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Return to 39655

GENERAL ELECTRIC

NUCLEAR ENERGY BUSINESS OPERATIONS
GENERAL ELECTRIC COMPANY • VALLECITOS NUCLEAR CENTER • PLEASANTON, CALIFORNIA 94566

April 20, 1984

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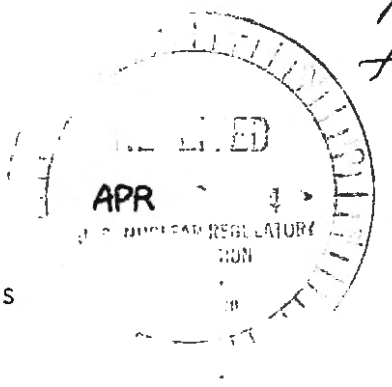


L. C. Rouse, Chief
Advanced Fuel and Spent Fuel Licensing Branch
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: 1) License SNM-960, Docket 70-754.
2) Application for Renewal of License SNM-960, 8/20/71.
3) Letter with Attachment, G. E. Cunningham to L. C. Rouse, 4/5/84.

Dear Mr. Rouse:

Enclosed are corrected pages to the updated supportive information section (Ref. 3) for the renewal application for License SNM-960. In addition, we are submitting revised proposed license conditions, Appendix A to License SNM-960. This revision totally supersedes our previous proposed Appendix A.

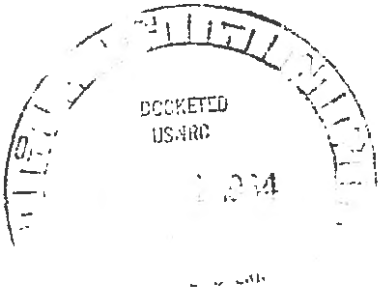
Sincerely,

G. E. Cunningham

G. E. Cunningham
Senior Licensing Engineer
(415) 862-2211, Ext. 4330

/ca

Encls.



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LICENSE CONDITIONS

FOR THE

VALLECITOS NUCLEAR CENTER

APPENDIX A

License SNM-960
Docket 70-754

Nuclear Fuel Engineering Department ● General Electric Company
Vallecitos Nuclear Center, Pleasanton, California 94566

GENERAL ELECTRIC

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LICENSE CONDITIONS FOR THE VALLECITOS NUCLEAR CENTER

Set forth herein are the technical and administrative requirements proposed for governing the receipt, possession and use of the special nuclear material and associated by-product material (as defined in Section 2.1 of this Appendix), subject to licensing and regulation by the Nuclear Regulatory Commission, in activities other than reactors at General Electric's Vallecitos Nuclear Center near Pleasanton, California.

1.0 AUTHORIZED ACTIVITIES

The following types of activities are authorized.

1.1 PRODUCT PROCESSING OPERATIONS

Development Shop. Fabrication, assembly, modification, cleaning, and repair of unirradiated encapsulated (including encapsulation) experimental assemblies. Assembly, modification, cleaning, and repair (but not fabrication) of fuel elements for use in licensed facilities.

1.2 LABORATORY OPERATIONS

1.2.1 Chemical. Analysis of the chemical and isotopic composition, concentration and behavior of special nuclear materials by wet chemistry and physical measurement techniques.

1.2.2 Metallurgical. Physical analyses and testing of physical and metallurgical properties of special nuclear materials.

1.2.3 Physics and Health Physics. Measurements of radiation and its effects on instruments and on the structure and composition of materials.

1.2.4 Hot Laboratories. Post-irradiation examination, testing, and analysis of fuel elements and materials in shielded enclosures by remote manipulative techniques; research and development and/or pilot plant activities involving recovery and recycling of waste or nonspecification material.

1.2.5 Research and Development. Including but not limited to the above.

1.3 GENERAL SERVICES OPERATIONS

1.3.1 Equipment Maintenance and Engineering. Design, fabrication, and testing of equipment containing special nuclear materials and maintenance of such equipment.

1.3.2 Storage. Storage of special nuclear materials other than wastes in shielded containers and/or at locations as applicable and in designated general purpose storage areas.

1.3.3 Transportation and Transfer. Inspection of packaging and preparation for shipment and/or transfer of special nuclear materials.

1.3.4 Decontamination. Decontamination of equipment and facilities.

1.4 WASTE TREATMENT

1.4.1 Liquids. Concentration of the radioactive constituents of liquid wastes by evaporation, chemical treatment, sedimentation, filtration, and ion exchange; agglomeration and packaging of concentrates and discharge of processed effluents.

1.4.2 Solids. Packaging and storage of wastes contaminated with or containing nonreclaimable special nuclear materials, excluding direct burial in soil.

1.5 OFF-SITE ACTIVITIES

Nonnuclear, nondestructive modification, demonstration and testing of materials and devices containing unirradiated uranium and plutonium provided that:

1. Such materials and devices shall be under the supervision of General Electric at all times, and

2. Plutonium shall be fully enclosed at all times in containment devices of adequate integrity to reduce to an acceptably low level the possibility of release and/or to mitigate the consequences of containment failure.

2.0 POSSESSION LIMITS

The following quantities of special nuclear materials are authorized.

2.1 VALLECITOS NUCLEAR CENTER

2.1.1 U-235. 50 kg enriched to less than or equal to 10 per cent for authorized activities. The material may be in the form of irradiated special nuclear material with its attendant by-product and reactor-produced transuranics.

2.1.2 U-235. 4 kg enriched to more than 10 per cent for authorized activities. The material may be in the form of irradiated special nuclear material with its attendant by-product and reactor-produced transuranics.

2.1.3 Plutonium. 500 grams in any form in addition to the irradiated quantities as referenced to in Subsections 2.1.1 and 2.1.2 above.

2.1.4 U-233. 200 grams in any form.

2.2 LOCATIONS OTHER THAN VALLECITOS NUCLEAR CENTER

Up to 15 grams of U-235 and plutonium and up to 170 grams of plutonium as encapsulated plutonium-beryllium sources may be used at other sites within the limits of the United States except where the material is subject to licensing by an Agreement State as defined in 10CFR150.

SNM fully packaged as for transport in containers meeting all of the general license requirements of 10CFR71 or in containers owned by the General Electric Company and certified for transport under the provisions of 10CFR71 in accordance with the conditions of a certificate of compliance authorizing delivery of such containers to a carrier for Fissile Class I transport may be stored at locations within the United States which minimize the possibility of mechanical damage and flooding providing such locations are controlled by the General Electric Company including provision of adequate safeguards against

theft or loss. Storage at nuclear reactor sites subject to the financial protection and indemnity provisions of 10CFR140 shall be limited to possession for purposes of delivery to a carrier for transport. The requirements of 10CFR70.24 are waived insofar as this section applies to the materials contained in the above containers.

3.0 DEFINITIONS

As used in the proposed license conditions set forth herein:

3.1 Area Manager means the lowest supervisory position fully responsible for the specific activity or function with which the term is associated. The generic term "Area Manager" does not necessarily refer to the title of any specific position in General Electric's system of organization and position nomenclature.

3.2 Array means two or more interacting fissile material accumulations.

3.3 Criticality Area means any physically identified area or location within which fissile materials are handled under the direction of a single area manager. A criticality area may include more than one criticality limit area.

3.4 Criticality Control means the administrative and technical requirements established to minimize the possibility of achieving inadvertent criticality in the environment analyzed.

3.5 Criticality Limit Area means a designated and physically identifiable locality within which a specific set of criticality control limits govern the use of fissile materials.

3.6 Fissile Material Accumulation means any single accumulation of fissile material; for example, one can of UO_2 powder, one can of fuel pellets, or one fuel element.

3.7 Full Reflection means that degree of reflection equivalent to a tight-fitting shell of greater than twelve inches of water.

3.8 Homogeneous System means a system containing compounds of fissile materials in the form of uniformly distributed particles and fissile compounds in solution.

3.9 Heterogeneous System means a system containing compounds of fissile materials in the form of clumped fissile compounds (e.g., fuel rods in water).

3.10 Normally Subcritical Values means those maximum values which provide safety under normal conditions of operation. Further adjustment of such values may be necessary to incorporate safety margins for the activity as it is conducted in the plant allowing for credible mishaps that could occur in the actual plant situation.

3.11 Safe Batch means an accumulation of fissile material which is 45% of the critical accumulation considering enrichment, full reflection, and optimum water moderation consistent with the form of the material.

3.12 Nuclear Energy Operations means those components of the General Electric Company engaged in the various aspects of nuclear energy and does not refer to a specific component by title.

3.13 Nuclear Safety means that field of safety comprised of criticality safety and radiation safety.

3.14 Subcritical Area means a physically identified area or location involving special nuclear materials in quantities of less than 500 grams of U-235, 300 grams of U-233, or 300 grams of plutonium or a prorated combination of such materials under the direction of a single area manager and which is unrelated to any other area where special nuclear materials are handled. A subcritical area is considered unrelated when it meets the isolation requirements of Section 6.10 of this Appendix and is not located in the same room.

4.0 GENERAL ADMINISTRATIVE REQUIREMENTS

4.1 AREA MANAGERS

Operations and activities in a specific criticality area or radiation area shall be directed by the designated area manager. The responsibility for safe operation and control of activities in the area and for the safety of the environs as influenced by the activities conducted therein shall be vested in this position. An area manager shall be proficient in the application of the VNC radiation protection program as it relates to limitations and radiological controls on work activities in his assigned radiation or radioactive materials area. Additionally, each area manager of a criticality area shall be proficient in the application of criticality control procedures and be knowledgeable in the procedures applicable to the criticality area under his management.

4.2 CRITICALITY SAFETY COMPONENT

The criticality safety component is defined as that component of the Nuclear Energy Operations with designated responsibility to provide authoritative professional advice and counsel to area managers on matters of control against accidental criticality and to measure the effectiveness of the criticality control program.

