials, etc. There are limited activities being performed with these materials at the Laboratory. The Laboratory maintains only a small inventory of the materials; periodically the Laboratory receives requests from other facilities for small quantities of purified material, (e.g., crystal bar thorium), which are sent as limited quantity shipments.

II. Small quantities of sealed and unsealed radioactive materials are used as check sources and calibration sources or are specifically ordered for use in short-term research projects. Some research may involve the use of small, low activity neutron-activated metal sources.

III. Radiation producing devices (x-ray systems) are utilized by several research groups.

Although the amounts of radioactive material commonly used in research at the Laboratory are small (uCi or mCi) and the dose rates are usually less than 100 millirems per hour, radiological conditions are monitored by the Health Physics Group. Radiological conditions in the research areas are evaluated through review of survey data, dosimetry records, special radiological monitoring and/or analytical measurements, and other means described in this RPP document.

New activities or modifications to approved activities involving the use of any source of ionizing radiation must be approved through the Ames Laboratory Readiness Review process before beginning operations. Occupational exposures, as a result of the use of sources of ionizing radiation at Ames Laboratory are consistently considerably less than the limits set forth in 10 CFR 835.

Areas of low-level contamination exist in some buildings of the Laboratory as a result of DOE historical research and production activities, but only in areas not routinely entered by employees. These areas are posted and any work in any contaminated area is performed using Radiological Work Permits.

4.0 As Low As Reasonably Achievable (ALARA) STATEMENT

ALARA is Ames Laboratory's approach to radiological protection, used to manage and control exposures (individual and collective) to employees, visitors, and the general public. ALARA is not a dose limit, but is a philosophy for devising processes, procedures and operations so as to maintain doses within applicable limits and as far below them as can be reasonably achieved. Ames Laboratory's policies and procedures are consistent with the ALARA philosophy.

It is the policy of Ames Laboratory to conduct its activities in such a manner that worker and public safety,

as well as protection of the environment, is given high priority. Ames Laboratory management is committed to maintaining ionizing radiation risks to levels that are ALARA and to minimizing associated environmental, safety and health impacts in all Laboratory activates. Both individual and collective exposures to laboratory workers, visitors, or members of the public, shall be maintained within appropriate regulatory limits and as far below such limits as social, technical, economic, practical, and public policy considerations permit.

5.0 COMPLIANCE STATEMENTS

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix A	Derived Air Concentrations (DAC) for Controlling Radiation Exposure to Workers at DOE Facilities		
Appendix A	The data presented in appendix A are to be used for controlling individual internal doses in accordance with § 835.209, identifying the need for air monitoring in accordance with § 835.403, and identifying and posting airborne radioactivity areas in accordance with § 835.603(d).	Full	Ames Laboratory policies and procedures are consistent with these requirements.
