SIEMENS

April 12, 1994

U.S. Nuclear Regulatory Commission
Attn: Mr. Robert C. Pierson, Chief
Licensing Branch
Division of Fuel Cycle Safety and Safeguards, NMSS
Washington, D.C. 20555

License No. SNM-1227
Docket No. 70-1257

Dear Mr. Pierson:

Siemens Power Corporation (SPC) requests an amendment to its license to allow the use of airborne particle size distributions in adjusting derived air concentration (DAC) limits and annual limits of intake (ALI) in work areas requiring airborne sampling. In addition to the introduction of particle size analysis, we have more fully described our bioassay program.

Enclosed for your review are revised page 1-6 and complete revisions of chapters 3 and 12 of the existing license. Chapters 3 and 12 are now identical to those in the renewal application. Also included are revised page 1-7 and revised chapters 3 and 12, with vertical lines in the right margins to indicate changes, for the renewal application.

We would appreciate an expedited review of the particle size measurement changes so that we can take credit for them in setting airborne concentration limits.

If you require further information, please call me on 509-375-8663.

Very truly yours,

James B. Edgar
Staff Engineer, Licensing

JBE:pm

cc: C. A. Hooker
Region IV, Walnut Creek

200027

Siemens Power Corporation
Nuclear Division - Engineering and Manufacturing Facility
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1. EMF-12, "Nuclear Material Safeguards Procedures Description for the Fuels Fabrication Plant," (Revision 23). This document shall be maintained in a current and approved status and shall be properly implemented.

1.6.7 Authorization at Reactor Sites

SPC is authorized to possess fuel assemblies or fuel rods at reactor sites for the purpose of loading them into shipping containers and delivering them to a carrier for transport.

1.6.8 Authorized Release Guidelines

SPC is authorized to release equipment, scrap or facilities for unrestricted use, or for termination of license according to the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" as published by the U.S. Nuclear Regulatory Commission dated August 1987. A copy of these guidelines is contained in Appendix A to Chapter 3.

1.6.9 Authorized Criticality Alarm System Outage

SPC is granted an exemption from 10 CFR 70.24(a) for the purpose of performing maintenance on the criticality alarm system. Sections of the criticality alarm system may be taken out-of-service provided that all movement or processing of fissile material in affected areas is halted for the duration of the outage. Health Physics Technicians will conduct periodic surveys of the areas during the criticality alarm system outage.

1.6.10 Authorized Workplace Air Sampling Adjustments

SPC is authorized to adjust Derived Air Concentration (DAC) limits and Annual Limit of Intake (ALI) values in process areas to reflect actual physical characteristics of the airborne uranium.

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Chapter 3 RADIATION PROTECTION

3.1 Administrative Requirements

3.1.1 ALARA Policy

SPC's policy is to conduct its business in a manner to assure that its facilities are in compliance with radiation control and other nuclear regulations, and that its operations will not be detrimental to the environs. In implementing this policy, SPC shall assure that radiation exposure to persons both in-plant and off-site is maintained as low as reasonably achievable (ALARA). In providing this assurance, conditions of applicable NRC and State licenses and other regulatory permits or licenses shall be complied with, and regard shall be given to applicable NRC regulatory guides and industry standards.

Responsibility for establishing and assuring adherence to this policy shall rest with the President of SPC. This policy shall be implemented through appropriate delegations to Vice Presidents responsible for facilities processing or handling radioactive materials.

In order to facilitate implementation of this policy, key positions in organizations involved with facilities processing or handling radioactive materials shall be filled by persons knowledgeable of, and experienced in, the nuclear industry, and the responsibilities under this policy shall be identified in writing. Each responsible manager shall be required to know, understand, and carry out the provisions of this policy, as well as the procedures for its implementation.

3.1.2 Radiation Work Procedures

Radiation Work Procedures (RWP's) are prepared by Radiological Safety, and establish the radiological safety requirements of all work involving radiation and/or radioactive materials. The applicable RWP's shall be immediately available to personnel working with such material.

RWP's shall be approved in accordance with Figure I-2.3 and include the following information:

1. The identification number of the procedure;
2. A description of the nature, extent, and location of the work to be done;
3. A description of the types and potential for contamination that may be encountered;
4. A description of the types and estimated maximum personnel dose rates;

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5. Personal survey and protective clothing requirements;

6. Personal dosimetry requirements; and

7. A statement of the respiratory protection equipment required for entry into an airborne radioactive materials area.

3.2 Technical Requirements

3.2.1 Controlled Areas

All radioactive materials at SPC's Engineering and Manufacturing Facility shall be stored and processed within controlled areas (i.e., with the perimeter fence). Access to areas in which radioactive materials are stored or used shall be controlled by SPC security personnel in accordance with a formal, NRC-approved physical protection plan.

3.2.1.1 Restricted Areas

Each access point to restricted areas (as defined in 10 CFR 20) shall be posted in accordance with 10 CFR 20.1902. Additionally, RWP's for the respective areas shall specify the existing or potential radiological conditions and radiation protection measures required.

3.2.1.2 Clean, Intermediate and Contaminated Radioactive Materials/Radiation Areas

With the possible exception of temporary stepoff pads, clean areas shall be separated from contaminated controlled areas by intermediate areas. Intermediate areas shall be identified, and their boundaries visibly marked. Personnel shall follow posted special procedures or restrictions when leaving one area and entering another.

3.2.1.3 Change Rooms and Step-Off Areas

Change rooms servicing contamination controlled area workers shall be divided into contaminated, intermediate, and clean areas to minimize the spread of contamination. Step-off pads shall be provided when exiting contaminated areas. Separate toilet facilities may be located in contaminated, intermediate, and clean areas. Use of the toilets in contaminated and intermediate areas without removal of protective clothing shall be permitted provided a personnel survey is performed first.

Additional step-off areas may be established for maintenance work, temporary situations or conditions, or to accommodate personnel entry and exit not requiring the use of change room facilities. Personnel survey requirements shall be adhered to at all step-off areas.

3.2.1.4 Protective Clothing

Protective clothing shall be provided for personnel entering contamination controlled areas. The type(s) of clothing required shall be consistent with the individual's work assignment and is dependent upon the type and level of contamination anticipated.

Used protective clothing shall be removed prior to entering clean areas from contaminated areas, with the exception of emergency evacuations.

3.2.1.5 Personnel Surveys

Personnel survey instruments shall be provided in change rooms and at step off pads for use by personnel leaving contaminated areas. Personnel exiting contaminated areas shall be required to survey themselves after removing their protective clothing prior to leaving the step-off area. An exception to survey requirements is exiting during emergency evacuations.

3.2.2 Ventilation

General ventilation systems shall be designed and maintained to limit the spread of airborne contamination by maintaining air pressure gradients and airflows from general areas of low potential airborne contamination to general areas of higher potential contamination. Where ventilation barriers exist between areas, these systems shall be balanced so that the air pressure differentials between clean and contaminated areas are maintained at a minimum of 0.05 inch of water.

Air locks shall be installed, where necessary, to insure maintenance of proper air pressure differentials. Installed differential air pressure measuring instrument readings shall be recorded at least monthly.

Monthly smoke tests shall be conducted to visually demonstrate that the airflows are from general areas of low contamination potential to general areas of higher contamination potential.

General recirculating air systems shall recirculate air only from room areas (not from process enclosures) and pass it through fire retardant HEPA filters, which have installed efficiencies of at least 99.95% for 0.8 micron particles, before returning it to the room.

In addition to general ventilation systems, SPC may employ local ventilation units designed to recirculate room air through HEPA filters, and then discharge room air at low velocities, to minimize the airborne concentrations in breathing zones.

Recirculated air, excluding that from the local ventilation units described above, shall be continuously monitored prior to the final stage of HEPA filtration. An indication that

airborne levels are such that a 40 DAC-hour (derived air concentration-hour) exposure could be realized in a week from the recirculated air shall automatically divert the air from the recirculation mode to the respective facility exhaust air system. Manual diversion shall be allowed during maintenance on the system.

A minimum of seven air changes an hour shall be maintained in contaminated areas.

Unless safety concerns override, the average air velocity through openings in uranium handling hoods and equipment containing readily dispersible uranium shall be a minimum of 125 LFPM (linear feet per minute). These velocities shall be checked at least monthly.

Both general recirculation and exhaust air system HEPA filter installations shall be equipped with continuous pressure differential measuring and indicating systems whose readings shall be recorded at least monthly. The differential pressure across the final HEPA filters shall not exceed four inches of water gauge. The final HEPA filter installations shall also be checked prior to first use for efficiency against 0.8 micron particles and must meet or exceed a removal efficiency of 99.95 percent.

3.2.3 Work Area Air Sampling

In areas where unencapsulated radioactive materials are handled, processed, and/or air concentrations are likely to exceed 10 percent of DAC, air shall be routinely monitored. Fixed air sampling heads may be used for calculating DAC-hours in areas where internal dose monitoring is required. Air sample concentrations determined by fixed samplers may be modified by correction factors.

Specialized air sampling or monitoring equipment, such as continuous air monitors, portable, high volume, and/or lapel air samplers, shall be available to supplement the normal air sampling system, and for use in studies or work on special problems.

Fixed air sampling used to determine DAC-hour exposures shall be evaluated to assure results remain reasonably representative of workers exposures. Re-evaluation of representativeness shall be conducted at least every 12 months for those work stations which averaged 25 percent or greater of DAC the previous calendar year and at least every 24 months for the remaining work stations. Representativeness studies shall also be performed following significant process or equipment changes.

The frequency of air sampling in contaminated areas shall be based upon historical experience for each sampling area.

Flow rates through air samplers, as measured by in-line rotameters, shall be checked at the start and end of each sampling period. Rotameter accuracy shall be confirmed at least annually.

SPC may elect to adjust DACs and ALIs based upon particle size distribution. The adjustment shall be based upon the AMAD (activity median aerodynamic diameter). Should SPC elect to adjust DAC, SPC shall decide whether an entire area or room or related operations can be represented by a single DAC or whether the area, room, or related operations need to be subdivided; each with its own DAC. Adjustments shall be based upon the methodologies described in Chapter 12 of this application. Records of such measurements and resulting AMAD and DAC/ALI calculations shall be documented in internal records. Notwithstanding the preceding, SPC may elect to choose a value for DAC which is between the Occupational DAC listed in 10 CFR 20 and the average DAC as determined from the measured particle size distributions. The methodology and data base for DAC/ALI adjustments shall be documented.

If SPC chooses to adjust DACs and ALIs by particle size, a particle size measurement and analysis will be performed at least semi-annually in each group of locations for which particle size credit is taken. After one year, the Health Physics Component may relax the frequency to once per calendar year if DAC determined by new measurement(s) for a group of locations does not differ significantly from that established from previous measurements.

Particle size will be reassessed following significant process changes deemed likely to change the particle size distribution.

SPC may elect to adjust DAC based upon model changes recognized by national and international radiation protection experts. Examples of such model changes specifically include changes in weighting factors for various organs and in revisions in the ICRP lung model.

Air sample counting instruments shall be checked for acceptable operation and background each day they are used.

For breathing zone samplers, the system counting time and airflow rate of the sampler shall be adequate to obtain a lower limit of detection less than 4 DAC-hours for samples collected over a 40 hour period. All airborne radioactivity monitoring programs shall provide for investigation and/or increased sampling frequency if the activity concentration, not directly resulting from a known cause, exceeds the applicable action levels in Table I-3.1.

3.2.4 Radioactivity Measurement Instruments

3.2.4.1 Radiation Safety Instruments and Equipment

The general capabilities of radiation safety instruments used to make radiation protection measurements are described in Table I-3.2.

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The Manager, Plant Engineering, shall be responsible for the maintenance and calibration of radiation safety instruments and equipment. The following general requirements shall apply to all such equipment and instruments:

1. All radiation detection and measurement instruments shall be inspected (and repaired when necessary) and calibrated at least semiannually or tagged out;

2. Instruments shall be calibrated following any maintenance deemed likely to affect operation before they are put back into routine service;

3. Each on-line radiation detection instrument shall be checked for proper operation either by Health and Safety Technicians or by electronic surveillance daily (Monday through Friday for a normal work week). When daily checks are performed in a manner which qualifies as calibration, separate semiannual calibrations shall not be required;

4. Portable survey instruments shall be source-checked each shift they are used;

5. Each AC-operated personnel contamination survey instrument shall be provided with an individual check source to allow personnel to source-check the instruments;

6. Calibration sources shall be traceable to the National Institute of Standards and Technology (NIST); and

3.2.4.2 Criticality Accident Alarm System

See Chapter 1, Section 1.6.1.