4.2.1 The functions of the criticality safety component shall exclude direct responsibility for operations involving the use of fissile materials, and the criticality safety component shall not report to an area manager responsible for an area where fissile material is handled other than a subcritical area.

4.2.2 The criticality safety component shall include at least one technically trained person with a bachelor's degree in science or engineering and three years experience in the nuclear field, including one year of directly relevant criticality safety experience. Should the criticality safety component lack the one year of experience, all analyses for the interim period until the experience is achieved shall be

verified by two of the individuals described in 5.5 or by the physics advice function in 5.4 of this Appendix.

4.2.3 The manager of the criticality safety component shall hold a bachelor's degree in science or engineering, have at least five years experience in a responsible position in a nuclear field such as engineering, physics or chemistry, and shall have sufficient expertise in the field of criticality safety to provide the review functions of 5.5 of this Appendix.

4.3 RADIATION SAFETY COMPONENT

The radiation safety component is defined as that component of the Nuclear Energy Operations with designated responsibility to provide authoritative professional advice and counsel to area managers at the Vallecitos Nuclear Center on matters of radiation protection and ALARA and to measure the effectiveness of the radiation protection program.

4.3.1 Functions. The functions of the radiation safety component shall exclude direct responsibility for operations involving the manufacture of nuclear products or processing of nuclear materials. The radiation safety component shall be responsible to establish and maintain the radiation safety program to ensure the protection of employees at the Vallecitos Nuclear Center and of the community. The radiation safety program shall include as a minimum: the evaluation of release of radioactive effluents and materials from the site, establishment of procedures and training programs to control contamination and exposure to individuals, the review of calibration and maintenance activities for radiation detection instruments, maintenance of appropriate records and reports, review of radioactive material handling practices, and review of change procedures (see Section 4.6), including ALARA considerations.

4.3.2 The minimum qualifications of personnel assigned functional responsibilities in the radiation safety component shall be as follows:

1. Manager: B.S. degree in science or engineering with five years experience in assignments involving radiation protection.

2. Specialists: B.S. degree in science or engineering with two years experience in assignments involving radiation protection or eight years of experience in health physics or radiation protection.

3. Monitors: High school with two years monitoring experience or two years of college and four months experience; also, successful completion of a General Electric certification program which includes written and oral examinations covering radiation protection procedures and/or criticality procedures.

4.4 VALLECITOS TECHNOLOGICAL SAFETY COUNCIL

The functions of the Vallecitos Technological Safety Council (VTSC) shall include responsibility for review of reportable incidents, new facilities or major changes to facilities, and for contributing professional advice and counsel on criticality and radiation safety policy. The VTSC shall review annually the site safety and compliance program performance to include effluent releases and occupational exposures in terms of ALARA and focus on trends for corrective action as necessary.

Its deliberations in any calendar quarter shall be reported in writing to the Manager, Irradiation Processing Operation, and retained two years. The Vallecitos Technological Safety Council shall consist of at least five senior members of General Electric's technical and/or management personnel appointed by the Manager, Irradiation Processing Operation, and shall include competence in the physics, chemistry, and engineering disciplines.

4.5 COMPLIANCE POLICY

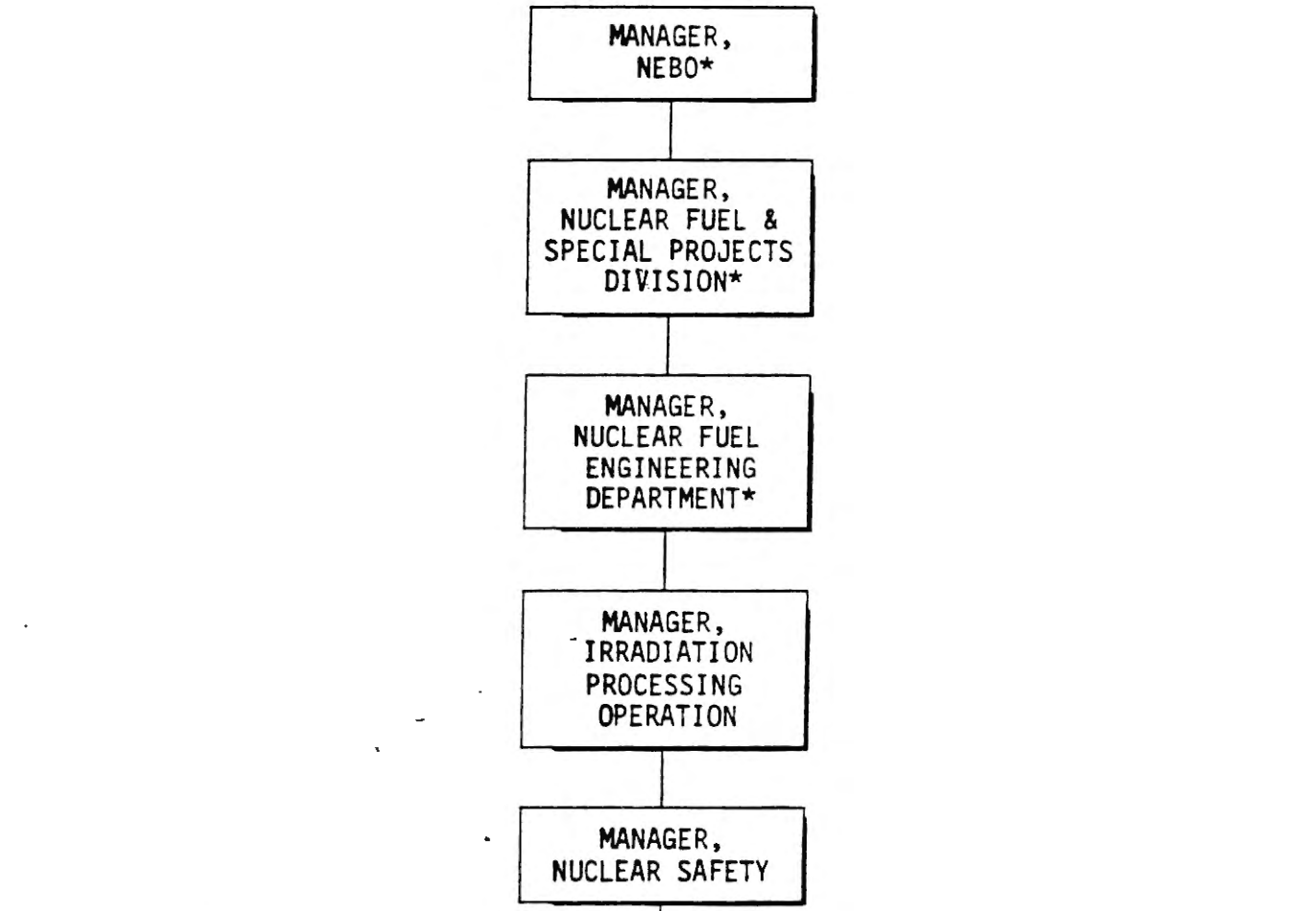
General Electric shall establish and maintain a policy statement in writing expressing requirements for compliance with the terms and conditions of special nuclear materials licenses and applicable NRC regulations. Each area manager shall know and understand the provisions of this policy.

4.6 CHANGE PROCEDURES

Activities which do not involve a change in license conditions but which require procedures, facilities, or equipment substantially different from those previously used shall not be initiated until the radiation safety component has completed a review and technical evaluation to assure adequacy of health and safety features and compliance with license conditions and ALARA policy where applicable.

In a criticality limit area, such activities shall not be initiated until the criticality safety component has completed a criticality analysis or a review of the existing criticality analysis for the proposed activity. Such changed activities shall be initiated in accordance with written procedures issued by the area manager.

4.7 NUCLEAR SAFETY ORGANIZATION



- Site Dosimetry and Bioassay Programs
- Radiological Instrumentation
- Routine Monitoring (Radiation)
- Records

- Criticality Safety and Training
- Experiment Review
- Compliance Engineering
- Special Studies
- Radiological Engineering
- Environmental Protection
- Radiological Training
- Emergency Preparedness and Response
- License and Permit Administration

*Located at San Jose

5.0 CRITICALITY CONTROL ADMINISTRATIVE REQUIREMENTS

5.1 PROCEDURES

Area managers shall develop and maintain written criticality control procedures incorporating limitations established by the criticality safety component and shall assure that these procedures are made readily available to concerned personnel through posting of limits or other appropriate notifications.

5.2 ANALYSIS REQUEST

A request for criticality analysis or review shall be prepared in writing by, or under the direction of, an area manager for any activity or change in activity requiring a change in criticality controls or changes in environment of possible consequence to criticality safety. The activity or change shall not be initiated until receipt of an approved criticality analysis.

5.3 CRITICALITY CONTROL ANALYSIS

Qualified individuals of the criticality safety component shall be responsible for the establishment of safe batches, safe geometries, safe concentrations, safe spacing of special nuclear materials, and limitations of other nuclear parameters utilizing information set forth in the Request for Criticality Analysis and verification and assessment of normal and potential environmental conditions of significance to criticality control.

5.4 NEUTRON PHYSICS ADVICE

An organizational component competent in neutron physics and the technical methods for criticality computations shall verify the use of any new computational methods for criticality control. This component also shall provide technical review and verification of criticality safety analyses as requested by the manager of the criticality safety component pursuant to 5.5.

5.5 VERIFICATION OF CRITICALITY SAFETY ANALYSIS RESULTS

The manager of the criticality safety component shall assure that the analyses in which an error in an analysis could lead to conditions that do not fulfill the double contingency policy are identified and reviewed. This review may be performed by the manager of the criticality safety component provided he has acquired a minimum of two years experience in the methods used or by a member of the criticality safety component other than the individual who performed the analysis or an independent reviewer of equivalent education and experience. The neutron physics advice function (5.4) may provide technical review of computation methods.

5.6 RECORDS

Records of criticality control analyses shall be maintained in sufficient detail and form to permit independent review of the method of calculation and results. Such records shall be retained for a period of at least six months following the cessation of activities to which they apply.