Appendix A	The DAC values are given for individual radionuclides. For known mixtures of radionuclides, determine the sum of the ratio of the observed concentration of a particular radionuclide and its corresponding DAC for all radionuclides in the mixture. If this sum exceeds unity (1), then the DAC has been exceeded. For unknown radionuclides, the most restrictive DAC (lowest value) for those isotopes not known to be absent shall be used. For any single radionuclide not listed in appendix A with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than two hours, the DAC value shall be 4 E−11 µCi/mL (1 Bq/m^3). For any single radionuclide not listed in appendix A that decays by alpha emission or spontaneous fission the DAC value shall be 2 E−13 µCi/mL (8 E−03 Bq/m^3). The DACs for limiting radiation exposures through inhalation of radionuclides by workers are listed in this appendix. The values are based on either a stochastic (committed effective dose) dose limit of 5 rems (0.05 Sv) or a deterministic (organ or tissue) dose limit of 50 rems (0.5 Sv) per year, whichever is more limiting. Note: the 15 rems (0.15 Sv) dose limit for the lens of the eye does not appear as a critical organ dose limit.	Full	Ames Laboratory policies and procedures are consistent with these requirements.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix A	The columns in this appendix contain the following information: (1) Radionuclide; (2) inhaled air DAC for type F (fast), type M (moderate), and type S (slow) materials in units of µCi/mL; (3) inhaled air DAC for type F (fast), type M (moderate), and type S (slow) materials in units of Bq/m^3; (4) an indication of whether or not the DAC for each class is controlled by the stochastic (effective dose) or deterministic (organ or tissue) dose. The absorption types (F, M, and S) have been established to describe the absorption type of the materials from the respiratory tract into the blood. The range of half-times for the absorption types correspond to: Type F, 100% at 10 minutes; Type M, 10% at 10 minutes and 90% at 140 days; and Type S 0.1% at 10 minutes and 99.9% at 7000 days. The DACs are listed by radionuclide, in order of increasing atomic mass, and are based on the assumption that the particle size distribution of 5 micrometers AMAD is used. For situations where the particle size distribution is known to differ significantly from 5 micrometers AMAD, appropriate corrections may be made to both the estimated dose to workers and the DACs.	Full	This is a statement that allows interpretation of the data presented in Appendix A and requires no action on the part of Ames Laboratory.
Appendix A Footnote 1	A determination of whether the DACs are controlled by stochastic (St) or deterministic (organ or tissue) dose, or if they both give the same result (E), for each absorption type, is given in this column. The key to the organ notation for deterministic dose is: BS = Bone surface, ET = Extra thoracic, K = Kidney, L = Liver, and T = Thyroid. A blank indicates that no calculations were performed for the absorption type shown.	Full	This is a statement that allows interpretation of the data presented in Appendix A and requires no action on the part of Ames Laboratory.
Appendix A Footnote 2	The ICRP identifies these materials as soluble or reactive gases and vapors or highly soluble or reactive gases and vapors. For tritiated water, the inhalation DAC values allow for an additional 50% absorption through the skin, as described in ICRP Publication No. 68, Dose Coefficients for Intakes of Radionuclides by Workers. For elemental tritium, the DAC values include a factor that irradiation from gas within the lungs might increase the dose by 20%.	Full	This is a statement that allows interpretation of the data presented in Appendix A and requires no action on the part of Ames Laboratory.
Appendix A Footnote 3	A dash indicates no values given for this data category.	Full	This is a statement that allows interpretation of the data presented in Appendix A and requires no action on the part of Ames Laboratory.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix A Footnote 4	DAC values derived using hafnium tritide particle and are based on "observed activity" (i.e., only radiation emitted from the particle is considered). DAC values derived using methodology found in Radiological Control Programs for Special Tritium Compounds, DOE-HDBK-1184-2004.	Full	This is a statement that allows interpretation of the data presented in Appendix A and requires no action on the part of Ames Laboratory.
Appendix A Footnote 5	These values are appropriate for protection from radon combined with its short-lived decay products and are based on information given in ICRP Publication 65: Protection Against Radon-222 at Home and at Work and in DOE-STD-1121-98: Internal Dosimetry. The values given are for 100% equilibrium concentration conditions of the short-lived radon decay products with the parent. To allow for an actual measured equilibrium concentration or a demonstrated equilibrium concentration, the values given in this table should be multiplied by the ratio (100%/actual %) or (100%/demonstrated %), respectively. Alternatively, the DAC values for Rn-220 and Rn-222 may be replaced by 2.5 working level (WL) and 0.83 WL, respectively, for appropriate limiting of decay product concentrations. A WL is any combination of short-lived radon decay products, in one liter of air without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3 E+05 MeV of alpha energy.	Full	This is a statement that allows interpretation of the data presented in Appendix A and requires no action on the part of Ames Laboratory.