3.2.4.3 Criticality Dosimeters

Criticality dosimeters shall be strategically located throughout the process facilities. These criticality dosimeters shall be capable of measuring 0.1 to 10^4 rems of neutron radiation over a neutron spectrum of thermal to 2.5 MeV. The criticality dosimeters shall be inspected at least annually to confirm their presence and undamaged condition.

3.2.5 Radiation Exposure

SPC shall strive to maintain external radiation exposures as far below the limits specified in 10 CFR 20.1201(a) as reasonably achievable. Radiation exposure records shall be reviewed by the ALARA Committee.

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In the event that it is necessary to exceed the exposure limits specified in 10 CFR 20.1201(a), exceptions shall be authorized in accordance with 10 CFR 20.1201(b). Respiratory protective equipment shall be used for entry into areas where airborne radioactive materials are known to exist in excess of the occupational DAC.

In addition to the controls specified elsewhere, the following methods of external radiation exposure control may be employed as applicable and reasonable:

1. Automation of operations;
2. Minimization of quantities of radioactive material and/or use of shielding;
3. Time and distance control;
4. Special handling tools; and
5. Exposure awareness, planning, and scheduling.

3.2.5.1 Radiation Surveys

A detailed survey of radiation levels (beta-gamma and neutron, as applicable) shall be performed for each new operation and radioactive material storage facility when activity in the area is first initiated.

Routine radiation surveys shall be performed at least monthly in all general areas where radioactive materials are stored or processed, where personnel have access.

Radiation surveys shall be performed on all incoming and outgoing shipments of radioactive materials per 10 CFR 20.

3.2.5.2 Dosimetry

Persons requiring radiation exposure monitoring per 10 CFR 20.1502(a) shall wear beta-gamma sensitive dosimeters which shall be processed and evaluated by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the NIST. For these personnel, exposure monitoring dosimeters shall be exchanged and analyzed quarterly. The beta-gamma dosimeters shall be supplemented, as appropriate, by other types of dosimeters (e.g., finger rings, direct-reading dosimeters, and neutron dosimeters), and by radiation measurements made with radiation survey instruments. Film badge dosimeters, if used, shall be exchanged and analyzed monthly.

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Indication of exposure of uranium fuel fabrication workers exceeding the action levels stated below shall be investigated and the report placed in the personnel folder of the individual.

Action/Investigation Levels	Rem/Qtr.
Deep Dose Equivalent to the Whole body: head and trunk, including gonads, arm above the elbow, and leg above the knee	1
Eye Dose Equivalent	3
Shallow Dose Equivalent to the skin or extremities	10

3.2.6 Surface Contamination

Radioactive materials shall be contained and/or confined during processing, transfer, and storage as necessary to maintain intake of such materials by personnel as low as reasonably achievable. As appropriate, operations involving readily dispersible forms of radioactive materials shall be accomplished within enclosures (e.g., process equipment, glove boxes, glove-port hoods, laboratory type hoods, etc.) which are exhausted to facility exhaust air systems.

3.2.6.1 Facility Surveys

The following minimum frequency schedule shall be applied to the facility contamination survey program:

Area Surveyed	Survey Frequency
Contaminated radioactive materials areas	Weekly
Non-contaminated radioactive material areas	Monthly
Intermediate areas	Daily
Lunchrooms adjacent to radioactive materials/radiation areas	Daily

Action levels for cleanup of the various areas are listed below.

1. Noncontaminated Radioactive Material Areas. The goal for these areas is to keep them contamination-free. Any contamination in excess of 200 dpm/100 cm^2 (alpha) shall be cleaned up during the shift detected.

2. Intermediate Areas. The goal for these areas is to keep them free of significant contamination. Cleanup is required during the shift detected if contamination is found and the level is greater than 200 dpm/100 cm^2 (alpha). Contamination in excess of 500 dpm/100 cm^2 (alpha) shall be cleaned up immediately. If the contamination level is in excess of 2000

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dpm/100 cm^2 (alpha), the area shall be reclassified and posted as a contaminated area until it is cleaned up.

3. Contaminated Radioactive Material Areas. Visible contamination in these areas and/or smearable contamination in excess of 10,000 dpm/100 cm^2 (alpha) shall be cleaned up immediately. These limits are not applicable to nonroutine tasks being conducted under special controls or inside process equipment.

4. Plutonium Contamination. Plutonium contamination shall be limited to 100 dpm/100 cm^2 average fixed, 300 dpm/100 cm^2 maximum fixed, and 20 dpm/100 cm^2 removable.

3.2.6.2 Release of Personnel, Materials, Equipment, Facilities, and Shipments

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Contamination surveys are performed on all personnel leaving contaminated areas, on all materials, equipment and facilities to be released from radiation protection requirements, and on all incoming and outgoing shipments of radioactive materials. Release of equipment and packages from the plant site, or to clean areas on-site, shall be in accordance with NRC guidelines dated May 1987 (see Appendix A).

1. Personnel. Personnel contamination surveys are conducted according to the following schedule:

   a. All persons leaving contaminated areas are required to survey themselves for contamination with survey instruments located at respective step-off areas after removing protective clothing, and prior to leaving the step-off area.

   b. Personnel are not released to eat or leave the respective facility, except with the approval of the Radiological and Industrial Safety Supervisor and the respective facility manager, if their personal clothing is contaminated in excess of 200[1] dpm/100 cm^2 (alpha) direct, or skin is contaminated in excess of 200[1] dpm/100 cm^2 (alpha).

   c. Protective clothing is not reused if the removable alpha contamination exceeds 1000 dpm/100 cm^2 after laundering. During the workday, protective clothing in a contaminated area will be changed if contamination is visible ($\geq$10,000 dpm/100 cm^2 alpha).

2. Materials, Equipment, and Facilities. Contamination surveys re performed by Health Physics Technicians on all materials and equipment removed from contaminated areas, and on areas or facilities to be released from radiation protection requirements. Limits for release are:

   Smearable: Less than or equal to 220 d/m/100 cm^2 alpha
   Fixed: 500 d/m/100 cm^2 alpha

   In special cases, the NRC guidelines contained in Appendix A to this chapter may be utilized.

3. Shipments of radioactive materials arriving at the facility are surveyed to the requirements of 10 CFR 20.205. All outgoing shipments of radioactive

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1 200 dpm/100 cm^2 (alpha) represents the practical lower detection level for most direct-reading contamination survey instruments.

materials are packaged and surveyed in accordance with 10 CFR 71 and 49 CFR 173.443.

3.2.7 Bioassay Program

Bioassay analyses shall be conducted on a scheduled basis to evaluate the effectiveness of radioactive material control and personnel protection programs.

Routine urine sampling frequencies shall be established for all operators and maintenance personnel normally assigned to work in areas where transportable uranium compounds are processed. These individuals shall be directed to submit urine samples at least monthly. Samples shall be scheduled throughout the month to provide a continuing overview of facility environment. Action levels and required actions are presented in Table I-3.3 for samples scheduled on a nominal routine 28 day frequency. Health Physics may adjust the action levels upward for shorter sampling periods. Such adjustments will be made in accordance with consensus models, such as ICRF 30, recognized by national and international radiation protection experts, and may make use of site-specific data.

Routine lung-counting frequencies shall be established for all operators and maintenance personnel normally assigned to work in areas where non-transportable compounds are processed. The minimum frequency for lung-counts shall be semi-annually for personnel routinely working in areas exceeding 10 percent of DAC the previous quarter. Action levels and required actions are presented in Table I-3.4.

Fecal analyses shall be substituted in lieu of lung-counting, for personnel such as claustrophobics, who cannot go through lung counting. Fecal sample analytical results shall be used to calculate lung burdens. Action levels and required actions for fecal sampling shall be the same as those for lung-counting.

Diagnostic bioassay studies shall be performed as necessary to evaluate the extent of actual personnel exposure whenever there is a good probability that an individual exceeded 200 DAC-hrs in an acute exposure. Analysis of the bioassay results shall be founded on consensus models recognized by national and international radiation protection experts and may make use of incident-specific data and/or an exposed individual's personal characteristics.

TABLE I-3.1

RESTRICTED AREA AIRBORNE RADIOACTIVITY CONCENTRATION ACTION LEVELS AND ACTIONS	
Action level multiple of derived air concentration	Required action
1.0 For a weekly average	Document investigation Special air sampling study
0.5 For a quarter average	Document investigation Special air sampling study Engineering evaluation
10 For a single shift sample	Notify Supervisor, Radiological Safety or the Health Physicist and the General Area Supervisor Assure use of appropriate respiratory equipment Initiate investigation

TABLE I-3.2

RADIATION SAFETY INSTRUMENT CAPABILITIES

Type of Instrument	Radiations Detected	Range	Lower Detection Level
Air sample analyzers	α	0-10^6 cpm	1 cpm
Air contamination monitors	α	0-5x10^3 cpm	1 cpm
AC-Operated survey meters	α	0-10^6 cpm	20 cpm
Portable survey meters	α	0-5x10^5 cpm	20 cpm
Portable survey meters	β,γ	0-5x10^4 cpm	20 cpm
Portable low energy dose rate survey meters	β,γ,x	0-300 mR/hr	0.1 mR/hr
Portable dose rate meters	β,γ,x	0-25 R/hr 0-100 R/hr 0-300 R/hr 0-500 R/hr	0.5 mR/hr 1.0 mR/hr 0.1 mR/hr 0.2 mR/hr
Portable dose rate meters	n	0-2 rem/hr	0.01 mrem/hr
Direct-Reading dosimeters	γ,x γ γ	0-200 mR 0-10 R 0-600 R	10 mR 500 mR 20 mR

TABLE I-3.3

ROUTINE URINALYSIS PROGRAM ACTION LEVELS AND ACTIONS (Transportable Uranium Compounds)	
Sample Results Exceed:	Required Action
15 µgU/ℓ	Confirm result Document investigation
130 µgU/ℓ	Confirm result Impose work restriction Collect and analyze additional urine sample(s) Document investigation Test urine sample for indications of kidney damage Initiate appropriate corrective action
400 µgU/ℓ	Confirm result Impose work restriction Collect and analyze additional urine sample(s) Contact medical personnel and inform of results Document investigation Test urine sample for indications of kidney damage Initiate appropriate corrective action

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TABLE I-3.4

ROUTINE LUNG-COUNTING PROGRAM ACTION LEVELS AND ACTIONS	
Lung Count Exceeds	Required Action
0.21 nCi U-235	Confirm result Document investigation If confirmed results were unexpected review relevant data to attempt to find probable cause Initiate appropriate corrective action
0.32 nCi U-235	Confirm result If confirmed result was unexpected, impose work restriction Document investigation Perform additional bioassay measurement and at least one other bioassay technique If confirmed results were unexpected, review relevant data to attempt to find probable cause Initiate appropriate corrective action

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APPENDIX A

CHAPTER 3

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Industrial and
Medical Nuclear Safety
Washington, DC 20555

August 1987

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Industrial and Medical Nuclear Safety, U. S. Nuclear Regulatory Commission, Washington, DC 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 dpm $\beta\gamma$/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] 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.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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CHAPTER 12 RADIATION PROTECTION

12.1 Program

SPC maintains radiation exposure as far below the limits specified in 10 CFR 20 as is reasonably achievable by establishing and maintaining a radiation protection program including:

1. Written policy guides, standards and procedures;
2. Design, installation and maintenance of facilities and equipment to the ALARA commitment;
3. Personnel training;
4. Access controls;
5. Exposure limit planning and control (this includes routine review of incurred radiation exposures);
6. Surveillance and monitoring of personnel adherence to established procedures and of radiological conditions;
7. Radioactive effluent and waste control;
8. Use of protective clothing and personnel protective equipment (including respiratory protection);
9. Inspections and audits; and
10. Recordkeeping.