5.7 CRITICALITY CONTROL INSPECTIONS

5.7.1 The radiation safety component shall be responsible for inspecting each criticality area on an ongoing basis to assure compliance with criticality control procedures. Items to be inspected shall include, but not be limited to, the posting of criticality control limits, the labeling of SNM containers with information needed for criticality control purposes, the movement of SNM, and general criticality safety work practices.

5.7.2 A program of inspection shall be performed by the criticality safety component to determine that actual operations conform to the physical situations on which the calculations of criticality limits have been based. Inspection reports shall be furnished to area managers. Where situations are identified which require corrective action, such reports shall so indicate. Corrective or follow-up action shall be

taken in accordance with VNC Safety Standards and/or site nuclear safety procedures.

Operations which handle routinely in process more than one safe batch (as defined in Section 3.11) of fissile material shall be inspected on a quarterly basis. All operations shall be inspected on an annual basis.

5.8 TRAINING PROGRAM

Area managers shall assure that new employees receive instruction in criticality safety and plant operating and emergency procedures prior to their working with special nuclear materials. A criticality control training program, approved by the criticality safety component shall be maintained to emphasize the need for following criticality control procedures and to aid personnel in understanding the various parameters which are essential to the maintenance of subcritical conditions. The program may be conducted by the criticality safety component or some other portion of the nuclear safety component and may be combined with radiation safety training. A written test shall be completed by each employee taking the course. The test shall be evaluated and the results forwarded to the appropriate area manager.

5.9 MONITOR ALARM SYSTEM

5.9.1 No transfers of fissile materials between criticality limit areas or between vessels within a criticality limit area shall be permitted in criticality areas required to have a monitor alarm system unless the system is operable. Transfers may resume following repair and verification of the monitoring system's operability.

5.9.2 Exemption from the monitor alarm requirement of Section 70.24(a)(2) of 10CFR70 is granted for the Radioactive Products and Services Laboratory (RP&S) pool and hot cells. At the high level solid waste storage facility and the storage pit in the RP&S pool area, for the purpose of compliance with 70.24(a)(2) of 10CFR70, the source of a

possible accidental condition of criticality may be considered as the accessible surface of the earth or concrete shielding.

5.9.3 Specific exemption from the prescribed preset alarm points (5 to 20 mRem/h) is granted for those monitoring devices where the routine movement of by-product materials could result in gamma fields at the monitoring devices in excess of those that would result in a dose rate of 20 mR/h. Further, the alarm setting for these monitoring devices under the above conditions shall not exceed 500 mRem/h.

5.9.4 Exemption from the requirements of Section 70.24 of 10CFR70 is granted for each area in which there is not more than: (a) one shipment of packages containing special nuclear materials licensed pursuant to 10 CFR Part 71 for transport outside the confines of the Vallecitos Nuclear Center; packages in any shipment which depend on special arrangement for nuclear safety shall be retained in that same arrangement during such storage; (b) one safe batch of finished reactor fuel rods or assemblies, providing no activities could cause rearrangement of fuel-bearing portions into more reactive configurations; (c) or which meets the requirements of a subcritical area as defined in Section 3.14 of this Appendix.

6.0 CRITICALITY CONTROL CONDITIONS - TECHNICAL AND ANALYTICAL REQUIREMENTS

6.1 GENERAL REQUIREMENTS

Criticality controls shall be based on the normal environmental conditions in the criticality area and also on all credible abnormal conditions that could affect the criticality safety in that area. These factors shall include, but not necessarily be limited to, moderation, reflection, neutronic interaction, fissile material accumulation size, physical form, chemical and isotopic composition, nuclear poisons, density, concentration, reliability of equipment, type of operation, and training and supervision of operating personnel.

In evaluating the subcriticality of individual accumulations, process configurations, or arrays of fissile material, the two-contingency criterion shall be applied. That is, two unlikely, independent, and concurrent accidents or changes in process conditions must occur before criticality is credible.

6.2 CALCULATIVE METHODS

Criticality analyses shall utilize calculative methods that have been validated by the calculation of models of critical experiments of similar geometrical configuration and material content; the maximum negative bias in the multiplication factor, defined as $(-\Delta k_{bias}) = k_{calculation} - k_{experiment}$, determined in the validation shall be applied to the analysis as given in the relationship below. The multiplication factor of the accumulation or array of accumulations shall satisfy the relationship:

$$k_{cal} + \Delta k_{uncertainty} + (-\Delta k_{bias}) \leq 0.95$$

where:

k_{cal} is the calculated multiplication factor by the calculative method, and $\Delta k_{uncertainty}$ is the statistical uncertainty (2σ) in the mean value

of the calculated multiplication factor, and ($-\Delta k_{bias}$) is the maximum negative bias determined from the validation of the calculative method. If the bias is positive, the ($-\Delta k_{bias}$) term shall not be used, so that overstatements in the multiplication factor shall not be corrected.

Calculative methods shall be subject to independent review and verification by persons with demonstrated competence in neutron physics computations before use.

6.3 NORMALLY SUBCRITICAL VALUES - INDIVIDUAL ACCUMULATIONS

Facilities and processes involving the accumulations listed below shall adhere to the two-contingency principle (Section 6.1). The two-contingency principle may be achieved through physical constraints and inventory controls or a combination thereof.

Normally subcritical values of nuclear parameters for individual accumulations under normal operating conditions shall be as shown below except that the multiplication factor shall not exceed 0.95 in any case.

1. For accumulations limited by mass, the normally subcritical mass shall not exceed 74% of the critical mass.

2. Not more than 45% of the critical mass shall be contained in any accumulation in a criticality limit area in which double batching is credible.

3. For accumulations limited by volume, the normally subcritical volume shall not exceed 76% of the critical volume.

4. For accumulations limited by dimension, the normally subcritical cylinder diameter or slab thickness shall not exceed 90% or 88%, respectively, of the critical dimension where U-235 is the fissile constituent, nor 85% in all other cases.

5. For accumulations limited by concentration, the normally subcritical concentration shall be less than that concentration which is equivalent to the following atomic ratios of hydrogen to fissile material: H/U-235, 5200; H/U-233, 7600; and H/Pu (fissile), 7600.

6. Accumulations limited by the multiplication factor shall be limited by Section 6.2.

6.4 NORMALLY SUBCRITICAL VALUES - INTERACTING ACCUMULATIONS

Facilities and processes involving arrays of fissile materials shall adhere to the two-contingency principle (Section 6.1). The two-contingency principle may be achieved through physical constraints and inventory controls or a combination thereof.

Normally subcritical (as defined in Section 3.10) numbers of interacting accumulations shall be as listed below except that the multiplication factor for the array shall not exceed 0.95.

1. Not more than 69% of the critical number of accumulations whenever the critical number has been determined by experiment; or

2. Not more than 50% of the critical number of accumulations in any array calculated by the density analog method (Ref: ARH-600); or

3. The number of accumulations determined by the solid angle method as described in TID-7016, Rev. 2, Paragraphs 4.29 through 4.34. The method may be applied only to accumulations that are well moderated (e.g., aqueous solutions) at the point of the maximum multiplication factor, and array reflection must be no more effective than a thick water reflector spaced at distances from the accumulations comparable to the spacing between accumulations.

4. Interacting accumulations limited by the multiplication factor shall be limited by Section 6.2.

6.5 INTEGRITY OF STRUCTURES

6.5.1 Whenever criticality control is directly dependent on the integrity of a structure used to retain a special nuclear material storage array, the structure will be designed with an adequate strength factor to assure against failure under foreseeable loads or accident conditions. Materials of construction will be selected to resist fire, and the degree to which any corrosive environment might affect nuclear safety will be considered and corrosion-resistant materials or coatings applied as necessary. The design shall be reviewed by a qualified engineer.

6.5.2 Whenever criticality control is directly dependent on the integrity of a neutron isolating structure, the structure will be designed to assure against loss of integrity through foreseeable accident conditions such as fire, impact, melting, corrosion or leakage of materials. The design shall be reviewed by a qualified engineer.

6.6 OPTIMUM CONDITIONS OF MODERATION AND REFLECTION

Unless moderation or reflection is controlled by physical and administrative means in accordance with Sections 6.7 or 6.8 below, calculations of criticality control limits shall be made assuming that optimum light water moderation and full reflection by light water exist, consistent with the form of the fissile material and its container. When mass limitation is to be employed for criticality control of an accumulation of fissile material, optimum moderation is that degree of moderation which minimizes the mass of material that is required to achieve criticality. When a geometric limitation is to be employed for criticality control of an accumulation of fissile material, optimum moderation is that degree of moderation which maximizes the material buckling.

6.7 CONDITIONS OF MODERATION OTHER THAN OPTIMUM

Notwithstanding Section 6.6 above, criticality control limits may be based on conditions of moderation other than optimum when all of the applicable following conditions exist:

1. The fissile material specifications require the state of moderation be greater or less than optimum.

2. No single credible mishap will result in a more effective degree of moderation than assumed in the specific criticality analysis.

3. The undermoderated material accumulation is either:

   a. Contained within a noncombustible water barrier, or

   b. Of such physical form and natural arrangement that the application of water cannot in any credible mishap result in a more effective degree of moderation than that assumed in the specific criticality analysis.

4. The overmoderated fissile material accumulation is assayed and periodically inspected or sampled to assure the proper chemical concentration and composition is maintained.

6.8 CONDITIONS OF REFLECTION OTHER THAN FULL REFLECTION

Notwithstanding Section 6.6 above, criticality control limits may be based on less than full reflection when all of the following conditions are satisfied:

1. The fissile material environment provides the unreflected condition or a specific degree less than fully reflected.

2. The environment of the fissile material is such that more effective reflection cannot occur through a single credible mishap.

3. The fissile material accumulation is within a structure that will preclude more effective reflection by personnel or other objects in the environment.