Appendix C	Derived Air Concentrations (DAC) For Workers From External Exposure During Immersion In A Cloud of Airborne Radioactive Material		
Appendix C (a)	The data presented in appendix C are to be used for controlling occupational exposures in accordance with § 835.209, identifying the need for air monitoring in accordance with § 835.403 and identifying the need for posting of airborne radioactivity areas in accordance with § 835.603(d).	Full	Ames Laboratory policies and procedures are consistent with these requirements.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix C (b)	The air immersion DAC values shown in this appendix are based on a stochastic dose limit of 5 rems (0.05 Sv) per year. Four columns of information are presented: (1) radionuclide; (2) half-life in units of seconds (s), minutes (min), hours (h), days (d), or years (yr); (3) air immersion DAC in units of µCi/mL; and (4) air immersion DAC in units of Bq/m^3. The data are listed by radionuclide in order of increasing atomic mass. The air immersion DACs were calculated for a continuous, nonshielded exposure via immersion in a semi-infinite cloud of airborne radioactive material. The DACs listed in this appendix may be modified to allow for submersion in a cloud of finite dimensions.	Full	This is a statement that allows interpretation of the data presented in Appendix C and requires no action on the part of Ames Laboratory.
Appendix C (c)	The DAC values are given for individual radionuclides. For known mixtures of radionuclides, determine the sum of the ratio of the observed concentration of a particular radionuclide and its corresponding DAC for all radionuclides in the mixture. If this sum exceeds unity (1), then the DAC has been exceeded. For unknown radionuclides, the most restrictive DAC (lowest value) for those isotopes not known to be absent shall be used. For any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than two hours, the DAC value shall be 6 E−06 µCi/mL (2 E+04 Bq/m^3).	Full	This is a statement that allows interpretation of the data presented in Appendix C and requires no action on the part of Ames Laboratory.
Appendix D	Surface Contamination Values		
Appendix D	The data presented in appendix D are to be used in identifying and posting contamination and high contamination areas in accordance with § 835.603(e) and (f) and identifying the need for surface contamination monitoring and control in accordance with § 835.1101 and 1102.	Full	Ames Laboratory policies and procedures are consistent with these requirements.
Appendix D Footnote 1	The values in this appendix, with the exception noted in footnote 6 below, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides apply independently.	Full	This is a statement that allows interpretation of the data presented in Appendix D and requires no action on the part of Ames Laboratory.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix D Footnote 2	As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.	Full	This is a statement that allows interpretation of the data presented in Appendix D and requires no action on the part of Ames Laboratory.
Appendix D Footnote 3	The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm^2 is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) from measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds three times the applicable value.	Full	This is a statement that allows interpretation of the data presented in Appendix D and requires no action on the part of Ames Laboratory.
Appendix D Footnote 4	The amount of removable radioactive material per 100 cm^2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note - The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.	Full	This is a statement that allows interpretation of the data presented in Appendix D and requires no action on the part of Ames Laboratory.
Appendix D Footnote 5	This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.	NA	This footnote is not applicable to Ames Laboratory as Ames Laboratory does not have mixed fission products in its inventory of radionuclides.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix D Footnote 6	Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a "Total" value does not apply. In certain cases, a “Total” value of 10,000 dpm/100 cm^2 may be applicable either to metals of the types from which insoluble special tritium compounds are formed, that have been exposed to tritium, or to bulk materials to which insoluble special tritium compound particles are fixed to a surface.	Full	This is a statement that allows interpretation of the data presented in Appendix D and requires no action on the part of Ames Laboratory.
Appendix D Footnote 7	These limits apply only to the alpha emitters within the respective decay series.	Full	This is a statement that allows interpretation of the data presented in Appendix D and requires no action on the part of Ames Laboratory.

Appendix E	Values For Establishing Sealed Radioactive Source Accountability and Radioactive Materials Posting And Labeling Requirements.		