12.2 Posting and Labeling

Radioactive material, airborne radioactivity, radiation, and high radiation areas as defined by 10 CFR 20 are identified, and their boundaries are visibly marked. Signs denoting these areas are placed so that at least one sign is visible from any approach.

12.3 External Radiation - Personnel Monitoring

A personnel monitoring program has been established. The program consists of the following:

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1. Establishment of external exposure limits, including internal Company guidelines which are lower than NRC limits;

2. Providing of dosimeters to measure the exposure of personnel; and

3. Analysis and maintenance of exposure records.

The occupational exposure received by SPC employees and visitors shall not exceed the NRC limit. Company guidelines (in Chapter 2 of EMF-30, "Siemens Power Corporation Safety Manual") have been established at less than the NRC limits in order to prevent overexposure. All employees are advised of the National Council of Radiation Protection and Measurements recommendation to keep radiation exposure to an embryo or fetus to the very lowest practicable level during the entire gestation period and of the NRC's dose limit for a fetus.

All personnel likely to exceed 10 percent of the NRC's external radiation limit shall wear NVLAP accredited dosimetry, with the exception of extremity monitoring. Finger rings will be used when extremity (finger) monitoring is required. Direct-reading dosimeters may be used when timely information is needed. Self-reading pocket dosimeters (pencils) may be used with x-ray operations or where external radiation exposures have the potential for exceeding Company guides in a matter of days.

Radiation exposure dosimeters are analyzed quarterly for personnel whose external exposure is likely to exceed 500 mrem (deep dose) per calendar year. Finger rings are processed quarterly, pencils read weekly, and readings are documented. TLD assigned to personnel who are not likely to exceed 10% of the annual Company guides are analyzed annually.

Dosimetry results are evaluated by Radiological Safety personnel to determine that external exposures of personnel at the Engineering and Manufacturing Facility are within limits. The exposure data is also reviewed by the ALARA Committee to determine the effectiveness of programs to maintain exposure as low as reasonably achievable.

12.4 Radiation Surveys

The routine radiation survey program consists of the following:

1. A detailed survey of the radiation levels is performed during the initial startup of each operation and each storage area involving radioactive material likely to significantly change the radiation levels. These surveys provide the necessary information for determination if the area must be

classified as a radiation area and the necessary boundaries of such an area. It also identify areas where ALARA modifications may be necessary.

2. Monthly radiation surveys are performed in all areas where radioactive materials are processed or stored and where personnel have access. These surveys identify areas where the radiation status has changed and potential areas for ALARA modifications.

3. Radiation surveys are performed on all incoming and outgoing shipments of radioactive materials to assure that such shipments conform to applicable regulations of the NRC, the USDOT, the U.S. Post Office, the State of Washington Utilities and Transportation Commission, and the International Atomic Energy Agency. Procedures are in place to assure that necessary radiation surveys are performed on all receipts and shipments of radioactive material.

When proposed test or nonroutine production work involves radiation or radioactive material, radiation surveys are performed prior to the start of such work both to confirm the levels of radiation present and to permit evaluation of methods to reduce exposure during the work. Surveys are also performed during the work to confirm that radiation levels have not increased significantly.

12.5 Reports and Records

All reports and records of the Radiation Protection Program required in Part I, Chapter 2, Section 2.8, are maintained in Company files in accordance with 10 CFR 20 Subpart L. Such reports and records are maintained for a minimum period of 5 years unless longer retention periods are specified for specific records.

12.6 Instruments

The criteria for selecting radiation measurement instruments for performing radiation and contamination surveys, sampling airborne radioactivity and monitoring area radiation are described in Part I, Chapter 3, Table I-3.2.

The Manager of Safety, Security, and Licensing is responsible for maintaining adequate quantities of radiation measurement instruments and related equipment.

The Manager of Plant Engineering is responsible for the maintenance and calibration of radiation safety instruments and equipment.

The following general requirements apply to all such equipment and instruments:

1. All radiation detection instruments are inspected and calibrated at least semiannually;

2. Instruments are calibrated following any maintenance on them before they are put back into routine service;

3. Each on-line radiation detection instrument is checked for proper operation by Health Physics Technicians daily (Monday through Friday). When daily checks are performed in a manner which qualifies as calibration, separate semi-annual calibrations are not required;

4. Portable survey instruments are source-checked each time they are turned on for use;

5. AC-operated personnel contamination survey instruments are provided with individual check sources to allow personnel to source-check the instruments at random intervals;

6. Calibration sources are traceable to the National Institute of Standards Technology (NIST);

7. Dose rate instruments are inspected and calibrated quarterly; and

12.7 Protective Clothing

The types of protective clothing required for operating personnel in normal, maintenance and accident conditions is dependent upon the work assignments and the levels and types of contamination present and is specified in the applicable SPC Radiation Work Procedures which govern those conditions.

For inspection activities lab coats and cotton or rubber shoe covers may suffice, perhaps supplemented with cotton gloves and surgeon's cap. Most normal operating and maintenance assignments will require rubber shoe covers, full coveralls, and surgical-type rubber gloves or light-weight PVC gloves. For more unusual type operations or maintenance full cotton hoods and cotton boots may be required. Industrial safety equipment is also available (face shields, goggles, and acid suits). In addition, both half-mask and full-face negative pressure respirators, as well as full-face positive pressure respirators, are available. The protective clothing requirements are specified in the applicable Radiation Work Procedures.

12.8 Administrative Control Levels (Including Effluent Control)

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The action levels, alarm set points, frequency of measurements and actions to be taken for the various radiation protection monitoring programs are described below.

12.8.1 Occupational Exposure (Internal and External)

The bioassay program, including frequency of measurements for determining internal exposure, is described in Section 12.12. The routine urinalysis and in-vivo results are reviewed by the Health Physics Component to determine any unusual trends or potential exposures. If the internal exposure of an individual exceeds action levels and appears uncertain, additional analyses and/or removal from further exposure are considered.

The external exposure personnel monitoring program, including frequency of measurements, is described in Section 12.3. The quarterly dosimeter results are reviewed by Health Physics or Radiological Safety to determine any unusual trends or exposures. If the external exposure status of an individual exceeds Company guidelines, the individual is removed from further exposure unless the Health Physics component and appropriate management impose special controls.

12.8.2 Airborne Activity

The gaseous effluent controls are described in Part I, Chapter 5, Section 5.1. The action levels are listed in Table I-5.1. Alpha samples are counted on a surface barrier detector. The lower level of detection varies with the stack being sampled, but typically is in the range of 10^{-15} μCi/ml for a 7-day sampling period. The lower level of detection for mixed fission and activation products is typically in the range of 10^{-14} μCi/ml for a 7-day sampling period.

The action levels specified in Table I-5.1 include shutdown requirements to reduce emissions. In the event that the calculated dose to any member of the public in any consecutive 12-month period is about to exceed the limits specified in 40 CFR 190.10, the Company takes immediate steps to reduce emissions as to comply with 40 CFR 190.10.

The facility air sampling program is discussed in Section 12.13.

12.8.3 Liquid Activity (Effluent Monitors)

Liquid effluent leaves the site at the south boundary and is discarded to the municipal sewer. This effluent is sampled continuously and a composite sample is analyzed each workday (Monday through Friday for a normal work week) for uranium and regulated chemicals. The amount of uranium is determined fluorometrically with a minimum detection level of 0.1 μgU/mℓ (0.1 ppm or 1.6 x 10_{-7} μCi/mℓ). Action levels are to

investigate any sample result greater than 0.1 ppm and to shutdown the processes which could discharge uranium upon a confirmed sample result greater than 1.0 ppm.

There is a potential for discharge of uranium to the groundwater by leakage from the process chemical waste storage lagoon system. The system between the liner sampling system and the action levels are described in Part I, Chapter 5, Section 5.1.3. The groundwater test wells and sampling programs are described in Part I, Chapter 5, Section 5.2.2. Action levels are based primarily on the regulated chemicals for resampling and investigation, although all data are reviewed and any significant change investigated.

12.9 Respiratory Protection

The primary objective of SPC's respiratory protection program is to limit the inhalation of airborne radioactive materials and harmful air contaminants, to comply with permissible exposure limits, and to protect employees in oxygen-deficient atmospheres. These objectives are normally accomplished by the application of engineering controls, including process, containment and ventilation equipment. When such controls are not feasible or cannot be applied, the use of respiratory protective equipment may be appropriate. In general, however, the use of respirators is less desirable in providing respiratory protection than the use of engineered controls. The use of respiratory protective equipment is subject to the following considerations regarding circumstances under which respiratory protection may be needed:

Routine operations are planned activities that are generally repetitive and occur frequently. For such operations, potential sources of airborne radioactive materials and other harmful air contaminants or oxygen-deficient atmospheres shall be identified so that respiratory protection may be accomplished by process, containment, and ventilation measures and by pre-planning of work. The use of respirators as a substitute for practicable engineered controls in routine operations is inappropriate. Respirators may be considered for use, however, while engineering controls are being instituted or evaluated.

Nonroutine operations are activities that are either non-repetitive or else occur so infrequently that adequate limitation of exposures by engineering controls is impractical. To the extent that process, containment and ventilation controls are not reasonably feasible in nonroutine operations, the use of respirators is appropriate.

Emergencies are unplanned events characterized by risks sufficient to require immediate action to avoid or mitigate an abrupt or rapidly deteriorating situation. Although emergencies are unplanned, preparations must be made for coping with potential emergencies. SPC's preparations include a program for providing

respiratory protection for use in emergencies that are likely to entail respiratory hazards. The advance preparations for a particular potential emergency depend on both its possible consequences and the probability of its occurrence (see EMF-32, Emergency Plan, for further details on plans for dealing with emergencies).

Most operations can be readily categorized as routine, nonroutine or emergency. In dealing with situations, which are not easy to categorize, sound judgment must be exercised in using engineered controls where feasible and by avoiding unwarranted use of respirators.

The period of time respirators are worn continuously and the overall durations of use are each kept to a practical minimum. It is necessary to allow respirator users adequate relief from wearing respirators at reasonable intervals and to limit total time to use. However, it is difficult to realistically assign specific time limits on respirator use because of wide variations in job requirements and in the physical capacities and psychological attitudes of individuals. Such factors must be taken into account in establishing a respirator program. Provision is made for the respirator users to leave respirator required areas for relief in case of equipment malfunction, undue physical or psychological distress, procedural or communication failure, significant deterioration of operational conditions, or any other condition that might require such relief.

12.10 Occupational Exposure Analysis

Occupational exposure analyses have been performed and documented in the form of an annual ALARA Report. The ALARA Report for 1991, is appended to this Chapter as Appendix A. It contains a history of external and internal exposure data in Tables II and V. These tables include estimates of dose based on airborne contamination, in-vivo (lung count) data and urinalysis. Trend evaluation is discussed in Section 3.0. Measures taken to further minimize personnel dose are presented in Section 4.0.

12.11 Measures Taken to Implement ALARA

SPC has committed to maintaining a functioning ALARA Committee as a subgroup of the Health and Safety Council. The membership and activities of this Committee are outlined in Part I, Chapter 2, Section 2.3.2. Company Policy in this area is outlined in Part I, Chapter 3, Section 3.1.1.

12.12 Bioassay Program

The bioassay program established by SPC is conducted to confirm the results of radioactive material contamination control and personnel protection programs. It also

may be used to estimate internal exposures due to internally deposited radioactive material and/or intakes of soluble uranium for chemical toxicity assessments.

The frequencies and types of measurements are established on the basis of the exposure potential of the individual's work assignment and the physical and biological properties of the radioactive material with which the individual works.

Radiation exposure due to internally deposited radioactive materials is kept as low as is reasonably achievable primarily by the implementation of engineered controls. Administrative controls and precautionary procedures are also employed to complement the engineering controls.

Aspects of the bioassay program:

1. Employees normally working in contaminated areas containing transportable uranium compounds submit urine specimens every 28 days for uranium analysis. Scheduling is staggered to help provide continuous assurance of airborne contamination control.

2. Routine lung counting frequencies are established for all operators and maintenance personnel assigned to work in areas where nontransportable compounds are processed. The minimum frequency for lung counts is semiannual for personnel normally working in areas exceeding 10 percent of DAC the previous quarter, provided adequate lung counting capacity can be provided by SPC's vendor.