6.9 MODERATORS

If special nuclear materials are to be stored, handled or used in the presence of heavy water, beryllium, or graphite, possible moderating and reflecting effects of those materials shall be considered.

6.10 NUCLEAR ISOLATION

Two accumulations or arrays of accumulations may be considered as being nuclearly isolated from each other only if an edge-to-edge separation exists which is not less than one of the following or its nuclear equivalent:

1. Twelve inches of water.

2. The larger of 12 feet or the greatest distance across an orthographic projection of either accumulation or array on a plane perpendicular to a line joining their centers.

7.0 RADIATION CONTROL ADMINISTRATIVE REQUIREMENTS

7.1 RADIATION STANDARDS

General Electric shall establish and maintain a comprehensive set of standards for operational health and safety, including ALARA considerations. Such standards shall be reviewed by the radiation safety component and the appropriate area managers prior to issuance. The radiation safety component shall review the standards annually thereafter.

7.2 RADIATION CONTROL INSPECTION

Activities involving special nuclear material shall be inspected by the radiation safety component on a continuing basis. Conditions of an unusual or uncertain nature that could lead to radiological health and safety problems shall be referred to the area manager immediately for correction.

7.3 RADIATION SAFETY TRAINING

A training program in radiation protection shall be in effect and shall include training in the requirements of 10CFR19 and 10CFR20, methods of controlling radiation exposure, license requirements, protective methods and basics of radiation effects. All personnel working in radioactive materials areas or in radiation areas shall receive an indoctrination lecture prior to starting work followed by additional training, including periodic retraining, commensurate with the work environment as determined by the area manager.

8.0 RADIATION CONTROL CONDITIONS - TECHNICAL AND OPERATING REQUIREMENTS

8.1 AIR CONTAMINATION CONTROL

The following design criteria for ventilation systems shall be used to provide air contamination control:

1. Air flow shall be from areas of lesser contamination to areas of higher contamination. Potential accident conditions shall be considered.

2. Duct flow velocities and design shall be such to minimize possible accumulation of contamination.

3. Air shall be routinely sampled in work areas with potential airborne contamination.

4. In general, potential airborne radioactivity-producing operations shall utilize close-capture ventilation devices, e.g., hoods, glove boxes, and high velocity local exhaust.

5. All HEPA filters shall be fire resistant.

6. All ventilation exhaust systems for facilities that routinely handle dispersible radioactive materials in quantities in excess of the limits specified in Appendix C of 10CFR20 shall be continuously sampled as proof of filter performance.

7. At least one filter in each such stream [8.1(6)] shall be equipped with a device for measuring differential pressure that shall be read monthly. Filters shall be changed when readings deviate from specification values or following evidence of damage.

8.2 EQUIPMENT AND FACILITY DESIGN CRITERIA AND GUIDELINES

Design criteria and guidelines for specific facilities are set forth in Table 1 of this Appendix.

8.3 INSTRUMENT CAPABILITY

Dose rate range capabilities of portable instrumentation shall include the following:

gamma	-	1 to 50,000 mR/h
beta	-	4 to 200,000 mrad/h
neutrons	-	1 to 5,000 mRem/h

8.4 CONTAMINATION DETECTION

8.4.1 Contamination detection of portable instrumentation shall be:

alpha	-	200 to 300,000 disintegrations per minute
beta-gamma	-	twice background to 80,000 counts per minute on Geiger-Mueller counter

8.4.2 Contamination detection capabilities of portable instrumentation when used in the smear survey technique shall be 200 disintegrations per minute.

8.4.3 Detection equipment shall be maintained on site to meet the requirements of Section 8.12 of this Appendix for contamination-free items.

8.5 SAMPLE DETECTION

Sample detection capabilities for laboratory analysis of effluents and other samples shall be $\leq$ 0.1 times the concentrations specified in 10CFR20, Appendix B, Tables I and II.

8.6 EXPOSURE DETECTION

Personnel dosimeters shall be capable of detecting gamma, beta, and x-ray radiation. Additional neutron detection capability shall be available as appropriate. In areas of possible criticality, equipment shall include detectors such as indium foil, gold foil, and sulphur to assist in post-accident dose determinations.

8.7 INSTRUMENT CALIBRATION

Monitoring instruments shall be calibrated upon initial acquisition, after major maintenance, and at least annually.

8.8 LABORATORY COUNTING INSTRUMENTS

Control charts indicating background and efficiency using standard sources shall be maintained on all laboratory instruments used for counting health physics samples.

8.9 INSTRUMENT CHECK SOURCES

Field check sources shall be available for use in functional response checks of portable radiation measuring instrumentation.

8.10 LIQUID WASTE DISPOSAL

Liquid wastes shall be retained in quarantine, sampled and analyzed before release to unrestricted areas.

8.11 AIRBORNE EFFLUENT CONTROL

Potentially contaminated airborne effluents shall be released through HEPA filter systems which shall be at least 99.95% efficient for 0.3-micrometer particles. Such effluents shall be limited at the point of release to the atmosphere so that the annual average concentration at the site boundary does not exceed the concentrations specified in 10CFR20, Appendix B, Table II,

Column 1. The limits at the points of release shall be based on a X/Q calculation, reconcentration factors, and the effects of other site stacks. If the environmental sampling program indicates a reconcentration of these materials, the release levels shall be lowered such that the reconcentration trend is reversed.

8.12 CONTAMINATION-FREE ARTICLES

Articles which have been handled, used, or stored in a radioactive materials area may be disposed of or transferred to persons not licensed to possess radioactive materials when all of the following conditions are satisfied:

1. Either all surfaces are accessible for survey or it is reasonable to assume from the design and usage that no radioactive materials could have contaminated inaccessible surfaces without having contaminated the accessible surfaces as well.

2. Articles are considered contamination free which meet the requirements of Annex C to this license.

8.13 BIOASSAY

Persons who work routinely in areas where there is potential for internal deposition of radioactive materials shall be subject to determination of the extent of radioactive materials intake by techniques such as analysis of excretia or whole body counting.

8.14 HIGH RADIATION ALARM EXEMPTION

Exemption from the provisions of 20.203(c)(2) of the Commission's regulations is granted for an area or location which is located within the 94-acre inner fenced exclusion area of the Vallecitos site provided such area or location is bounded by a distinctly colored rope or chain providing a barrier where dose rate values are not higher than 100 mR/h and is posted as a High Radiation Area in accordance with 10CFR20.203(c) and is:

1. Used for the temporary storage of strong, weatherproof containers not exceeding 1,000 mR/h at any point of readily accessible surface, or

2. An area established for any continuous period of 30 days or less in which there are contained radioactive materials, the readily accessible surfaces of which do not exceed 1,000 mR/h at any time and which do not exceed 100 mR/hr at the barrier.

TABLE 1. Equipment and Facility Design Criteria and Guidelines

Facility	Alarms, Interlocks and Safety Features	Basis
Hot Cells	Door interlock.	Prevents both doors from opening simultaneously during normal operation. Interlock can be nullified during cell cleanout.
	CO_2 or dry chemical fire extinguishers.	Combustibles held to a minimum; however, fire detection and extinguishing necessary for pyrophoric metals and cleaning agents.
	Stepped plugs in cell penetrations.	Prevents beam-type exposure to personnel at cell face.
	Check valves on all inlet lines for liquids and gases.	Prevents release of contaminants to work area through backflow.
	Continuous air monitors at face of cells; alarm in 10 min. at 10 x MPC.	Give prompt alarm in case of contamination spread outside cell.
	Continuous dose-rate meters in vicinity of cells. Alarm at $\leq$ 5 mR/h.	Give immediate alarm in case of high radiation outside cell.
	Effluent air double filtration - HEPA filters.	Provides contingency in case of cell fire and loss of first filter.
	> 0.02 inch of H_2O ΔP.	Prevents blowback to working area; positive flow through openings around plugs, etc., > 125 ft/mi...
	Gallery working area dose rate normally $\leq$ 2.0 mR/h.	Controlled by type and amount of material allowed in cells.
	Liquid waste to collection tanks.	Prevents contamination of the environs.
Underwater Storage Pools	Working area dose rate normally < 20 mR/h.	Controlled by amount and type of material allowed in pools.
	Anti-syphon drain.	Prevents water draining out.
	Automatic filling.	Prevents loss of shielding by evaporation, etc.

TABLE 1. Continued

Facility	Alarms, Interlocks and Safety Features	Basis
	Gamma dose-rate meter in work area set to alarm at 20 mR/h.	Personnel exposure rate control. Alerts to development of potential problem.
	Air from pool area filtered with HEPA filters.	Provides environmental protection.
Hoods	Air flow designed to 125 lineal ft/min.	Prevents carryout of radioactive materials.
	Uncontained plutonium is limited to 100 μCi in solution form, 50 μCi in powder form.	Limits the consequences of possible spills or spread of radioactive materials (based on ALI's < 1 mgm).
	Fire extinguishers in work area.	Provides fire prevention.
	Effluent air filtered with HEPA filters.	Prevents release of radioactive materials to environs.
	Liquid waste to collection tanks or solidified.	Prevents contamination of the environs.
Glove Boxes	$\geq$ 0.5 inch H_2O ΔP for conventional boxes. $\geq$ 0.02 inch H_2O ΔP for vacuum boxes. $\geq$ 0.0 inch H_2O ΔP for inert boxes.	Prevents spread of radioactive material to working areas. Plutonium is not permitted in pressurized glove boxes.
	Effluent and inlet air filtered through HEPA filters.	Prevents release of contamination to working areas or environs.
	Material egress through air locks or bagout equipment; ingress through air locks, sphincters, or bagout equipment.	Prevents release of contaminants to working areas.
	Fire extinguishers in work area where flammables are handled.	Minimizes consequences of contamination spread in locations with fire potential.
	Smooth internal surfaces.	Facilitates cleanup.
	Fire-resistant construction.	Prevents fire damage to main containment.