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
Appendix E	The data presented in appendix E are to be used for identifying accountable sealed radioactive sources and radioactive material areas as those terms are defined at § 835.2(a), establishing the need for radioactive material area posting in accordance with § 835.603(g), and establishing the need for radioactive material labeling in accordance with § 835.605. Any alpha emitting radionuclide not listed in appendix E in the table and mixtures of alpha emitters of unknown composition have a value of 10µCi. With the exception that any type of STC has a value of 10 Ci, any radionuclide other than alpha emitting radionuclides not listed above and mixtures of beta emitters of unknown composition have a value of 100 µCi. Note: Where there is involved a combination of radionuclides in known amounts, derive the value for the combination as follows: determine, for each radionuclide in the combination, the ratio between the quantity present in the combination and the value otherwise established for the specific radionuclide when not in combination. If the sum of such ratios for all radionuclides in the combination exceeds unity (1), then the accountability criterion has been exceeded.	Full	Ames Laboratory policies and procedures are consistent with these requirements and data presented in appendix E.
Subpart A	**General Provisions**		
1	Scope.		
1(a)	General. The rules in this part establish radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.	Full	This statement summarizes the contents of the rules in this part and does not require any specific action on the part of Ames Laboratory.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
1(b)	Exclusion. Except as provided in paragraph (c) of this section, the requirements in this part do not apply to: (1) Activities that are regulated through a license by the Nuclear Regulatory Commission or a State under an Agreement with the Nuclear Regulatory Commission, including activities certified by the Nuclear Regulatory Commission under section 1701 of the Atomic Energy Act; (2) Activities conducted under the authority of the Deputy Administrator for Naval Reactors, as described in Pub. L. 98-525 and 106-65; (3) Activities conducted under the Nuclear Explosives and Weapons Surety Program relating to the prevention of accidental or unauthorized nuclear detonations. (4) DOE activities conducted outside the United States on territory under the jurisdiction of a foreign government to the extent governed by occupational radiation protection requirements agreed to between the United States and the cognizant government; (5) Background radiation, radiation doses received as a patient for the purposes of medical diagnosis or therapy, or radiation doses received from participation as a subject in medical research programs; or (6) Radioactive material on or within material, equipment, and real property which is approved for release when the radiological conditions of the material, equipment, and real property have been documented to comply with the criteria for release set forth in a DOE authorized limit which has been approved by a Secretarial Officer in consultation with the Chief Health, Safety and Security Officer. (7) Radioactive material transportation not performed by DOE or a DOE contractor.	Full	Ames Laboratory acknowledges that the activities mentioned in § 835.1(b) are specifically excluded from the requirements of § 835 and commits to implementing the rules and regulations that govern such activities. Ames Laboratory plans, policies and procedures include specific provisions to ensure that background radiation, radiation doses received as a patient for the purposes of medical diagnosis or therapy, or radiation doses received from participation as a subject in medical research programs are not included as part of the Laboratory's occupational radiation protection program.
1(c)	Occupational doses received as a result of excluded activities and radioactive material transportation, listed in paragraphs (b)(1) through (b)(4) and (b)(7) of this section, shall be included to the extent practicable when determining compliance with the occupational dose limits at §§ 835.202 and 835.207, and with the limits for the embryo/fetus at § 835.206. Occupational doses resulting from authorized emergency exposures and planned special exposures shall not be considered when determining compliance with the dose limits at §§ 835.202 and 835.207.	Full	Ames Laboratory policies are consistent with these requirements.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
1 (d)	The requirements in subparts F and G of this part do not apply to radioactive material transportation by DOE or a DOE contractor conducted: (1) Under the continuous observation and control of an individual who is knowledgeable of and implements required exposure control measures, or (2) In accordance with Department of Transportation regulations or DOE orders that govern such movements.		Ames Laboratory policies are consistent with these requirements.
2	Definitions.		
2(a).01	As used in this part: Accountable sealed radioactive source means a sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in appendix E of this part.	Full	Ames Laboratory has accepted this definition.
2(a).02	Activity Median Aerodynamic Diameter (AMAD) means a particle size in an aerosol where fifty percent of the activity in the aerosol is associated with particles of aerodynamic diameter greater than the AMAD.	Full	Ames Laboratory has accepted this definition.