3. Bioassay investigations are undertaken when action levels are exceeded and elevated results are confirmed. The investigations are documented and discussed at ALARA meetings. When appropriate, corrective actions are executed.

4. Non-routine bioassays, consisting of in vivo (lung) counts, urine samples, and/or fecal samples are requested when individuals are suspected of acute exposures exceeding 200 DAC-hours. The Health Physics Component evaluates the results of such assays. The exposures from these bioassays may be substituted for those from airborne measurements.

In evaluating the bioassay results, the health physics component uses internationally recognized models and may make use of site specific data.

12.13 Air Sampling and Internal Exposure Program

The air in all general areas where uncontained radioactive materials are handled, processed or are likely to exist is regularly sampled and the samples are analyzed for radioactivity. The air sampling system consists of a combination of equipment and instruments. Field-run lines (flexible or hard-piped) connect individual air samplers to overhead vacuum lines such that the samplers may be moved about and located at any desirable point without causing obstructions or creating industrial safety problems. The locations of air samplers are determined, in part, by the need to measure potential airborne contamination; representative airborne contamination at workstations; and background airborne contamination.

The frequency of exchanging and analyzing filter papers of the workstation sampling units is based on historical experience. Sampler filters may be exchanged and analyzed more frequently in the event of suspected elevated airborne contamination; to assess the effectiveness of radioactive material containment/confinement following equipment modification or maintenance; or to assess the air quality of sequential shift operations.

Permanently-mounted air sampling equipment is evaluated for representativeness following significant process or equipment changes; at least every 12 months for work stations which averaged greater than 10% of DAC the previous year; and at least every 24 months for remaining work stations.

Specialized air sampling or monitoring equipment such as continuous air monitors, portable high volume air samplers, and lapel air samplers, is available to supplement the normal air sampling system and for use in special studies.

SPC pursues maintaining radiation exposures as far below the normal limits specified in 10 CFR 20.1201 and 1202 as reasonably achievable.

Respiratory protective equipment is required for entry into areas where airborne radioactive materials are known to exist in yexcess of the occupational concentration stated in 10 CFR 20.

12.13.1 Particle Size Distribution Effects

SPC may elect to alter Derived Air Concentrations (DACs) and Annual Limits of Intake (ALIs) based on the results of particle size distribution measurements. The method of obtaining such measurements and applying the results is described below.

Particle size distribution measurements will be taken using Andersen 1 ACFM Non-viable Ambient Particle Sizing Samplers with a pre-separator and 8 stages (Model #20-830).

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The particle size range for each stage in micrometers is: stage 0: 9-10; stage 1: 5.8-9; stage 2: 4.7-5.8; stage 3: 3.3-4.7, stage 4: 2.1-3.3, stage 5: 1.1-2.1; stage 6: 0.7-1.1; and stage 7: 0.4-0.7. A backup filter is for size range 0-0.4 microns. (Glass fiber filters have efficiencies of 0.997.)

For multimodal distributions, the method of analysis consists of estimating the fractional activity, the geometric mean, and geometric standard deviation of each subdistribution. The predicted total distribution is compared with the measured distribution. The object is to minimize the sum of the squares of differences for each stage between the measured and estimated distributions. As an indication of fit, a chi-square statistic will be determined assuming n-2 degrees of freedom, where n is the number of stages. The chi-square is a surrogate statistic used to determine the goodness-of-fit. When a statistically good fit has been achieved, the fractional activities and AMADs will be used to determine the DACs, etc. in accordance with Appendix B to this chapter. The level of confidence required to demonstrate goodness-of-fit will be p greater than or equal to 0.8, where p is the probability of obtaining a value equal to or less than the chi-square statistic when the hypothesized distribution is true. If this level cannot be achieved, the data will be discarded and additional data taken. However, if additional data can not be fitted, i.e. p is also less than 0.8 then the Health Physics Component will apply a conservative analysis and will document the analysis.

At least three particle size measurements will be taken for each grouping of locations. If SPC chooses to adjust DACs and ALIs by particle size, particle size analysis will be performed at least semi-annually in each group of locations for which particle size credit is taken. After one year, the Health Physics Component may relax the frequency to once per calendar year if data for a group of locations does not differ significantly from previous measurements. Particle size will be reassessed following significant process changes deemed likely to change the particle size distribution. Using the results of particle size measurements and knowledge of the process, the Health Physics Component will decide whether specific operations or specific locations can be grouped together for characterization purposes.

Particle size distributions for maintenance operations may be different than for routine operations. There is a practical difficulty in obtaining particle size data for maintenance operations; namely, several days to weeks of sampling time are generally required and maintenance operations seldom last long enough. In the absence of particle size data during such operations it is assumed particle size data during normal operations would still be the best data to use. If particle size data is available, and if maintenance operations yield significantly lower particle size distributions than for routine work, then for prolonged operations, i.e. longer than 24 hours, the DACs will be modified for maintenance operations.

Should assignments be performed away from normal working areas, the Health Physics Component will decide whether to take credit for particle size. If credit is taken, the Health Physics Component will use conservative judgment is assigning a DAC adjustment factor and will document the analysis.

12.14 Surface Contamination

Radioactive materials are contained and/or confined during processing, transfer and storage to the extent of maintaining intake of such materials by personnel as low as reasonably achievable. Operations involving readily dispersible forms of radioactive materials are accomplished within enclosures such as process equipment, glove boxes, glove port hoods, laboratory-type hoods, etc.), which are exhausted to facility exhaust air systems.

12.14.1 Facility Surveys

A detailed survey of contamination levels is performed for each new operation involving radioactive material and frequently thereafter, for a period of time dependent on demonstrated operational controls as reflected in survey results. Operations involved in the production of fuel are repetitive in nature, equipment and systems employed in development activities are normally similar to those used in the production facilities, and containment and confinement principals are employed consistently throughout SPC's facilities, thus making it possible to effectively establish routine and repetitive contamination surveys. The frequencies of routine surveys is determined by a combination of professional judgment and experience and are periodically reviewed by the Radiological Safety Component. In general, reduced frequencies are permitted when the stability of an operation, as demonstrated by the consistency of survey results and the relationship between observed values and operational controls is established. Such reduced survey frequencies are approved by Health Physics Component. The following frequency schedule is applied to the facility contamination survey program:

1. Contaminated radioactive materials area - weekly
2. Noncontaminated radioactive materials area - monthly
3. Intermediate areas - daily
4. Lunchrooms adjacent to radioactive materials/radiation areas - daily

Operational controls are considered adequate for uranium operations when the following conditions prevail:

1. The is no visible or smearable contamination in excess of 10,000 dpm/10cm² on exposed or non-hooded surfaces in the process areas (not applicable to nonroutine tasks being conducted under special controls).

2. There is no smearable contamination on intermediate area floors greater than 500 dpm/100 cm² alpha.

3. There is no smearable contamination in clean areas greater than 200 dpm/100 cm² alpha.

Cleanup of uranium contamination in excess of the levels specified in conditions 1-3 above is initiated during the shift detected.

12.14.2 Release of Personnel, Materials, Equipment, Facilities and Shipments

Contamination surveys are performed on all personnel leaving contaminated areas, on all materials, equipment and facilities to be released from radiation protection requirements, and on all incoming and outgoing shipments of radioactive materials.

1. Personnel. Contamination surveys conducted according to the following schedule:

   a. All persons leaving contaminated areas are required to survey themselves for contamination with survey instruments.

   b. Personnel are not released to eat or leave the respective facility if their personal clothing is contaminated in excess of the following limits, except with the approval of the Supervisor, Radiological Safety and the respective facility manager:

      Smearable and Fixed Uranium: 200[(1)] dpm/100 cm² alpha

   c. For routine release personnel skin surface contamination shall not exceed 200 dpm/100 cm² (alpha).

2. Materials, Equipment and Facilities. Contamination surveys are performed by Health and Safety Technicians on all materials and equipment removed from contaminated areas, and on areas or facilities to be released from

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[1] 200 dpm (alpha) per 100 cm² represents the practical lower detection level for most direct-reading contamination survey instruments.

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radiation protection requirements. Decontamination of facilities and equipment prior to release for unrestricted use or termination of license is in accordance with levels established in 3.2.6.2.

3. Shipments. Shipments of radioactive materials arriving at SPC are surveyed to the requirements of 10 CFR 20.205. All outgoing shipments of radioactive materials are packaged and surveyed in accordance with 10 CFR 71 and 49 CFR 173.443.

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APPENDIX A

CHAPTER 12

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APPENDIX B

CHAPTER 12

ADJUSTMENT OF DAC/ALI BASED ON PARTICLE SIZE MEASUREMENTS

SPC may alter the DACs (Derived Air Concentrations) and ALIs (Annual Limits of Intake) for class W and class Y compounds by taking credit for particle size distributions. Adjustments will be made according to the following formulas:

$$\frac{ALI\ (AMAD)}{ALI\ (1\ \mu)} = \frac{H_{50}\ (1\ \mu)}{H_{50}\ (AMAD)} = \frac{DAC\ (AMAD)}{DAC\ (1\ \mu)}$$

and

$$\frac{H_{50}(AMAD)}{H_{50}(\ 1\ \mu)} = f_{np} \cdot \frac{D_{np}(AMAD)}{D_{np}(\ 1\ \mu)} + f_{tb} \cdot \frac{D_{tb}(AMAD)}{D_{tb}(\ 1\ \mu)} + f_{p} \cdot \frac{D_{p}(AMAD)}{D_{p}(\ 1\ \mu)}$$

Where $H_{50}()$ is the committed dose equivalent; f_{np}, f_{tb}, and f_p, are the relative fractions of H_{50} due to deposition in the nasal passage, the trachea and bronchial tree, and the pulmonary regions, respectively; and D_{np}, D_{tb}, and D_p, are the deposition probabilities in the nasal passage, the trachea and bronchial tree, and the pulmonary regions, respectively.

When applied to class Y uranium compounds, such as UO_2 and U_3O_8, and class W uranium compounds, $f_{np} = 0 = f_{tb}$ and $f_p = 1$ according to ICRP 30.

Therefore the following equation will be used:

$$\frac{H_{50}(AMAD)}{H_{50}(\ 1\ \mu)} = \frac{D_{p}(AMAD)}{D_{p}(\ 1\ \mu)}$$

If the particle size distribution is multimodal, the following equation will be used:

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APPENDIX B (Cont.)

$$\frac{H_{50}(AMAD)}{H_{50}(1\ \mu)} = a_1 \cdot \frac{D_p(AMAD(d_1))}{D_p(1\ \mu)} + a_2 \cdot \frac{D_p(AMAD(d_2))}{D_p(1\ \mu)} + \ldots + a_n \cdot \frac{D_p(AMAD(d_n))}{D_p(1\ \mu)}$$

where a_i is the fraction of the activity associated with the distribution having AMAD(d_i).

When multiple measurements are taken for a specific location or group of samples, the grand average H_{50}(AMAD) will be determined as follows:

$$\frac{H_{50}(AMAD)}{H_{50}(1\ \mu)} = a_{11} \cdot \frac{D_p(AMAD(d_{11}))}{D_p(1\ \mu)} + a_{12} \cdot \frac{D_p(AMAD(d_{12}))}{D_p(1\ \mu)} + \ldots + a_{1n} \cdot \frac{D_p(AMAD(d_1n))}{D_p(1\ \mu)}$$

$$+ a_{21} \cdot \frac{D_p(AMAD(d_{21}))}{D_p(1\ \mu)} + a_{22} \cdot \frac{D_p(AMAD(d_{22}))}{D_p(1\ \mu)} + \ldots + a_{2m} \cdot \frac{D_p(AMAD(d_2m))}{D_p(1\ \mu)}$$

$$+ \ldots$$

$$+ a_{j1} \cdot \frac{D_p(AMAD(d_{j1}))}{D_p(1\ \mu)} + a_{j2} \cdot \frac{D_p(AMAD(d_{j2}))}{D_p(1\ \mu)} + \ldots + a_{jm} \cdot \frac{D_p(AMAD(d_{jn}))}{D_p(1\ \mu)}$$

where a_{jk} is the fraction of activity associated with the distribution having AMAD(d_{jk}) of the j-th measurement.