9.0 ON-SITE TRANSFERS

9.1 TYPE A AND UNIRRADIATED SNM

Transfers of Type A quantities of radioactive materials or transfers of unirradiated SNM between buildings on the VNC site shall be made in such a manner as to limit the probability of any release of radioactive material to the environs of the VNC site.

9.2 TYPE B

Transfers of Type B irradiated special nuclear materials with associated by-product materials may be made in containers approved by the NRC pursuant to 10CFR71 but without the crash/fire overpacks or in containers for which written and approved procedures have been generated in accordance with Section 4.6 of this Appendix.

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2.4 RESPONSIBILITIES OF THE NUCLEAR SAFETY COMPONENT

a. Radiation Safety. Establish and administer a radiation safety program to ensure the protection of employees and the general public. Provide monitoring support, a dosimetry program, an environmental monitoring program, and employee training in the methods for minimizing exposure through proper use of survey instruments and protective clothing and devices. Maintain all radiation exposure records required by regulatory agencies.

b. Nuclear Safety Compliance and Review. Provide review of reportable incidents, new facilities or major changes to facilities and operations control standards, and professional advice and counsel on nuclear and radiation safety policy.

c. Licensing. Represent VNC components in regulatory activities concerning radiation protection and licensing. Procure, administer and interpret NRC licenses and regulations, state and local government licenses and regulations, and provide advice and counsel to VNC components and their customers on regulatory matters.

d. Radiological Engineering. Assist in improved operation of VNC facilities and the overall radiation protection program through the analyses of existing systems, equipment and operation thereof and the recommendation of improved systems, equipment or methods. Generally, these studies will be safety and plant life oriented.

e. Training. Establish and administer a site-wide training program at VNC to ensure adequate knowledge of radiation control procedures.

f. Criticality Safety. Perform criticality control analyses to establish safe batches, geometries, concentrations, and spacing of special nuclear materials and equipment. Audit the criticality control environment and conduct educational programs in criticality matters.

density, etc.; (2) a change in the parameters such as quantity or dimensions of unit accumulations; (3) a change in the spacing or dimensions of processing, handling or storage equipment; or (4) a change in environment such as the addition of fire sprinkler systems of possible consequence to criticality safety.

c. Prepare in writing a Request for Criticality Analysis stating the activity or area involved, including a description of the special nuclear material, process description, and equipment description with appropriate charts, diagrams, and drawings. All special nuclear material shall be included whether license or license-exempt and whether as usable forms or as scrap and waste.

d. Upon receipt of results of a Criticality Analysis in writing from the criticality safety component, take all necessary steps to implement the appropriate controls such as:

1. Posting of limitations at strategic locations at the criticality areas where they apply.

2. Issue appropriate procedures for establishing and maintaining equipment and materials in the arrangement and quantities specified by the Criticality Analysis.

3. Assure boundaries identifying each separate criticality area and position are conspicuously marked.

4. Assure all operating personnel are advised of any special limitations or controls other than as outlined above and are trained to follow the necessary precautionary procedures.

5. Establish procedures for handling off-standard processing conditions.

2.7.2 Responsibility of Criticality Safety Component

It is the responsibility of the criticality safety component to:

a. Review requests for Criticality Analysis to verify completeness of submitted information and, as appropriate, personally inspect the equipment or location involved to obtain a first-hand determination of the possibility of interactions with other special nuclear material in the environment.

b. Make criticality control calculations to establish safe batches, geometries, concentrations, and spacing of special nuclear materials and equipment in accordance with authorized computational methods.

c. Furnish a written Criticality Analysis to the requesting operation for each request received. The person in charge of the criticality safety component shall identify the analyses which involve systems in which the direct achievement of criticality may be the consequence of error in analysis and shall assure that such analyses are reviewed and verified.

d. Perform a periodic inspection of the degree to which actual operations conform to physical situations on which the criticality calculations were based.

e. Establish a criticality control educational program to emphasize the need for following precise instructions.

2.7.3 Responsibility of Radiation Safety Component

It is the responsibility of the radiation safety component through its staff of qualified and experienced radiation monitors to:

a. In their normal rounds of duty be continuously alert to possible criticality safety practices inconsistent with the appropriate criticality analyses and/or procedures.

b. Be familiar with applicable parameters for criticality control and use these parameters as standards for inspection.

c. Verify that physical conditions and activities comply with the conditions specified in the Criticality Analysis.

d. Initiate immediate action to discontinue any SNM movement and shut down any operation which in its judgment does not fully comply with the Criticality Analysis.

2.8 IMPLEMENTATION OF RADIATION SAFETY PROGRAM

The program for protection against radiation hazards is implemented by means of functional responsibility assignments. Managers are responsible for integrating and measuring the efforts of line and staff participants in the program.

2.8.1 Responsibility of the Manager

It is the responsibility of the manager of an activity or area involving radioactive materials to:

a. Take all necessary steps to plan and organize the work of his component in accordance with approved radiation safety standards and operational procedures.

b. Identify needs for operational procedure revisions when there is a planned change in conditions such as types or quantities of radioactive materials or equipment modifications.

c. Integrate the results of reviews, inspections, engineering assessments and investigations made by the radiation safety component to correct or improve operational procedures, controls and performance.

2.8.2 Responsibility of Radiation Safety Component

It is the responsibility of the radiation safety component to:

a. Establish and administer through a system of instructions a radiation control program and maintain all radiation exposure records required by regulatory agencies.

b. Review and approve new operations in the design stage, identifying potential hazards and providing recommendations for their avoidance through education, training methods, and equipment application.

c. Review and approve requests for allocations of radioactive materials, within licensed quantities, to individual user groups after thorough investigation of the proposed detailed procedures, equipment and the qualifications of persons who will be responsible for using such materials. Maintain records of allocated quantities.

d. Inspect each radiation area to assure compliance with radiation safety procedures and limits.

e. Provide management with reports of inspection results showing trends in activities involving radioactive materials.

2.9 TRAINING PROGRAMS

2.9.1 Radiation Safety

Every new employee at VNC receives a radiation safety orientation, "New Employees Radiological Safety Orientation", within thirty days of reporting to the site. If an employee's area manager determines that the employee will be regularly or frequently exposed to radiation and/or radioactive materials, the employee is instructed in radiation protection such that he is able to protect himself and is made aware of the degree of hazard involved. A training program entitled, "Radiological Safety At Vallecitos Nuclear Center", is completed by each such employee normally within one year of his starting date at VNC. This course is scheduled and conducted by the radiation safety component.

The training course includes the following elements:

a. basic principles of radiation safety,
b. Company policies and operating procedures,
c. radioactive materials handling methods and shielding requirements,
d. emergency procedures,
e. requirements of NRC regulations, and
f. NRC license requirements.

Follow-up training commensurate with the work environment and the employee's work performance is determined by employee supervision. The employee also receives on-going training in the form of on-the-job demonstrations, periodic safety meetings, etc.

Employees whose work assignments may include the need for the use of respiratory protection equipment also receive the "Respiratory Protection Training Course" (RPTC). The course provides both instruction and hands-on experience in the proper use and fitting of the respiratory protective equipment. RPTC includes the following topics:

- o regulatory requirements on respirator usage
- o qualification of respirator users
- o description and selection of respiratory equipment
- o use and care of respiratory equipment
- o mask fitting

2.9.2 Criticality

Every new employee who will work regularly in areas in which quantities of special nuclear material sufficient to form a critical mass are present is instructed in the principles of criticality safeguards and is made aware of the degree of hazard involved. This instruction normally is completed within one year after the employee's starting date at that facility. The instruction is established by the criticality safety component and includes:

- o nuclear fission
- o conditions for achieving nuclear criticality
- o hazards associated with criticality
- o prevention of accidental criticality
- o criticality detection systems
- o case histories of criticality accidents

Area supervision is responsible for informing all personnel at work or otherwise present in their area of specific procedures for criticality control, and for appropriate administrative action to assure compliance with these procedures.

2.9.3 Other Programs

Members of emergency response teams receive additional training to assure prompt and adequate response to identified site emergency situations. The training may be through formal programs (e.g., first aid), drills and critiques, or discussion sessions.

Radiation monitors receive the "Radiation Monitoring Technicians Certification Course". This is an intensive six-week training program designed to qualify participants as VNC certified radiation monitoring technicians.

Other courses are available from the radiation safety component on an as-needed basis. Some examples are training in radiation detection instrumentation and work in high dose-rate fields.

2.9.4 Records

Records of individuals receiving training courses are kept in a central computerized record file.

2.10 INDEPENDENT REVIEW AND CHANGE AUTHORIZATION PROCEDURE

2.10.1 Definitions

a. Change Authorization. A Change Authorization is the VNC mechanism for independently reviewing and documenting changes. Any addition, alteration, deletion, modification, or substitution which results in a different position, course, or direction not previously analyzed, adds a new capability, performs a different function, modifies performance characteristics, or introduces a hazard not previously analyzed will constitute a change. Descriptions of existing facilities and standard methods of operation normally are contained in documents supporting Federal and State licenses or previously approved operating instructions and may be used to assist in determining if the proposed activity constitutes a change.

b. Facility. A facility consists of any permanent structure and that apparatus which, wholly or in part, is integrated with the structure, i.e., shielding, piping, ventilation, reactor core, etc.

c. Equipment. Equipment is defined as that apparatus which operates independently or in conjunction with the facilities to perform the various VNC activities.

d. Experiment or Test. An experiment or test consists of any device or combination of devices (not to include the facility or equipment wherein the experiment or test is housed) designed and operated for the purpose of obtaining a predetermined objective, or any nonroutine operation or manipulation of objects, systems or process streams for the purpose of gaining information.

e. Procedure. Procedures are the written guidelines established by facility management to describe and define the methods and instructions for operations.