2(a).03	Airborne radioactive material or airborne radioactivity means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.	Full	Ames Laboratory has accepted this definition.
2(a).04	Airborne radioactivity area means any area, accessible to individuals, where: (1) The concentration of airborne radioactivity, above natural background, exceeds or is likely to exceed the derived air concentration (DAC) values listed in appendix A or appendix C of this part; or (2) An individual present in the area without respiratory protection could receive an intake exceeding 12 DAC-hours in a week.	Full	Ames Laboratory has accepted this definition.
2(a).05	ALARA means "As Low As is Reasonably Achievable," which is the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this part, ALARA is not a dose limit but a process which has the objective of attaining doses as far below the applicable limits of this part as is reasonably achievable.	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(a).06	Annual limit on intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man (ICRP Publication 23) that would result in a committed effective dose of 5 rems (0.05 sieverts (Sv)) (1 rem = 0.01 Sv) or a committed equivalent dose of 50 rems (0.5 Sv) to any individual organ or tissue. ALI values for intake by ingestion and inhalation of selected radionuclides are based on International Commission on Radiological Protection Publication 68, Dose Coefficients for Intakes of Radionuclides by Workers, published July, 1994 (ISBN 0 08 042651 4). This document is available from Elsevier Science Inc., Tarrytown, NY.	Full	Ames Laboratory has accepted this definition.
2 (a).07	Authorized limit means a limit on the concentration of residual radioactive material on the surfaces or within the property that has been derived consistent with DOE directives including the as low as is reasonably achievable (ALARA) process requirements, given the anticipated use of the property and has been authorized by DOE to permit the release of the property from DOE radiological control.		Ames Laboratory has accepted this definition.
2(a).08	Background means radiation from: (1) Naturally occurring radioactive materials which have not been technologically enhanced; (2) Cosmic sources; (3) Global fallout as it exists in the environment (such as from the testing of nuclear explosive devices); (4) Radon and its progeny in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities; and (5) Consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation.	Full	Ames Laboratory has accepted this definition.
2(a).09	Bioassay means the determination of kinds, quantities, or concentrations, and, in some cases, locations of radioactive material in the human body, whether by direct measurement or by analysis and evaluation of radioactive materials excreted or removed from the human body.	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(a).10	Calibration means to adjust and/or determine either: (1) The response or reading of an instrument relative to a standard (e.g., primary, secondary, or tertiary) or to a series of conventionally true values; or (2) The strength of a radiation source relative to a standard (e.g., primary, secondary, or tertiary) or conventionally true value.	Full	Ames Laboratory has accepted this definition.
2(a).11	Contamination area means any area, accessible to individuals, where removable surface contamination levels exceed or are likely to exceed the removable surface contamination values specified in appendix D of this part, but do not exceed 100 times those values.	Full	Ames Laboratory has accepted this definition.
2(a).12	Controlled area means any area to which access is managed by or for DOE to protect individuals from exposure to radiation and/or radioactive material.	Full	Ames Laboratory has accepted this definition.
2(a).13	Declared pregnant worker means a woman who has voluntarily declared to her employer, in writing, her pregnancy for the purpose of being subject to the occupational dose limits to the embryo/fetus as provided in § 835.206. This declaration may be revoked, in writing, at any time by the declared pregnant worker.	Full	Ames Laboratory has accepted this definition.
2(a).14	Derived air concentration (DAC) means, for the radionuclides listed in appendix A of this part, the airborne concentration that equals the ALI divided by the volume of air breathed by an average worker for a working year of 2000 hours (assuming a breathing volume of 2400 m^3). For the radionuclides listed in appendix C of this part, the air immersion DACs were calculated for a continuous, non-shielded exposure via immersion in a semi-infinite cloud of radioactive material. Except as noted in the footnotes to appendix A of this part, the values are based on dose coefficients from International Commission on Radiological Protection Publication 68, Dose Coefficients for Intakes of Radionuclides by Workers, published July, 1994 (ISBN 0 08 042651 4) and the associated ICRP computer program, The ICRP Database of Dose Coefficients: Workers and Members of the Public, (ISBN 0 08 043 8768). These materials are available from Elsevier Science Inc., Tarrytown, NY.	Full	Ames Laboratory has accepted this definition.