Where

$$\sum_k a_{jk} = 1$$

and

$$\sum_{jk} a_{jk} = \textit{No. of measurements; e.g., } a_{11} + a_{12} + a_{21} + a_{22} + a_{31} + a_{32} + a_{33} = 3$$

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1.6.6.2 Material Control and Accounting

SPC shall follow the special safeguards conditions given in the Safeguards Amendment SG-2 and the NRC approved Fundamental Nuclear Material Control Plan (FNMC) submitted in accordance with 10 CFR Part 74.31(b). The NRC approved FNMC Plan is:

> EMF-12(P), "Nuclear Material Safeguards Procedures Description for the Fuels Fabrication Plants." This document shall be maintained in a current and approved status and shall be properly implemented.

1.6.7 Authorization at Reactor Sites

SPC is authorized to possess fuel assemblies or fuel rods at reactor sites for the purpose of loading them into shipping containers and delivering them to a carrier for transport.

1.6.8 Authorized Release Guidelines

SPC is authorized to release equipment, scrap or facilities for unrestricted use, or for termination of license according to the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" as published by the U.S. Nuclear Regulatory Commission dated August 1987.

1.6.9 Authorized Criticality Alarm System Outage

SPC is granted an exemption from 10 CFR 70.24(a) for the purpose of performing maintenance on the criticality alarm system. Sections of the criticality alarm system may be taken out-of-service provided that all movement or processing of fissile material in affected areas is halted for the duration of the outage. Health and Safety Technicians shall conduct periodic surveys of the areas during the criticality alarm system outage.

1.6.10 Notification

Notifications to the NRC shall be made as required by regulations with the exception of 10 CFR 20.2202(a)(2) and (b)(2) as they apply to restricted areas. Reports to the NRC shall be made as required by regulations with the exception of those paragraphs in 10 CFR 20.2203 which refer to 10 CFR 20.2202(a)(2) and (b)(2) as they apply to restricted areas.

1.6.11 Authorized Workplace Air Sampling Adjustments

SPC is authorized to adjust Drived Air Concentration (DAC) limits and Annual Limit of Intake (ALI) values in process areas to reflect actual physical characteristics of the airborne uranium.

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Chapter 3 RADIATION PROTECTION

3.1 Administrative Requirements

3.1.1 ALARA Policy

SPC's policy is to conduct its business in a manner to assure that its facilities are in compliance with radiation control and other nuclear regulations, and that its operations will not be detrimental to the environs. In implementing this policy, SPC shall assure that radiation exposure to persons both in-plant and off-site is maintained as low as reasonably achievable (ALARA). In providing this assurance, conditions of applicable NRC and State licenses and other regulatory permits or licenses shall be complied with, and regard shall be given to applicable NRC regulatory guides and industry standards.

Responsibility for establishing and assuring adherence to this policy shall rest with the President of SPC. This policy shall be implemented through appropriate delegations to Vice Presidents responsible for facilities processing or handling radioactive materials.

In order to facilitate implementation of this policy, key positions in organizations involved with facilities processing or handling radioactive materials shall be filled by persons knowledgeable of, and experienced in, the nuclear industry, and the responsibilities under this policy shall be identified in writing. Each responsible manager shall be required to know, understand, and carry out the provisions of this policy, as well as the procedures for its implementation.

3.1.2 Radiation Work Procedures

Radiation Work Procedures (RWP's) are prepared by Radiological Safety, and establish the radiological safety requirements of all work involving radiation and/or radioactive materials. The applicable RWP's shall be immediately available to personnel working with such material.

RWP's shall be approved in accordance with Figure I-2.3 and include the following information:

1. The identification number of the procedure;
2. A description of the nature, extent, and location of the work to be done;
3. A description of the types and potential for contamination that may be encountered;
4. A description of the types and estimated maximum personnel dose rates;

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5. Personal survey and protective clothing requirements;

6. Personal dosimetry requirements; and

7. A statement of the respiratory protection equipment required for entry into an airborne radioactive materials area.

3.2 Technical Requirements

3.2.1 Controlled Areas

All radioactive materials at SPC's Engineering and Manufacturing Facility shall be stored and processed within controlled areas (i.e., with the perimeter fence). Access to areas in which radioactive materials are stored or used shall be controlled by SPC security personnel in accordance with a formal, NRC-approved physical protection plan.

3.2.1.1 Restricted Areas

Each access point to restricted areas (as defined in 10 CFR 20) shall be posted in accordance with 10 CFR 20.1902. Additionally, RWP's for the respective areas shall specify the existing or potential radiological conditions and radiation protection measures required.

3.2.1.2 Clean, Intermediate and Contaminated Radioactive Materials/Radiation Areas

With the possible exception of temporary stepoff pads, clean areas shall be separated from contaminated controlled areas by intermediate areas. Intermediate areas shall be identified, and their boundaries visibly marked. Personnel shall follow posted special procedures or restrictions when leaving one area and entering another.

3.2.1.3 Change Rooms and Step-Off Areas

Change rooms servicing contamination controlled area workers shall be divided into contaminated, intermediate, and clean areas to minimize the spread of contamination. Step-off pads shall be provided when exiting contaminated areas. Separate toilet facilities may be located in contaminated, intermediate, and clean areas. Use of the toilets in contaminated and intermediate areas without removal of protective clothing shall be permitted provided a personnel survey is performed first.

Additional step-off areas may be established for maintenance work, temporary situations or conditions, or to accommodate personnel entry and exit not requiring the use of change room facilities. Personnel survey requirements shall be adhered to at all step-off areas.

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3.2.1.4 Protective Clothing

Protective clothing shall be provided for personnel entering contamination controlled areas. The type(s) of clothing required shall be consistent with the individual's work assignment and is dependent upon the type and level of contamination anticipated.

Used protective clothing shall be removed prior to entering clean areas from contaminated areas, with the exception of emergency evacuations.

3.2.1.5 Personnel Surveys

Personnel survey instruments shall be provided in change rooms and at step off pads for use by personnel leaving contaminated areas. Personnel exiting contaminated areas shall be required to survey themselves after removing their protective clothing prior to leaving the step-off area. An exception to survey requirements is exiting during emergency evacuations.

3.2.2 Ventilation

General ventilation systems shall be designed and maintained to limit the spread of airborne contamination by maintaining air pressure gradients and airflows from general areas of low potential airborne contamination to general areas of higher potential contamination. Where ventilation barriers exist between areas, these systems shall be balanced so that the air pressure differentials between clean and contaminated areas are maintained at a minimum of 0.05 inch of water.

Air locks shall be installed, where necessary, to insure maintenance of proper air pressure differentials. Installed differential air pressure measuring instrument readings shall be recorded at least monthly.

Monthly smoke tests shall be conducted to visually demonstrate that the airflows are from general areas of low contamination potential to general areas of higher contamination potential.

General recirculating air systems shall recirculate air only from room areas (not from process enclosures) and pass it through fire retardant HEPA filters, which have installed efficiencies of at least 99.95% for 0.8 micron particles, before returning it to the room.

In addition to general ventilation systems, SPC may employ local ventilation units designed to recirculate room air through HEPA filters, and then discharge room air at low velocities, to minimize the airborne concentrations in breathing zones.

Recirculated air, excluding that from the local ventilation units described above, shall be continuously monitored prior to the final stage of HEPA filtration. An indication that

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airborne levels are such that a 40 DAC-hour (derived air concentration-hour) exposure could be realized in a week from the recirculated air shall automatically divert the air from the recirculation mode to the respective facility exhaust air system. Manual diversion shall be allowed during maintenance on the system.

A minimum of seven air changes an hour shall be maintained in contaminated areas.

Unless safety concerns override, the average air velocity through openings in uranium handling hoods and equipment containing readily dispersible uranium shall be a minimum of 125 LFPM (linear feet per minute). These velocities shall be checked at least monthly.

Both general recirculation and exhaust air system HEPA filter installations shall be equipped with continuous pressure differential measuring and indicating systems whose readings shall be recorded at least monthly. The differential pressure across the final HEPA filters shall not exceed four inches of water gauge. The final HEPA filter installations shall also be checked prior to first use for efficiency against 0.8 micron particles and must meet or exceed a removal efficiency of 99.95 percent.

3.2.3 Work Area Air Sampling

In areas where unencapsulated radioactive materials are handled, processed, and/or air concentrations are likely to exceed 10 percent of DAC, air shall be routinely monitored. Fixed air sampling heads may be used for calculating DAC-hours in areas where internal dose monitoring is required. Air sample concentrations determined by fixed samplers may be modified by correction factors.

Specialized air sampling or monitoring equipment, such as continuous air monitors, portable, high volume, and/or lapel air samplers, shall be available to supplement the normal air sampling system, and for use in studies or work on special problems.

Fixed air sampling used to determine DAC-hour exposures shall be evaluated to assure results remain reasonably representative of workers exposures. Re-evaluation of representativeness shall be conducted at least every 12 months for those work stations which averaged 25 percent or greater of DAC the previous calendar year and at least every 24 months for the remaining work stations. Representativeness studies shall also be performed following significant process or equipment changes.

The frequency of air sampling in contaminated areas shall be based upon historical experience for each sampling area.

Flow rates through air samplers, as measured by in-line rotameters, shall be checked at the start and end of each sampling period. Rotameter accuracy shall be confirmed at least annually.

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SPC may elect to adjust DACs and ALIs based upon particle size distri' ion. The adjustment shall be based upon the AMAD (activity median aerodynam. diameter). Should SPC elect to adjust DAC, SPC shall decide whether an entire area or room or related operations can be represented by a single DAC or whether the area, room, or related operations need to be subdivided; each with its own DAC. Adjustments shall be based upon the methodologies described in Chapter 12 of this application. Records of such measurements and resulting AMAD and DAC/ALI calculations shall be documented in internal records. Notwithstanding the preceding, SPC may elect to choose a value for DAC which is between the Occupational DAC listed in 10 CFR 20 and the average DAC as determined from the measured particle size distributions. The methodology and data base for DAC/ALI adjustments shall be documented.

If SPC chooses to adjust DACs and ALIs by particle size, a particle size measurement and analysis will be performed at least semi-annually in each group of locations for which particle size credit is taken. After one year, the Health Physics Component may relax the frequency to once per calendar year if DAC determined by new measurement(s) for a group of locations does not differ significantly from that established from previous measurements.

Particle size will be reassessed following significant process changes deemed likely to change the particle size distribution.

SPC may elect to adjust DAC based upon model changes recognized by national and international radiation protection experts. Examples of such model changes specifically include changes in weighting factors for various organs and in revisions in the ICRP lung model.

Air sample counting instruments shall be checked for acceptable operation and background each day they are used.

For breathing zone samplers, the system counting time and airflow rate of the sampler shall be adequate to obtain a lower limit of detection less than 4 DAC-hours for samples collected over a 40 hour period. All airborne radioactivity monitoring programs shall provide for investigation and/or increased sampling frequency if the activity concentration, not directly resulting from a known cause, exceeds the applicable action levels in Table I-3.1.

3.2.4 Radioactivity Measurement Instruments

3.2.4.1 Radiation Safety Instruments and Equipment

The general capabilities of radiation safety instruments used to make radiation protection measurements are described in Table I-3.2.

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The Manager, Plant Engineering, shall be responsible for the maintenance and calibration of radiation safety instruments and equipment. The following general requirements shall apply to all such equipment and instruments:

1. All radiation detection and measurement instruments shall be inspected (and repaired when necessary) and calibrated at least semiannually or tagged out;

2. Instruments shall be calibrated following any maintenance deemed likely to affect operation before they are put back into routine service;

3. Each on-line radiation detection instrument shall be checked for proper operation either by Health and Safety Technicians or by electronic surveillance daily (Monday through Friday for a normal work week). When daily checks are performed in a manner which qualifies as calibration, separate semiannual calibrations shall not be required;

4. Portable survey instruments shall be source-checked each shift they are used;

5. Each AC-operated personnel contamination survey instrument shall be provided with an individual check source to allow personnel to source-check the instruments;

6. Calibration sources shall be traceable to the National Institute of Standards and Technology (NIST); and

3.2.4.2 Criticality Accident Alarm System

See Chapter 1, Section 1.6.1.