2.10.2 Purpose

Any addition, alteration, deletion or substitution which adds a new capability, performs a different function, modifies performance characteristics, or introduces a hazard not previously analyzed requires an independent review by use of the Change Authorization procedure. A Change Authorization is prepared whenever the work involves changes to:

a. Facilities, equipment, or procedures so that safety or regulatory compliance considerations differ from those previously analyzed.

b. Preventive or corrective maintenance procedures for which no separate review procedures are established which could affect safety or violate a license condition or technical specification.

c. Radioactive material inventories and/or limits.

d. Hazardous or potentially hazardous industrial material inventories where such change is significant in terms of quantities or use.

The independent review of items is conducted so that the hazards (both direct and indirect) of the proposal are recognized and appropriate safeguards are provided to eliminate or reduce the probability and severity of potential accidents. While procurement, fabrication, selective installation or testing, etc., may proceed prior to the final CA review and approval, actual implementation of the proposed change may not proceed until this review and approval are received.

The Change Authorization is processed in accordance with a written procedure and reviewed by the Nuclear Safety component and by the Industrial Safety component as appropriate.

Early consultation with these review parties is important to the safety and economy of component plans. Should the operating component decide that the proposed activity does not require an independent review, that component is responsible to fully document its proposed activity, the results of its internal review, and the reasons an independent review was not required.

2.10.3 Procedures

a. Preparation of Change Authorization. Knowledgeable individuals prepare Change Authorizations which describe in sufficient detail the nature of the changes and the effect on safety, including applicable drawings and specifications, acceptance test procedures (ATPs), quality control requirements (if applicable), means for assuring personnel indoctrination for initiating method changes, and specifying the responsible supervision.

Certain minor changes and changes previously evaluated and documented need only internal review and documentation. The Nuclear Safety component will assist the initiating component in making this determination.

b. Review of Change Authorization. All Change Authorizations (CA) are reviewed by the initiating component, by the Nuclear Safety component, and, as appropriate, by Industrial Safety and are approved by the appropriate area or facility manager or his designated alternate. Recommendations for the change needed for safety may be added by the reviewers following discussion with facility personnel as appropriate. The Nuclear Safety component has the responsibility for determining whether a proposed change constitutes an unreviewed safety question or other license or technical specification violation. No CA may be implemented until review is completed and the CA signed by the manager of the Nuclear Safety component or his designated alternate.

c. Distribution. A Change Authorization file will be maintained by each facility. A copy of the Change Authorization form with all supporting information must be filed with the Nuclear Safety component with other copies distributed as appropriate.

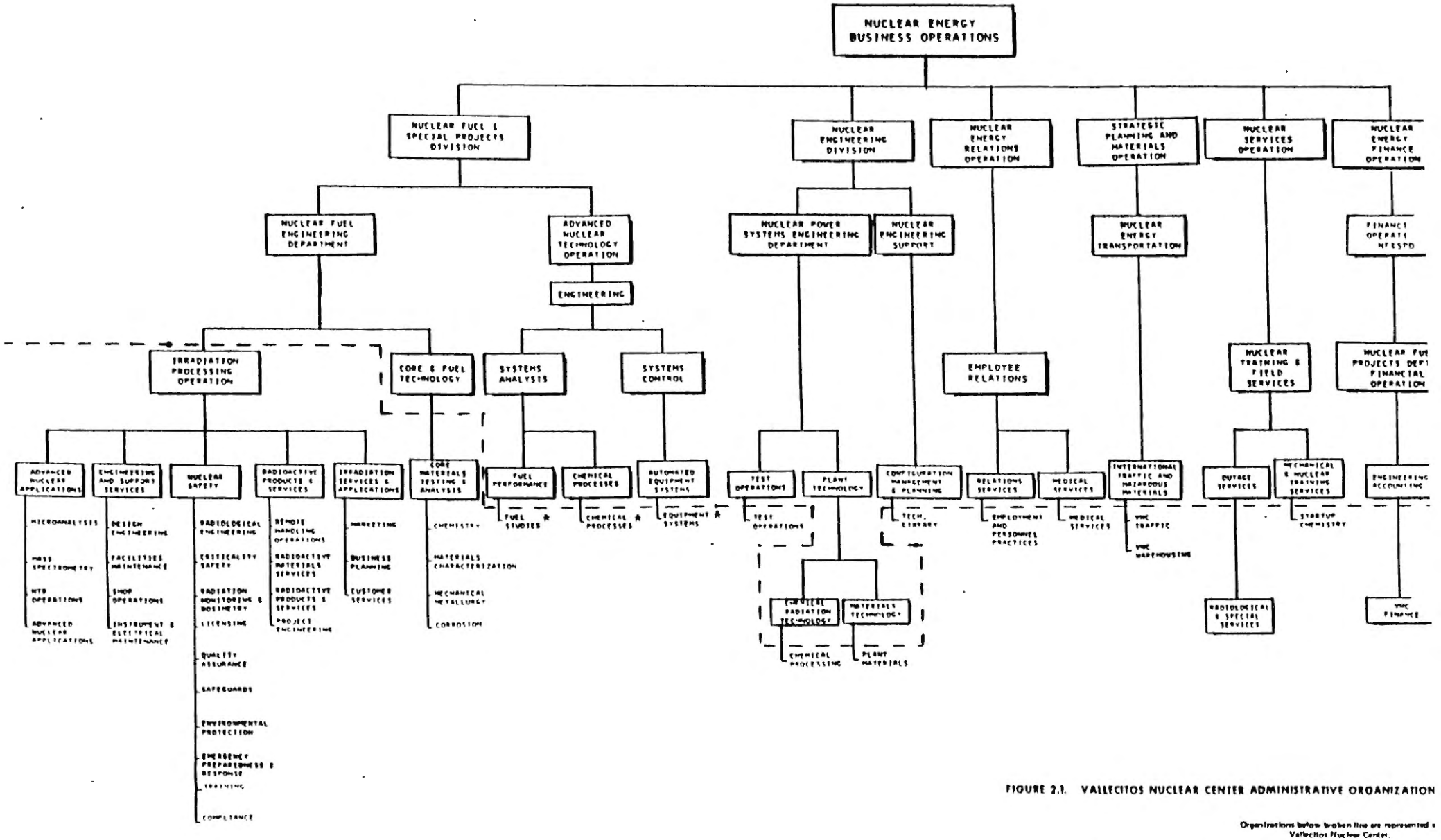

FIGURE 2.1. VALLECITOS NUCLEAR CENTER ADMINISTRATIVE ORGANIZATION

Organizations below broken line are represented at Vallecitos Nuclear Center.