2(a).15	Derived air concentration-hour (DAC-hour) means the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide, in hours.	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(a).16	Deterministic effects means effects due to radiation exposure for which the severity varies with the dose and for which a threshold normally exists (e.g., radiation-induced opacities within the lens of the eye).	Full	Ames Laboratory has accepted this definition.
2(a).17	DOE means the United States Department of Energy.	Full	Ames Laboratory has accepted this definition.
2(a).18	DOE activity means an activity taken for or by DOE in a DOE operation or facility that has the potential to result in the occupational exposure of an individual to radiation or radioactive material. The activity may be, but is not limited to, design, construction, operation, or decommissioning. To the extent appropriate, the activity may involve a single DOE facility or operation or a combination of facilities and operations, possibly including an entire site or multiple DOE sites.	Full	Ames Laboratory has accepted this definition.
2(a).19	Entrance or access point means any location through which an individual could gain access to areas controlled for the purpose of radiation protection. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.	Full	Ames Laboratory has accepted this definition.
2(a).20	General employee means an individual who is either a DOE or DOE contractor employee; an employee of a subcontractor to a DOE contractor; or an individual who performs work for or in conjunction with DOE or utilizes DOE facilities.	Full	Ames Laboratory has accepted this definition.
2(a).21	High contamination area means any area, accessible to individuals, where removable surface contamination levels exceed or are likely to exceed 100 times the removable surface contamination values specified in appendix D of this part.	Full	Ames Laboratory has accepted this definition.
2(a).22	High radiation area means any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.1 rems (0.001 Sv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.	Full	Ames Laboratory has accepted this definition.
2(a).23	Individual means any human being.	Full	Ames Laboratory has accepted this definition.
2(a).24	Member of the public means an individual who is not a general employee. An individual is not a "member of the public" during any period in which the individual receives an occupational dose.	Full	Ames Laboratory has accepted this definition.
2(a).25	Minor means an individual less than 18 years of age.	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(a).26	Monitoring means the measurement of radiation levels, airborne radioactivity concentrations, radioactive contamination levels, quantities of radioactive material, or individual doses and the use of the results of these measurements to evaluate radiological hazards or potential and actual doses resulting from exposures to ionizing radiation.	Full	Ames Laboratory has accepted this definition.
2(a).27	Occupational dose means an individual's ionizing radiation dose (external and internal) as a result of that individual's work assignment. Occupational dose does not include doses received as a medical patient or doses resulting from background radiation or participation as a subject in medical research programs.	Full	Ames Laboratory has accepted this definition.
2(a).28	Person means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency, any State or political subdivision of, or any political entity within a State, any foreign government or nation or other entity, and any legal successor, representative, agent or agency of the foregoing; provided that person does not include DOE or the United States Nuclear Regulatory Commission.	Full	Ames Laboratory has accepted this definition.
2(a).29	Radiation means ionizing radiation: alpha particles, beta particles, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this part, does not include non-ionizing radiation, such as radio waves or microwaves, or visible, infrared, or ultraviolet light.	Full	Ames Laboratory has accepted this definition.
2(a).30	Radiation area means any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the source or from any surface that the radiation penetrates.	Full	Ames Laboratory has accepted this definition.
2(a).31	Radioactive material area means any area within a controlled area, accessible to individuals, in which items or containers of radioactive material exist and the total activity of radioactive material exceeds the applicable values provided in appendix E of this part.	Full	Ames Laboratory has accepted this definition.
2(a).32	Radioactive material transportation means the movement of radioactive material by aircraft, rail, vessel, or highway vehicle. Radioactive material transportation does not include preparation of material or packagings for transportation, storage of material awaiting transportation, or application of markings and labels required for transportation.	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(a).33	Radiological area means any area within a controlled area defined in this section as a "radiation area," "high radiation area," "very high radiation area," "contamination area," "high contamination area," or "airborne radioactivity area."	Full	Ames Laboratory has accepted this definition.