3.2.4.3 Criticality Dosimeters

Criticality dosimeters shall be strategically located throughout the process facilities. These criticality dosimeters shall be capable of measuring 0.1 to 10^4 rems of neutron radiation over a neutron spectrum of thermal to 2.5 MeV. The criticality dosimeters shall be inspected at least annually to confirm their presence and undamaged condition.

3.2.5 Radiation Exposure

SPC shall strive to maintain external radiation exposures as far below the limits specified in 10 CFR 20.1201(a) as reasonably achievable. Radiation exposure records shall be reviewed by the ALARA Committee.

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In the event that it is necessary to exceed the exposure limits specified in 10 CFR 20.1201(a), exceptions shall be authorized in accordance with 10 CFR 20.1201(b). Respiratory protective equipment shall be used for entry into areas where airborne radioactive materials are known to exist in excess of the occupational DAC.

In addition to the controls specified elsewhere, the following methods of external radiation exposure control may be employed as applicable and reasonable:

1. Automation of operations;
2. Minimization of quantities of radioactive material and/or use of shielding;
3. Time and distance control;
4. Special handling tools; and
5. Exposure awareness, planning, and scheduling.

3.2.5.1 Radiation Surveys

A detailed survey of radiation levels (beta-gamma and neutron, as applicable) shall be performed for each new operation and radioactive material storage facility when activity in the area is first initiated.

Routine radiation surveys shall be performed at least monthly in all general areas where radioactive materials are stored or processed, where personnel have access.

Radiation surveys shall be performed on all incoming and outgoing shipments of radioactive materials per 10 CFR 20.

3.2.5.2 Dosimetry

Persons requiring radiation exposure monitoring per 10 CFR 20.1502(a) shall wear beta-gamma sensitive dosimeters which shall be processed and evaluated by a processor holding current accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the NIST. For these personnel, exposure monitoring dosimeters shall be exchanged and analyzed quarterly. The beta-gamma dosimeters shall be supplemented, as appropriate, by other types of dosimeters (e.g., finger rings, direct-reading dosimeters, and neutron dosimeters), and by radiation measurements made with radiation survey instruments. Film badge dosimeters, if used, shall be exchanged and analyzed monthly.

Indication of exposure of uranium fuel fabrication workers exceeding the action levels stated below shall be investigated and the report placed in the personnel folder of the individual.

Action/Investigation Levels	Rem/Qtr.
Deep Dose Equivalent to the Whole body: head and trunk, including gonads, arm above the elbow, and leg above the knee	1
Eye Dose Equivalent	3
Shallow Dose Equivalent to the skin or extremities	10

3.2.6 Surface Contamination

Radioactive materials shall be contained and/or confined during processing, transfer, and storage as necessary to maintain intake of such materials by personnel as low as reasonably achievable. As appropriate, operations involving readily dispersible forms of radioactive materials shall be accomplished within enclosures (e.g., process equipment, glove boxes, glove-port hoods, laboratory type hoods, etc.) which are exhausted to facility exhaust air systems.

3.2.6.1 Facility Surveys

The following minimum frequency schedule shall be applied to the facility contamination survey program:

Area Surveyed	Survey Frequency
Contaminated radioactive materials areas	Weekly
Non-contaminated radioactive material areas	Monthly
Intermediate areas	Daily
Lunchrooms adjacent to radioactive materials/radiation areas	Daily

Action levels for cleanup of the various areas are listed below.

1. Noncontaminated Radioactive Material Areas. The goal for these areas is to keep them contamination-free. Any contamination in excess of 200 dpm/100 cm^2 (alpha) shall be cleaned up during the shift detected.

2. Intermediate Areas. The goal for these areas is to keep them free of significant contamination. Cleanup is required during the shift detected if contamination is found and the level is greater than 200 dpm/100 cm^2 (alpha). Contamination in excess of 500 dpm/100 cm^2 (alpha) shall be cleaned up immediately. If the contamination level is in excess of 2000

dpm/100 cm^2 (alpha), the area shall be reclassified and posted as a contaminated area until it is cleaned up.

3. Contaminated Radioactive Material Areas. Visible contamination in these areas and/or smearable contamination in excess of 10,000 dpm/100 cm^2 (alpha) shall be cleaned up immediately. These limits are not applicable to nonroutine tasks being conducted under special controls or inside process equipment.

4. Plutonium Contamination. Plutonium contamination shall be limited to 100 dpm/100 cm^2 average fixed, 300 dpm/100 cm^2 maximum fixed, and 20 dpm/100 cm^2 removable.

3.2.6.2 Release of Personnel, Materials, Equipment, Facilities, and Shipments

Contamination surveys are performed on all personnel leaving contaminated areas, on all materials, equipment and facilities to be released from radiation protection requirements, and on all incoming and outgoing shipments of radioactive materials. Release of equipment and packages from the plant site, or to clean areas on-site, shall be in accordance with NRC guidelines dated May 1987 (see Appendix A).

1. Personnel. Personnel contamination surveys are conducted according to the following schedule:

   a. All persons leaving contaminated areas are required to survey themselves for contamination with survey instruments located at respective step-off areas after removing protective clothing, and prior to leaving the step-off area.

   b. Personnel are not released to eat or leave the respective facility, except with the approval of the Radiological and Industrial Safety Supervisor and the respective facility manager, if their personal clothing is contaminated in excess of 200[1] dpm/100 cm^2 (alpha) direct, or skin is contaminated in excess of 200[1] dpm/100 cm^2 (alpha).

   c. Protective clothing is not reused if the removable alpha contamination exceeds 1000 dpm/100 cm^2 after laundering. During the workday, protective clothing in a contaminated area will be changed if contamination is visible ($\geq$10,000 dpm/100 cm^2 alpha).

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1 200 dpm/100 cm^2 (alpha) represents the practical lower detection level for most direct-reading contamination survey instruments.

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2. Materials, Equipment, and Facilities. Contamination surveys re performed by Health Physics Technicians on all materials and equipment removed from contaminated areas, and on areas or facilities to be released from radiation protection requirements. Limits for release are:

Smearable:	Less than or equal to 220 d/m/100 cm² alpha
Fixed:	500 d/m/100 cm² alpha

In special cases, the NRC guidelines contained in Appendix A to this chapter may be utilized.

3. Shipments of radioactive materials arriving at the facility are surveyed to the requirements of 10 CFR 20.205. All outgoing shipments of radioactive materials are packaged and surveyed in accordance with 10 CFR 71 and 49 CFR 173.443.

3.2.7 Bioassay Program

Bioassay analyses shall be conducted on a scheduled basis to evaluate the effectiveness of radioactive material control and personnel protection programs.

Routine urine sampling frequencies shall be established for all operators and maintenance personnel normally assigned to work in areas where transportable uranium compounds are processed. These individuals shall be directed to submit urine samples at least monthly. Samples shall be scheduled throughout the month to provide a continuing overview of facility environment. Action levels and required actions are presented in Table I-3.3 for samples scheduled on a nominal routine 28 day frequency. Health Physics may adjust the action levels upward for shorter sampling periods. Such adjustments will be made in accordance with consensus models. such as ICRP 30, recognized by national and international radiation protection experts, and may make use of site-specific data.

Routine lung-counting frequencies shall be established for all operators and maintenance personnel normally assigned to work in areas where non-transportable compounds are processed. The minimum frequency for lung-counts shall be semi-annually for personnel routinely working in areas exceeding 10 percent of DAC the previous quarter. Action levels and required actions are presented in Table I-3.4.

Fecal analyses shall be substituted in lieu of lung-counting, for personnel such as claustrophobics, who cannot go through lung counting. Fecal sample analytical results shall be used to calculate lung burdens. Action levels and required actions for fecal sampling shall be the same as those for lung-counting.

Diagnostic bioassay studies shall be performed as necessary to evaluate the extent of actual personnel exposure whenever there is a good probability that an individual

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exceeded 200 DAC-hrs in an acute exposure. Analysis of the bioassay results shall be founded on consensus models recognized by national and international radiation protection experts and may make use of incident-specific data and/or an exposed individual's personal characteristics.	

TABLE I-3.1

RESTRICTED AREA AIRBORNE RADIOACTIVITY CONCENTRATION ACTION LEVELS AND ACTIONS	
Action level multiple of derived air concentration	Required action
1.0 For a weekly average	Document investigation Special air sampling study
0.5 For a quarter average	Document investigation Special air sampling study Engineering evaluation
10 For a single shift sample	Notify Supervisor, Radiological Safety or the Health Physicist and the General Area Supervisor Assure use of appropriate respiratory equipment Initiate investigation

TABLE I-3.2

RADIATION SAFETY INSTRUMENT CAPABILITIES			
Type of Instrument	**Radiations Detected**	**Range**	**Lower Detection Level**
Air sample analyzers	α	0-10^6 cpm	1 cpm
Air contamination monitors	α	0-5x10^3 cpm	1 cpm
AC-Operated survey meters	α	0-10^6 cpm	20 cpm
Portable survey meters	α	0-5x10^5 cpm	20 cpm
Portable survey meters	β,γ	0-5x10^4 cpm	20 cpm
Portable low energy dose rate survey meters	β,γ,x	0-300 mR/hr	0.1 mR/hr
Portable dose rate meters	β,γ,x	0-25 R/hr 0-100 R/hr 0-300 R/hr 0-500 R/hr	0.5 mR/hr 1.0 mR/hr 0.1 mR/hr 0.2 mR/hr
Portable dose rate meters	-	0-2 rem/hr	0.01 mrem/hr
Direct-Reading dosimeters	γ,x γ γ	0-200 mR 0-10 R 0-600 R	10 mR 500 mR 20 mR

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TABLE I-3.3

ROUTINE URINALYSIS PROGRAM ACTION LEVELS AND ACTIONS (Transportable Uranium Compounds)	
Sample Results Exceed:	Required Action
15 µgU/ℓ	Confirm result Document investigation
130 µgU/ℓ	Confirm result Impose work restriction Collect and analyze additional urine sample(s) Document investigation Test urine sample for indications of kidney damage Initiate appropriate corrective action
400 µgU/ℓ	Confirm result Impose work restriction Collect and analyze additional urine sample(s) Contact medical personnel and inform of results Document investigation Test urine sample for indications of kidney damage Initiate appropriate corrective action

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TABLE I-3.4

ROUTINE LUNG-COUNTING PROGRAM ACTION LEVELS AND ACTIONS	
Lung Count Exceeds	Required Action
0.21 nCi U-235	Confirm result Document investigation If confirmed results were unexpected review relevant data to attempt to find probable cause Initiate appropriate corrective action
0.32 nCi U-235	Confirm result If confirmed result was unexpected, impose work restriction Document investigation Perform additional bioassay measurement and at least one other bioassay technique If confirmed results were unexpected, review relevant data to attempt to find probable cause Initiate appropriate corrective action

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APPENDIX A

CHAPTER 3

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Industrial and
Medical Nuclear Safety
Washington, DC 20555

August 1987

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Industrial and Medical Nuclear Safety, U. S. Nuclear Regulatory Commission, Washington, DC 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 dpm $\beta\gamma$/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] 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.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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CHAPTER 12 RADIATION PROTECTION

12.1 Program

SPC maintains radiation exposure as far below the limits specified in 10 CFR 20 as is reasonably achievable by establishing and maintaining a radiation protection program including:

1. Written policy guides, standards and procedures;
2. Design, installation and maintenance of facilities and equipment to the ALARA commitment;
3. Personnel training;
4. Access controls;
5. Exposure limit planning and control (this includes routine review of incurred radiation exposures);
6. Surveillance and monitoring of personnel adherence to established procedures and of radiological conditions;
7. Radioactive effluent and waste control;
8. Use of protective clothing and personnel protective equipment (including respiratory protection);
9. Inspections and audits; and
10. Recordkeeping.

12.2 Posting and Labeling

Radioactive material, airborne radioactivity, radiation, and high radiation areas as defined by 10 CFR 20 are identified, and their boundaries are visibly marked. Signs denoting these areas are placed so that at least one sign is visible from any approach.