* OCCUPY THE CORE MATERIALS ENGINEERING LABORATORY

License No. SNM-960 Docket No. 70-754 Sect. No. Figure 2.1 Pa

Date 3/28/84 Amends Sect.(s) 2-

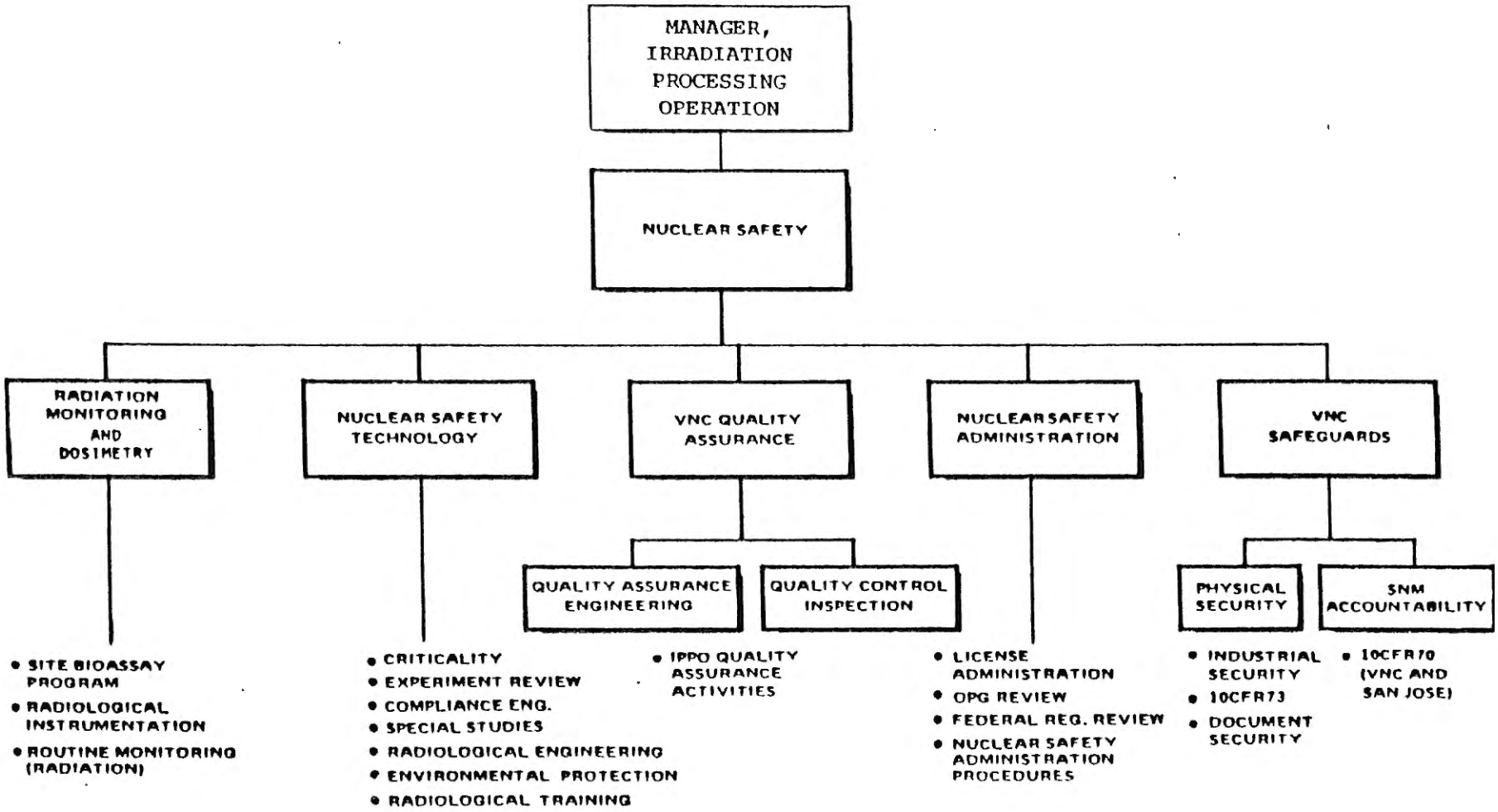

FIGURE 2.2. NUCLEAR SAFETY ORGANIZATION

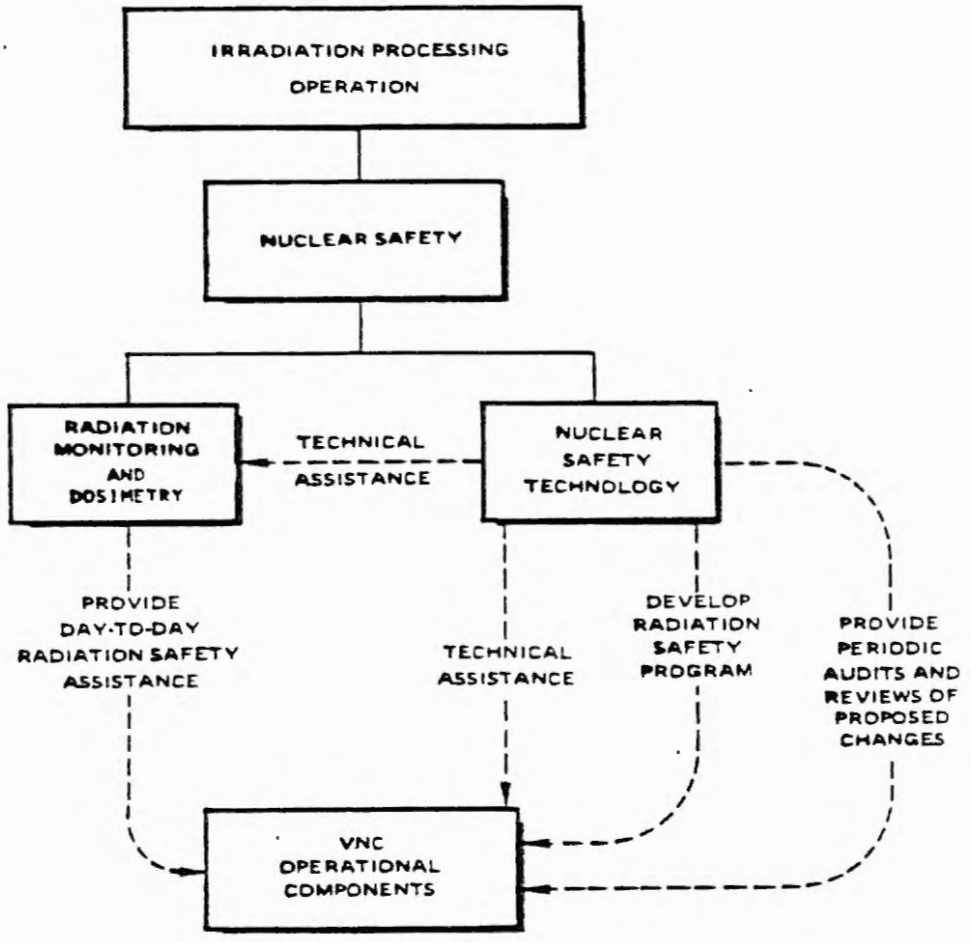

FIGURE 2.3. RADIATION SAFETY STRUCTURE

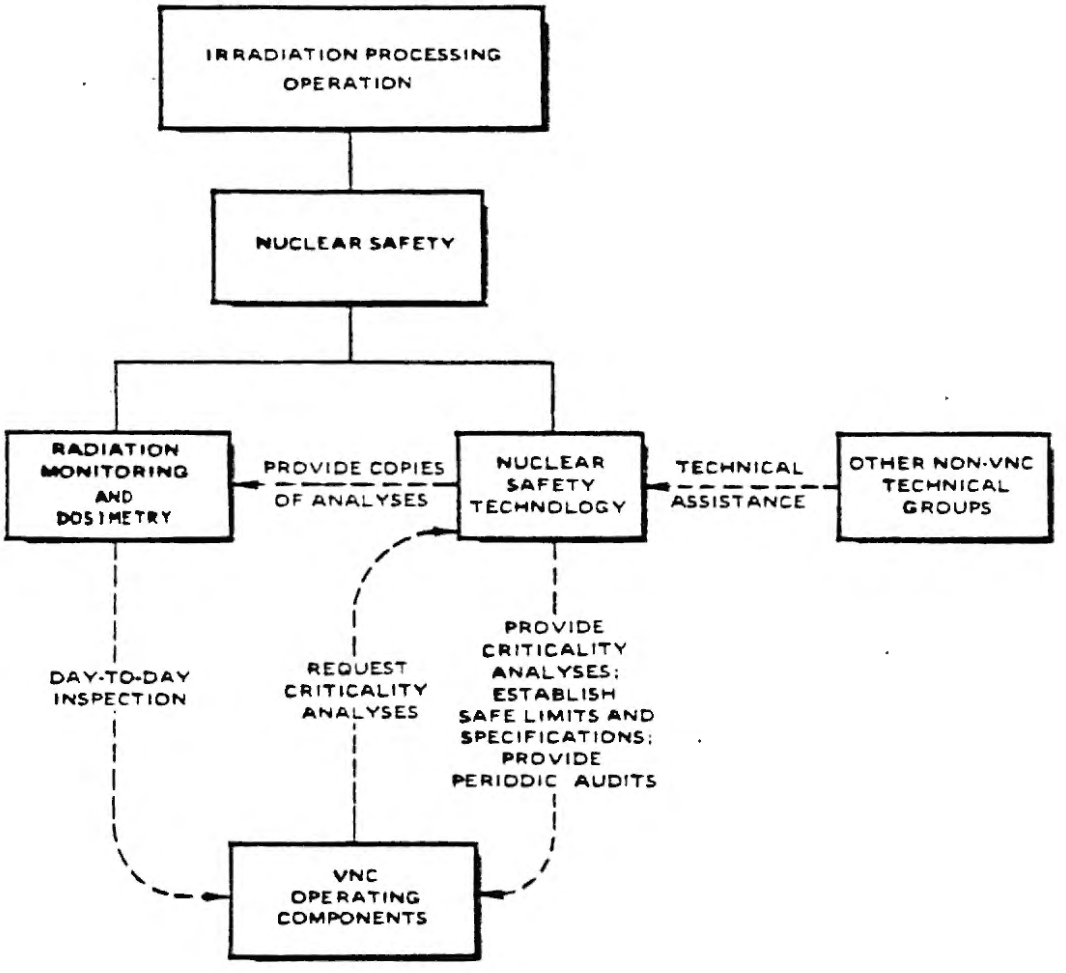

FIGURE 2.4. CRITICALITY SAFETY STRUCTURE

3.9 ANALYTICAL LABORATORY COUNTING EQUIPMENT AND CAPABILITIES

The following is a summary of the normal capabilities of the analytical laboratory counting room for radiation safety samples:

Sample Type	Instrument	Detection Limit*
Air and Exhaust	Alpha Proportional	3×10^{-15} µCi/cc
Stack Samples (Millipore)	Beta Proportional	7×10^{-15} µCi/cc
Charcoal Cartridges (I-131)	NaI(Tl)	2×10^{-13} µCi/cc
Smears	Alpha Proportional	7×10^{-8} µCi
	Beta Proportional	3×10^{-6} µCi
Water (Retention Basin)	Alpha Proportional	3×10^{-8} µCi/cc
	Beta Proportional	5×10^{-8} µCi/cc

*Based on standard sample size and counting times.

4.0 RADIATION PROTECTION PROCEDURES

A system of Vallecitos Safety Standards establishes the site radiation and criticality protection and regulatory compliance programs. The manager of the nuclear safety component issues the standards with review and comment of the managers of the major organizational components located on the site.

Currently, there are about 50 standards dealing with radiation protection matters. The principal features of these are summarized below.

4.1 PERSONNEL WORK RULES

Requirements are established to prevent or minimize the hazards of radioactivity and radioactive materials. Eating, storing, or preparing food is not permitted in radioactive materials areas. Smoking or storing tobacco is not permitted in areas where there is a potential for contamination with radioactive materials. Food containers may not be used for storing or handling radioactive materials.

General Electric furnishes protective clothing for service in areas where contamination is likely to contact personal clothing. Protective clothing standards are set by the site radiation safety function to assure effective quality, positive identification, and to avoid use for other than its intended purpose. The amount and type of clothing for any specific activity is assessed on the basis of potential for personnel contamination.

4.2 LIMITS OF RADIATION IN CONTROLLED WORK AREAS

All Vallecitos locations where there is a potential for radiation exposure are classified (radiation area, high radiation area, etc.) in accordance with the definitions of 10CFR20, Sections 20.202 and 20.203. General Electric's philosophy of protection is to keep radiation exposure at the lowest reasonably achievable level in all cases. Thus, design working limits substantially more conservative than the maximum permissible limits

5.2 MINIMUM CRITICAL QUANTITIES AT ISOLATED LOCATIONS

When only small quantities of special nuclear materials are required at any one time within an isolated facility, accidental criticality hazards are easily and definitely avoided by control of inventory to quantities substantially lower than the minimum quantities of such materials that have been experimentally found to be capable of criticality under optimum laboratory conditions. The literature* gives these minimum critical quantities as approximately:

820 grams U-235
570 grams U-233
531 grams Plutonium

Therefore, on this basis, activities are safe without consideration of factors other than administration of inventory controls to quantities not greater than:

500 grams U-235, or
300 grams U-233, or
300 grams Plutonium, or
any pro-rated combination thereof.