2(a).34	Radiological worker means a general employee whose job assignment involves operation of radiation producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (0.001 Sv) per year total effective dose.	Full	Ames Laboratory has accepted this definition.
2(a).35	Real property means land and anything permanently affixed to the land such as buildings, fences and those things attached to the buildings, such as light fixtures, plumbing and heating fixtures.	Full	Ames Laboratory has accepted this definition.
2(a).36	Real-time air monitoring means measurement of the concentrations or quantities of airborne radioactive materials on a continuous basis.	Full	Ames Laboratory has accepted this definition.
2(a).37	Respiratory protective device means an apparatus, such as a respirator, worn by an individual for the purpose of reducing the individual's intake of airborne radioactive materials.	Full	Ames Laboratory has accepted this definition.
2(a).38	Sealed radioactive source means a radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation. The sealed radioactive source consists of a known or estimated quantity of radioactive material contained within a sealed capsule, sealed between layer(s) of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means intended to prevent leakage or escape of the radioactive material. Sealed radioactive sources do not include reactor fuel elements, nuclear explosive devices, and radioisotope thermoelectric generators.	Full	Ames Laboratory has accepted this definition.
2(a).39	Source leak test means a test to determine if a sealed radioactive source is leaking radioactive material.	Full	Ames Laboratory has accepted this definition.
2(a).40	Special tritium compound means any compound, except for H_2O, that contains tritium, either intentionally (e.g., by synthesis) or inadvertently (e.g., by contamination mechanisms).	Full	Ames Laboratory has accepted this definition.
2(a).41	Stochastic effects means malignant and hereditary diseases for which the probability of an effect occurring, rather than its severity, is regarded as a function of dose without a threshold, for radiation protection purposes.	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(a).42	Very high radiation area means any area accessible to individuals in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in one hour at 1 meter from a radiation source or from any surface that the radiation penetrates.	Full	Ames Laboratory has accepted this definition.
2(a).43	Week means a period of seven consecutive days.	Full	Ames Laboratory has accepted this definition.
2(a).44	Year means the period of time beginning on or near January 1 and ending on or near December 31 of that same year used to determine compliance with the provisions of this part. The starting and ending date of the year used to determine compliance may be changed, provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.	Full	Ames Laboratory has accepted this definition.
2(b).01	As used in this part to describe various aspects of radiation dose: Absorbed dose (D) means the average energy imparted by ionizing radiation to the matter in a volume element per unit mass of irradiated material. The absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray).	Full	Ames Laboratory has accepted this definition.
2(b).02	Committed effective dose (E_{50}) means the sum of the committed equivalent doses to various tissues or organs in the body ($H_{T,50}$), each multiplied by the appropriate tissue weighting factor (w_T)--that is, $E_{50} = \Sigma w_T H_{T,50} + w_{Remainder} H_{Remainder,50}$. Where $w_{Remainder}$ is the tissue weighting factor assigned to the remainder organs and tissues and $H_{Remainder,50}$ is the committed equivalent dose to the remainder organs and tissues. Committed effective dose is expressed in units of rems (or Sv).	Full	Ames Laboratory has accepted this definition.
2(b).03	Committed equivalent dose ($H_{T,50}$) means the equivalent dose calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed equivalent dose is expressed in units of rems (or Sv).	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(b).04	Cumulative total effective dose means the sum of all total effective dose values recorded for an individual plus, for occupational exposures received before the implementation date of this amendment, the cumulative total effective dose equivalent (as defined in the November 4, 1998 amendment to this rule) values recorded for an individual, where available, for each year occupational dose was received, beginning January 1, 1989.	Full	Ames Laboratory has accepted this definition.