12.3 External Radiation - Personnel Monitoring

A personnel monitoring program has been established. The program consists of the following:

1. Establishment of external exposure limits, including internal Company guidelines which are lower than NRC limits;

2. Providing of dosimeters to measure the exposure of personnel; and

3. Analysis and maintenance of exposure records.

The occupational exposure received by SPC employees and visitors shall not exceed the NRC limit. Company guidelines (in Chapter 2 of EMF-30, "Siemens Power Corporation Safety Manual") have been established at less than the NRC limits in order to prevent overexposure. All employees are advised of the National Council of Radiation Protection and Measurements recommendation to keep radiation exposure to an embryo or fetus to the very lowest practicable level during the entire gestation period and of the NRC's dose limit for a fetus.

All personnel likely to exceed 10 percent of the NRC's external radiation limit shall wear NVLAP accredited dosimetry, with the exception of extremity monitoring. Finger rings will be used when extremity (finger) monitoring is required. Direct-reading dosimeters may be used when timely information is needed. Self-reading pocket dosimeters (pencils) may be used with x-ray operations or where external radiation exposures have the potential for exceeding Company guides in a matter of days.

Radiation exposure dosimeters are analyzed quarterly for personnel whose external exposure is likely to exceed 500 mrem (deep dose) per calendar year. Finger rings are processed quarterly, pencils read weekly, and readings are documented. TLD assigned to personnel who are not likely to exceed 10% of the annual Company guides are analyzed annually.

Dosimetry results are evaluated by Radiological Safety personnel to determine that external exposures of personnel at the Engineering and Manufacturing Facility are within limits. The exposure data is also reviewed by the ALARA Committee to determine the effectiveness of programs to maintain exposure as low as reasonably achievable.

12.4 Radiation Surveys

The routine radiation survey program consists of the following:

1. A detailed survey of the radiation levels is performed during the initial startup of each operation and each storage area involving radioactive material likely to significantly change the radiation levels. These surveys provide the necessary information for determination if the area must be

classified as a radiation area and the necessary boundaries of such an area. It also identify areas where ALARA modifications may be necessary.

2. Monthly radiation surveys are performed in all areas where radioactive materials are processed or stored and where personnel have access. These surveys identify areas where the radiation status has changed and potential areas for ALARA modifications.

3. Radiation surveys are performed on all incoming and outgoing shipments of radioactive materials to assure that such shipments conform to applicable regulations of the NRC, the USDOT, the U.S. Post Office, the State of Washington Utilities and Transportation Commission, and the International Atomic Energy Agency. Procedures are in place to assure that necessary radiation surveys are performed on all receipts and shipments of radioactive material.

When proposed test or nonroutine production work involves radiation or radioactive material, radiation surveys are performed prior to the start of such work both to confirm the levels of radiation present and to permit evaluation of methods to reduce exposure during the work. Surveys are also performed during the work to confirm that radiation levels have not increased significantly.

12.5 Reports and Records

All reports and records of the Radiation Protection Program required in Part I, Chapter 2, Section 2.8, are maintained in Company files in accordance with 10 CFR 20 Subpart L. Such reports and records are maintained for a minimum period of 5 years unless longer retention periods are specified for specific records.

12.6 Instruments

The criteria for selecting radiation measurement instruments for performing radiation and contamination surveys, sampling airborne radioactivity and monitoring area radiation are described in Part I, Chapter 3, Table I-3.2.

The Manager of Safety, Security, and Licensing is responsible for maintaining adequate quantities of radiation measurement instruments and related equipment.

The Manager of Plant Engineering is responsible for the maintenance and calibration of radiation safety instruments and equipment.

The following general requirements apply to all such equipment and instruments:

1. All radiation detection instruments are inspected and calibrated at least semiannually;

2. Instruments are calibrated following any maintenance on them before they are put back into routine service;

3. Each on-line radiation detection instrument is checked for proper operation by Health Physics Technicians daily (Monday through Friday). When daily checks are performed in a manner which qualifies as calibration, separate semi-annual calibrations are not required;

4. Portable survey instruments are source-checked each time they are turned on for use;

5. AC-operated personnel contamination survey instruments are provided with individual check sources to allow personnel to source-check the instruments at random intervals;

6. Calibration sources are traceable to the National Institute of Standards Technology (NIST);

7. Dose rate instruments are inspected and calibrated quarterly; and

12.7 Protective Clothing

The types of protective clothing required for operating personnel in normal, maintenance and accident conditions is dependent upon the work assignments and the levels and types of contamination present and is specified in the applicable SPC Radiation Work Procedures which govern those conditions.

For inspection activities lab coats and cotton or rubber shoe covers may suffice, perhaps supplemented with cotton gloves and surgeon's cap. Most normal operating and maintenance assignments will require rubber shoe covers, full coveralls, and surgical-type rubber gloves or light-weight PVC gloves. For more unusual type operations or maintenance full cotton hoods and cotton boots may be required. Industrial safety equipment is also available (face shields, goggles, and acid suits). In addition, both half-mask and full-face negative pressure respirators, as well as full-face positive pressure respirators, are available. The protective clothing requirements are specified in the applicable Radiation Work Procedures.

12.8 Administrative Control Levels (Including Effluent Control)

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The action levels, alarm set points, frequency of measurements and actions to be taken for the various radiation protection monitoring programs are described below.

12.8.1 Occupational Exposure (Internal and External)

The bioassay program, including frequency of measurements for determining internal exposure, is described in Section 12.12. The routine urinalysis and in-vivo results are reviewed by the Health Physics Component to determine any unusual trends or potential exposures. If the internal exposure of an individual exceeds action levels and appears uncertain, additional analyses and/or removal from further exposure are considered.

The external exposure personnel monitoring program, including frequency of measurements, is described in Section 12.3. The quarterly dosimeter results are reviewed by Health Physics or Radiological Safety to determine any unusual trends or exposures. If the external exposure status of an individual exceeds Company guidelines, the individual is removed from further exposure unless the Health Physics component and appropriate management impose special controls.

12.8.2 Airborne Activity

The gaseous effluent controls are described in Part I, Chapter 5, Section 5.1. The action levels are listed in Table I-5.1. Alpha samples are counted on a surface barrier detector. The lower level of detection varies with the stack being sampled, but typically is in the range of 10^{-15} μCi/ml for a 7-day sampling period. The lower level of detection for mixed fission and activation products is typically in the range of 10^{-14} μCi/ml for a 7-day sampling period.

The action levels specified in Table I-5.1 include shutdown requirements to reduce emissions. In the event that the calculated dose to any member of the public in any consecutive 12-month period is about to exceed the limits specified in 40 CFR 190.10, the Company takes immediate steps to reduce emissions as to comply with 40 CFR 190.10.

The facility air sampling program is discussed in Section 12.13.

12.8.3 Liquid Activity (Effluent Monitors)

Liquid effluent leaves the site at the south boundary and is discarded to the municipal sewer. This effluent is sampled continuously and a composite sample is analyzed each workday (Monday through Friday for a normal work week) for uranium and regulated chemicals. The amount of uranium is determined fluorometrically with a minimum detection level of 0.1 μgU/mℓ (0.1 ppm or 1.6 x 10_{-7} μCi/mℓ). Action levels are to

investigate any sample result greater than 0.1 ppm and to shutdown the processes which could discharge uranium upon a confirmed sample result greater than 1.0 ppm.

There is a potential for discharge of uranium to the groundwater by leakage from the process chemical waste storage lagoon system. The system between the liner sampling system and the action levels are described in Part I, Chapter 5, Section 5.1.3.1. The groundwater test wells and sampling programs are described in Part I, Chapter 5, Section 5.2.2. Action levels are based primarily on the regulated chemicals for resampling and investigation, although all data are reviewed and any significant change investigated.

12.9 Respiratory Protection

The primary objective of SPC's respiratory protection program is to limit the inhalation of airborne radioactive materials and harmful air contaminants, to comply with permissible exposure limits, and to protect employees in oxygen-deficient atmospheres. These objectives are normally accomplished by the application of engineering controls, including process, containment and ventilation equipment. When such controls are not feasible or cannot be applied, the use of respiratory protective equipment may be appropriate. In general, however, the use of respirators is less desirable in providing respiratory protection than the use of engineered controls. The use of respiratory protective equipment is subject to the following considerations regarding circumstances under which respiratory protection may be needed:

Routine operations are planned activities that are generally repetitive and occur frequently. For such operations, potential sources of airborne radioactive materials and other harmful air contaminants or oxygen-deficient atmospheres shall be identified so that respiratory protection may be accomplished by process, containment, and ventilation measures and by pre-planning of work. The use of respirators as a substitute for practicable engineered controls in routine operations is inappropriate. Respirators may be considered for use, however, while engineering controls are being instituted or evaluated.

Nonroutine operations are activities that are either non-repetitive or else occur so infrequently that adequate limitation of exposures by engineering controls is impractical. To the extent that process, containment and ventilation controls are not reasonably feasible in nonroutine operations, the use of respirators is appropriate.

Emergencies are unplanned events characterized by risks sufficient to require immediate action to avoid or mitigate an abrupt or rapidly deteriorating situation. Although emergencies are unplanned, preparations must be made for coping with potential emergencies. SPC's preparations include a program for providing

respiratory protection for use in emergencies that are likely to entail respiratory hazards. The advance preparations for a particular potential emergency depend on both its possible consequences and the probability of its occurrence (see EMF-32, Emergency Plan, for further details on plans for dealing with emergencies).

Most operations can be readily categorized as routine, nonroutine or emergency. In dealing with situations, which are not easy to categorize, sound judgment must be exercised in using engineered controls where feasible and by avoiding unwarranted use of respirators.

The period of time respirators are worn continuously and the overall durations of use are each kept to a practical minimum. It is necessary to allow respirator users adequate relief from wearing respirators at reasonable intervals and to limit total time to use. However, it is difficult to realistically assign specific time limits on respirator use because of wide variations in job requirements and in the physical capacities and psychological attitudes of individuals. Such factors must be taken into account in establishing a respirator program. Provision is made for the respirator users to leave respirator required areas for relief in case of equipment malfunction, undue physical or psychological distress, procedural or communication failure, significant deterioration of operational conditions, or any other condition that might require such relief.

12.10 Occupational Exposure Analysis

Occupational exposure analyses have been performed and documented in the form of an annual ALARA Report. The ALARA Report for 1991, is appended to this Chapter as Appendix A. It contains a history of external and internal exposure data in Tables II and V. These tables include estimates of dose based on airborne contamination, in-vivo (lung count) data and urinalysis. Trend evaluation is discussed in Section 3.0. Measures taken to further minimize personnel dose are presented in Section 4.0.

12.11 Measures Taken to Implement ALARA

SPC has committed to maintaining a functioning ALARA Committee as a subgroup of the Health and Safety Council. The membership and activities of this Committee are outlined in Part I, Chapter 2, Section 2.3.2. Company Policy in this area is outlined in Part I, Chapter 3, Section 3.1.1.

12.12 Bioassay Program

The bioassay program established by SPC is conducted to confirm the results of radioactive material contamination control and personnel protection programs. It also

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may be used to estimate internal exposures due to internally deposited radioactive material and/or intakes of soluble uranium for chemical toxicity assessments.

The frequencies and types of measurements are established on the basis of the exposure potential of the individual's work assignment and the physical and biological properties of the radioactive material with which the individual works.

Radiation exposure due to internally deposited radioactive materials is kept as low as is reasonably achievable primarily by the implementation of engineered controls. Administrative controls and precautionary procedures are also employed to complement the engineering controls.

Aspects of the bioassay program:

1. Employees normally working in contaminated areas containing transportable uranium compounds submit urine specimens every 28 days for uranium analysis. Scheduling is staggered to help provide continuous assurance of airborne contamination control.

2. Routine lung counting frequencies are established for all operators and maintenance personnel assigned to work in areas where nontransportable compounds are processed. The minimum frequency for lung counts is semiannual for personnel normally working in areas exceeding 10 percent of DAC the previous quarter, provided adequate lung counting capacity can be provided by SPC's vendor.

3. Bioassay investigations are undertaken when action levels are exceeded and elevated results are confirmed. The investigations are documented and discussed at ALARA meetings. When appropriate, corrective actions are executed.

4. Non-routine bioassays, consisting of in vivo (lung) counts, urine samples, and/or fecal samples are requested when individuals are suspected of acute exposures exceeding 200 DAC-hours. The Health Physics Component evaluates the results of such assays. The exposures from these bioassays may be substituted for those from airborne measurements.

In evaluating the bioassay results, the health physics component uses internationally recognized models and may make use of site specific data.

12.13 Air Sampling and Internal Exposure Program

The air in all general areas where uncontained radioactive materials are handled, processed or are likely to exist is regularly sampled and the samples are analyzed for radioactivity. The air sampling system consists of a combination of equipment and instruments. Field-run lines (flexible or hard-piped) connect individual air samplers to overhead vacuum lines such that the samplers may be moved about and located at any desirable point without causing obstructions or creating industrial safety problems. The locations of air samplers are determined, in part, by the need to measure potential airborne contamination; representative airborne contamination at workstations; and background airborne contamination.

The frequency of exchanging and analyzing filter papers of the workstation sampling units is based on historical experience. Sampler filters may be exchanged and analyzed more frequently in the event of suspected elevated airborne contamination; to assess the effectiveness of radioactive material containment/confinement following equipment modification or maintenance; or to assess the air quality of sequential shift operations.

Permanently-mounted air sampling equipment is evaluated for representativeness following significant process or equipment changes; at least every 12 months for work stations which averaged greater than 10% of DAC the previous year; and at least every 24 months for remaining work stations.

Specialized air sampling or monitoring equipment such as continuous air monitors, portable high volume air samplers, and lapel air samplers, is available to supplement the normal air sampling system and for use in special studies.

SPC pursues maintaining radiation exposures as far below the normal limits specified in 10 CFR 20.1201 and 1202 as reasonably achievable.

Respiratory protective equipment is required for entry into areas where airborne radioactive materials are known to exist in yexcess of the occupational concentration stated in 10 CFR 20.

12.13.1 Particle Size Distribution Effects

SPC may elect to alter Derived Air Concentrations (DACs) and Annual Limits of Intake (ALIs) based on the results of particle size distribution measurements. The method of obtaining such measurements and applying the results is described below.

Particle size distribution measurements will be taken using Andersen 1 ACFM Non-viable Ambient Particle Sizing Samplers with a pre-separator and 8 stages (Model #20-830).

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The particle size range for each stage in micrometers is: stage 0: 9-10; stage 1: 5.8-9; stage 2: 4.7-5.8; stage 3: 3.3-4.7, stage 4: 2.1-3.3, stage 5: 1.1-2.1; stage 6: 0.7-1.1; and stage 7: 0.4-0.7. A backup filter is for size range 0-0.4 microns. (Glass fiber filters have efficiencies of 0.997.)

For multimodal distributions, the method of analysis consists of estimating the fractional activity, the geometric mean, and geometric standard deviation of each subdistribution. The predicted total distribution is compared with the measured distribution. The object is to minimize the sum of the squares of differences for each stage between the measured and estimated distributions. As an indication of fit, a chi-square statistic will be determined assuming n-2 degrees of freedom, where n is the number of stages. The chi-square is a surrogate statistic used to determine the goodness-of-fit. When a statistically good fit has been achieved, the fractional activities and AMADs will be used to determine the DACs, etc. in accordance with Appendix B to this chapter. The level of confidence required to demonstrate goodness-of-fit will be p greater than or equal to 0.8, where p is the probability of obtaining a value equal to or less than the chi-square statistic when the hypothesized distribution is true. If this level cannot be achieved, the data will be discarded and additional data taken. However, if additional data can not be fitted, i.e. p is also less than 0.8 then the Health Physics Component will apply a conservative analysis and will document the analysis.

At least three particle size measurements will be taken for each grouping of locations. If SPC chooses to adjust DACs and ALIs by particle size, particle size analysis will be performed at least semi-annually in each group of locations for which particle size credit is taken. After one year, the Health Physics Component may relax the frequency to once per calendar year if data for a group of locations does not differ significantly from previous measurements. Particle size will be reassessed following significant process changes deemed likely to change the particle size distribution. Using the results of particle size measurements and knowledge of the process, the Health Physics Component will decide whether specific operations or specific locations can be grouped together for characterization purposes.

Particle size distributions for maintenance operations may be different than for routine operations. There is a practical difficulty in obtaining particle size data for maintenance operations; namely, several days to weeks of sampling time are generally required and maintenance operations seldom last long enough. In the absence of particle size data during such operations it is assumed particle size data during normal operations would still be the best data to use. If particle size data is available, and if maintenance operations yield significantly lower particle size distributions than for routine work, then for prolonged operations, i.e. longer than 24 hours, the DACs will be modified for maintenance operations.

Should assignments be performed away from normal working areas, the Health Physics Component will decide whether to take credit for particle size. If credit is taken, the Health Physics Component will use conservative judgment is assigning a DAC adjustment factor and will document the analysis.

12.14 Surface Contamination

Radioactive materials are contained and/or confined during processing, transfer and storage to the extent of maintaining intake of such materials by personnel as low as reasonably achievable. Operations involving readily dispersible forms of radioactive materials are accomplished within enclosures such as process equipment, glove boxes, glove port hoods, laboratory-type hoods, etc.), which are exhausted to facility exhaust air systems.

12.14.1 Facility Surveys

A detailed survey of contamination levels is performed for each new operation involving radioactive material and frequently thereafter, for a period of time dependent on demonstrated operational controls as reflected in survey results. Operations involved in the production of fuel are repetitive in nature, equipment and systems employed in development activities are normally similar to those used in the production facilities, and containment and confinement principals are employed consistently throughout SPC's facilities, thus making it possible to effectively establish routine and repetitive contamination surveys. The frequencies of routine surveys is determined by a combination of professional judgment and experience and are periodically reviewed by the Radiological Safety Component. In general, reduced frequencies are permitted when the stability of an operation, as demonstrated by the consistency of survey results and the relationship between observed values and operational controls is established. Such reduced survey frequencies are approved by Health Physics Component. The following frequency schedule is applied to the facility contamination survey program:

1. Contaminated radioactive materials area - weekly
2. Noncontaminated radioactive materials area - monthly
3. Intermediate areas - daily
4. Lunchrooms adjacent to radioactive materials/radiation areas - daily

Operational controls are considered adequate for uranium operations when the following conditions prevail:

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1. The is no visible or smearable contamination in excess of 10,000 dpm/10cm² on exposed or non-hooded surfaces in the process areas (not applicable to nonroutine tasks being conducted under special controls).

2. There is no smearable contamination on intermediate area floors greater than 500 dpm/100 cm² alpha.

3. There is no smearable contamination in clean areas greater than 200 dpm/100 cm² alpha.

Cleanup of uranium contamination in excess of the levels specified in conditions 1-3 above is initiated during the shift detected.

12.14.2 Release of Personnel, Materials, Equipment, Facilities and Shipments

Contamination surveys are performed on all personnel leaving contaminated areas, on all materials, equipment and facilities to be released from radiation protection requirements, and on all incoming and outgoing shipments of radioactive materials.

1. Personnel. Contamination surveys conducted according to the following schedule:

   a. All persons leaving contaminated areas are required to survey themselves for contamination with survey instruments.

   b. Personnel are not released to eat or leave the respective facility if their personal clothing is contaminated in excess of the following limits, except with the approval of the Supervisor, Radiological Safety and the respective facility manager:

      Smearable and Fixed Uranium: 200[1] dpm/100 cm² alpha

   c. For routine release personnel skin surface contamination shall not exceed 200 dpm/100 cm² (alpha).

2. Materials, Equipment and Facilities. Contamination surveys are performed by Health and Safety Technicians on all materials and equipment removed from contaminated areas, and on areas or facilities to be released from

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1 200 dpm (alpha) per 100 cm² represents the practical lower detection level for most direct-reading contamination survey instruments.

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radiation protection requirements. Decontamination of facilities and equipment prior to release for unrestricted use or termination of license is in accordance with levels established in 3.2.6.2.

3. Shipments. Shipments of radioactive materials arriving at SPC are surveyed to the requirements of 10 CFR 20.205. All outgoing shipments of radioactive materials are packaged and surveyed in accordance with 10 CFR 71 and 49 CFR 173.443.

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APPENDIX A

CHAPTER 12

ALARA REPORT

APPENDIX B

CHAPTER 12

ADJUSTMENT OF DAC/ALI BASED ON PARTICLE SIZE MEASUREMENTS

SPC may alter the DACs (Derived Air Concentrations) and ALIs (Annual Limits of Intake) for class W and class Y compounds by taking credit for particle size distributions. Adjustments will be made according to the following formulas:

$$\frac{ALI\ (AMAD)}{ALI\ (1\ \mu)} = \frac{H_{50}\ (1\ \mu)}{H_{50}\ (AMAD)} = \frac{DAC\ (AMAD)}{DAC\ (1\ \mu)}$$

and

$$\frac{H_{50}(AMAD)}{H_{50}(\ 1\ \mu)} = f_{np} \cdot \frac{D_{np}(AMAD)}{D_{np}(\ 1\ \mu)} + f_{tb} \cdot \frac{D_{tb}(AMAD)}{D_{tb}(\ 1\ \mu)} + f_{p} \cdot \frac{D_{p}(AMAD)}{D_{p}(\ 1\ \mu)}$$

Where $H_{50}()$ is the committed dose equivalent; f_{np}, f_{tb}, and f_p, are the relative fractions of H_{50} due to deposition in the nasal passage, the trachea and bronchial tree, and the pulmonary regions, respectively; and D_{np}, D_{tb}, and D_p, are the deposition probabilities in the nasal passage, the trachea and bronchial tree, and the pulmonary regions, respectively.

When applied to class Y uranium compounds, such as UO_2 and U_3O_8, and class W uranium compounds, $f_{np} = 0 = f_{tb}$ and $f_p = 1$ according to ICRP 30.

Therefore the following equation will be used:

$$\frac{H_{50}(AMAD)}{H_{50}(\ 1\ \mu)} = \frac{D_{p}(AMAD)}{D_{p}(\ 1\ \mu)}$$

if the particle size distribution is multimodal, the following equation will be used:

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APPENDIX B (Cont.)

$$\frac{H_{50}(AMAD)}{H_{50}(1\ \mu)} = a_1 \cdot \frac{D_p(AMAD(d_1))}{D_p(1\ \mu)} + a_2 \cdot \frac{D_p(AMAD(d_2))}{D_p(1\ \mu)} + \ldots + a_n \cdot \frac{D_p(AMAD(d_n))}{D_p(1\ \mu)}$$

where a_i is the fraction of the activity associated with the distribution having AMAD(d_i).

When multiple measurements are taken for a specific location or group of samples, the grand average H_{50}(AMAD) will be determined as follows:

$$\frac{H_{50}(AMAD)}{H_{50}(1\ \mu)} = a_{11} \cdot \frac{D_p(AMAD(d_{11}))}{D_p(1\ \mu)} + a_{12} \cdot \frac{D_p(AMAD(d_{12}))}{D_p(1\ \mu)} + \ldots + a_{1n} \cdot \frac{D_p(AMAD(d_1n))}{D_p(1\ \mu)}$$

$$+ a_{21} \cdot \frac{D_p(AMAD(d_{21}))}{D_p(1\ \mu)} + a_{22} \cdot \frac{D_p(AMAD(d_{22}))}{D_p(1\ \mu)} + \ldots + a_{2m} \cdot \frac{D_p(AMAD(d_2m))}{D_p(1\ \mu)}$$

$$+ \ldots$$

$$+ a_{j1} \cdot \frac{D_p(AMAD(d_{j1}))}{D_p(1\ \mu)} + a_{j2} \cdot \frac{D_p(AMAD(d_{j2}))}{D_p(1\ \mu)} + \ldots + a_{jm} \cdot \frac{D_p(AMAD(d_{js}))}{D_p(1\ \mu)}$$

where a_{jk} is the fraction of activity associated with the distribution having AMAD(d_{jk}) of the j-th measurement.

Where

$$\sum_{k} a_{jk} = 1$$

and

$$\sum_{jk} a_{jk} = \textit{No. of measurements; e.g., } a_{11} + a_{12} + a_{21} + a_{22} + a_{31} + a_{32} + a_{33} = 3$$