2(b).05	Dose is a general term for absorbed dose, equivalent dose, effective dose, committed equivalent dose , committed effective dose , or total effective dose as defined in this part.	Full	Ames Laboratory has accepted this definition.
2(b).06	Effective dose (E) means the summation of the products of the equivalent dose received by specified tissues or organs of the body (H_T) and the appropriate tissue weighting factor (w_T)--that is, $E = \Sigma w_T H_T$. It includes the dose from radiation sources internal and/or external to the body. For purposes of compliance with this part, equivalent dose to the whole body may be used as effective dose for external exposures. The effective dose is expressed in units of rems (or Sv).	Full	Ames Laboratory has accepted this definition.
2(b).07	Equivalent dose (H_T) means the product of average absorbed dose ($D_{T,R}$) in rad (or gray) in a tissue or organ (T) and a radiation (R) weighting factor (w_R). For external dose, the equivalent dose to the whole body is assessed at a depth of 1 cm in tissue; the equivalent dose to the lens of the eye is assessed at a depth of 0.3 cm in tissue, and the equivalent dose to the extremity and skin is assessed at a depth of 0.007 cm in tissue. Equivalent dose is expressed in units of rems (or Sv).	Full	Ames Laboratory has accepted this definition.
2(b).08	External dose or exposure means that portion of the equivalent dose received from radiation sources outside the body (i.e., "external sources").	Full	Ames Laboratory has accepted this definition.
2(b).09	Extremity means hands and arms below the elbow or feet and legs below the knee.	Full	Ames Laboratory has accepted this definition.
2(b).10	Internal dose or exposure means that portion of the equivalent dose received from radioactive material taken into the body (i.e., "internal sources").	Full	Ames Laboratory has accepted this definition.

REFERENCE	REQUIREMENT TEXT	STATUS	COMPLIANCE STATEMENT
2(b).11	Radiation weighting factor (w_R) means the modifying factor used to calculate the equivalent dose from the average tissue or organ absorbed dose; the absorbed dose (expressed in rad or gray) is multiplied by the appropriate radiation weighting factor. The radiation weighting factors to be used for determining equivalent dose in rems are as follow: [w_R Table contained in § 835.2(b)(i)] 1. All values relate to the radiation incident on the body or, for internal sources, emitted from the source. 2. When spectral data are insufficient to identify the energy of the neutrons, a radiation weighting factor of 20 shall be used. 3. When spectral data are sufficient to identify the energy of the neutrons, the following equation may be used to determine a neutron radiation weighting factor value: $w_R = 5 + 17 \exp\left[\frac{-(\ln(2E_n))^2}{6}\right]$ Where E_n is the neutron energy in MeV.	Full	Ames Laboratory has accepted this definition.
2(b).12	Tissue weighting factor (w_T) means the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The equivalent dose to tissue, (H_T), is multiplied by the appropriate tissue weighting factor to obtain the effective dose (E) contribution from that tissue. The tissue weighting factors are as follows: [TISSUE WEIGHTING FACTORS FOR VARIOUS ORGANS AND TISSUES Table contained in § 835.2(b)(i)] 1 "Remainder" means the following additional tissues and organs and their masses, in grams, following parenthetically: adrenals (14), brain (1400), extrathoracic airways (15), small intestine (640), kidneys (310), muscle (28,000), pancreas (100), spleen (180), thymus (20), and uterus (80). The equivalent dose to the remainder tissues ($H_{remainder}$), is normally calculated as the mass-weighted mean dose to the preceding ten organs and tissues. In those cases in which the most highly irradiated remainder tissue or organ receives the highest equivalent dose of all the organs, a weighting factor of 0.025 (half of remainder) is applied to that tissue or organ and 0.025 (half of remainder) to the mass-weighted equivalent dose in the rest of the remainder tissues and organs to give the remainder equivalent dose. 2 For the case of uniform external irradiation of the whole body, a tissue weighting factor (w_T) equal to 1 may be used in determination of the effective dose.	Full	Ames Laboratory has accepted this definition.