As used in this section, the term "isolated" means physically separated from other areas where special nuclear materials are used. The procedures for accounting for inventories of SNM normally will be under specifically designated custodians. The minimum neutronic isolation barrier is taken as the equivalent of twelve inches of water or a distance of 12 feet, or the greatest distance across an orthographic projection of either accumulation or array on a plane perpendicular to a line joining their centers.

*ARH-600

5.6 ADJUSTMENT FACTORS FOR NORMAL OPERATING CONDITIONS

Criticality analyses shall utilize calculative methods that have been evaluated by the calculation of models of critical experiments of similar geometrical configuration and material content; the maximum negative bias in the multiplication factor, defined as $(-\Delta k_{bias}) = k_{calculation} - k_{experiment}$, determined in the evaluation shall be applied to the analysis as given in the relationship below. The multiplication factor of the accumulation or array of accumulations shall satisfy the relationship:

$$k_{cal} + \Delta k_{uncertainty} + (-\Delta k_{bias}) \leq 0.95$$

where:

k_{cal} is the calculated multiplication factor by the calculative method, and $\Delta k_{uncertainty}$ is the statistical uncertainty (2σ) in the mean value of the calculated multiplication factor, and $(-\Delta k_{bias})$ is the maximum negative bias determined from the validation of the calculative method. If the bias is positive, the $(-\Delta k_{bias})$ term shall not be used, so that over-statements in the multiplication factor shall not be corrected.

Normally, subcritical values of nuclear parameters for individual accumulations under normal operating conditions shall be as shown below. However, in no case shall the multiplication factor exceed 0.95.

1. For accumulations limited by mass, the normally subcritical mass shall not exceed 74% of the critical mass.

2. For accumulations limited by volume, the normally subcritical volume shall not exceed 76% of the critical volume.

3. For accumulations limited by dimension, the normally subcritical cylinder diameter or slab thickness shall not exceed 90% or 88%, respectively, of the critical dimension where U-235 is the fissile constituent, nor 85% in all other cases.

4. For accumulations limited by concentration, the normally subcritical concentration shall be less than that concentration which is equivalent to the following atomic ratios of hydrogen to fissile material: H/U-235, 5200; H/U-233, 7600; and H/Pu (fissile), 7600.

5. Not more than 45% of the critical mass shall be contained in any accumulation in a criticality limit area in which double batching is credible.

Normally, subcritical values of nuclear parameters of interacting accumulations shall be:

1. Not more than 69% of the critical number of accumulations whenever the critical number has been determined by experiment; or

2. Not more than 50% of the critical number of accumulations in any array calculated by the density analog method (Ref: ARH-600); or

3. The number of accumulations determined by the solid angle method as described in TID-7016, Rev. 2, Paragraphs 4.29 through 4.34. The method may be applied only to accumulations that are well moderated (e.g., aqueous solutions) at the point of the maximum multiplication factor, and array reflection must be no more effective than a thick water reflector spaced at distances from the accumulations comparable to the spacing between accumulations.

The operating areas are supplied at rates of 6 to 40 changes per hour. A minimum of 6 air changes per hour is being exhausted from the RML cell spaces. This amount of airflow to the cells is adequate for control of contamination. Air conditioners provide up to 11,000 cfm to the Core Materials Engineering Laboratory facilities.

6.2.3 Pressure and Flow Rates

Small static pressures (-0.01 to -0.03 inches of water) are used in the isolation of thin-walled general work areas, while static pressures from 0.02 to 0.20 inches of water are used to isolate the RML cells. The flow diagram as shown in Figure 6.2 indicates the airflow. Glove box contamination control is effected by maintaining from 0.5 to 1.0 inches of water negative static pressure. At this static pressure, air velocities of 125 linear feet per minute or greater are achieved through openings, an adequate rate to provide the necessary control.

6.2.4 Filtration and Exhaust

The main exhaust equipment is located in Building 102A (Figure 6.1). During regular working hours and any other times radioactive material is handled, four of six exhaust fans are used to provide a normal exhaust flow of 56,500 cfm with the other two fans in a standby status. At other times, two fans are employed. Exhaust air from Building 102 is routed to Building 102A via overhead ducts. At Building 102, this exhaust air is passed through 90 HEPA filters and then discharged to the atmosphere through a 66-inch diameter, 75-foot high stack.

Exhaust air from the RML Hot Cells is prefiltered at the outlet of each cell and is routed to a filter bank of 10 HEPA filters in the Building 102 basement before it joins the main exhaust stream at Building 102A. Two activated charcoal filters are available as needed. Two booster fans (one operating and one on automatic standby) are provided as required to aid in the transfer of the RML Hot Cell effluent from Building 102 to Building 102A.

Exhaust air from the glove boxes and hoods located in the Core Materials Engineering east Laboratory is filtered first through high efficiency filters located on each glove box or hood and then is passed through high efficiency filters in the laboratory exhaust duct before joining the main Building 102 exhaust stream. Exhaust air from glove boxes and hoods located in other CMEL areas is filtered at the glove box or hood. Pressurized glove boxes (which cannot handle plutonium) are not equipped with filters and rely on the building filtration system.

The filter banks and the exhaust connections, at their point of origin, utilize high efficiency filters. The filter system is 99.95% efficient for 0.3 micrometers diameter homogeneous particles of dioctyl sebacate. The filters are constructed of fire-resistant materials and are housed in noncombustible duct work.

The exhaust connections have adjustable dampers where necessary to provide the capability for balancing flows throughout the system.

Figure 6.4 is a schematic diagram of the ventilation exhaust system.

Fire protection is provided to the exhaust system by: (1) a CO_2 suppression system and a water fog system for the Hot Cell basement exhaust filter bank; (2) a water spray system for the Hot Cell charcoal filters; and (3) a water fog spray for the main exhaust ducting from Building 102. None of the water suppression systems can discharge into facilities (e.g., Hot Cells, glove boxes) containing SNM.

6.2.5 Emergency Exhaust

In the event of the loss of utility power, emergency power is provided by a 335 kW diesel-driven electric generator. The generator is activated automatically by power loss and will reach full capacity within 1 minute. All critical equipment normally supplied with normal power through the main building switchboard will be supplied with emergency power. This equipment includes two exhaust fans, fans supplying air to areas where radioactive materials are handled, and the main stack monitoring equipment.

6.5 LIQUID WASTE HANDLING

Sinks and gravity drains in Building 102 radioactive materials areas are routed to a filter which removes particulates. The liquid then is pumped to a 3,000-gallon tank. The tank periodically is emptied, and the waste liquid is sent to the liquid waste evaporator facility to be concentrated, solidified, and transferred to a commercially licensed waste disposal contractor. This liquid waste material contains only minute quantities of SNM.

High-level liquid wastes and those originating from CMEL operations are solidified at the work stations for transfer to the waste contractor.

6.6 EMERGENCY POWER

In addition to the exhaust system as described in Section 6.2.5, the Building 102 emergency generator also provides emergency power to the criticality alarms, the breathing air alarm (loss of pressure alarm), the fire alarms, and an annunciator panel which transmits these alarms to the security building.

7.3.2 High-Level Cells (Hot Cells 1, 2, 3, and 4)

The cell area is the heart of the Radioactive Materials Laboratory as it is here that work on irradiated material is performed. A double or twin cell block for high-level work is located on either side of the south end of the service corridor, constituting a total of four high-level cells. Each of these cells can contain safely in excess of one million curies of 1 MeV gammas. The high-level cell walls are 36 inches thick up to a height of 12 feet, where they are reduced to 24 inches to take advantage of reduced shielding requirements and to provide a set-back for overhead manipulator rails. The shielding material is a high-density concrete made with ferro-phosphorous aggregate with a poured weight of 300 pounds per cubic foot. Shielding in the vertical direction is provided by the 3-foot-thick concrete roof above the cells.

Each cell is equipped with an overhead bridge-mounted manipulator and a 3-ton bridge crane running on the same rails. The units are designed to traverse the entire length of the cell and the radiation lock and can be moved out of the cells on removable extension rails. This equipment provides handling capability for transfer of irradiated materials in heavy shielded casks.

The viewing window at each operating station is a 3-foot-thick, lead glass window with glass of sufficient density (at least 6.2 gm/cc) to give shielding equivalent to the cell wall.

Each of the high-level cells as shown by Figure 7.1 has a 6-foot-long radiation lock for entry from the access corridor. These radiation locks are formed by hydraulically operated bi-parting steel shielding doors. The outer door is 18 inches thick, and the inner door is 15 inches thick. A 3.5-foot-diameter by 9-foot-deep pit is provided in the radiation lock floor to accommodate very large casks and permit long irradiation assemblies to be withdrawn. The access corridor width and floor loading specifications were based on the use of a 15-ton capacity fork lift truck in this area. An intercell transfer system is provided in the common wall between each pair of cells.

A hot shop facility now occupies the former Plutonium Analytical Laboratory (PAL) next to the radiochemistry laboratory. The PAL was surveyed completely (except for the area behind a metal security wall) and decontaminated following the discontinuance of plutonium operations. The area now is used for the repair of contaminated equipment. Only traces of SNM are present in the contamination.

7.3.10 Criticality Alarm Sensors

The Radioactive Materials Laboratory is monitored for criticality accidents by a detector located at the storage pool area entrance (Figure 6.2).

7.4 RML CRITICALITY CONTROL SYSTEM

Special nuclear materials used in connection with RML operations are principally in the form of oxides in irradiated fuel elements and experimental capsules. The spectrum of material and activity types may be quite broad. This required flexibility has been taken into account in the establishment of criticality controls and is reflected in considerably larger safety margins than might be appropriate to more routine or repetitive situations. For example, each CLA in each fuel examination cell is limited to 45 percent of a critical number of units (fuel rods, assemblies, etc.), and each fuel examination cell is limited further so that criticality is not possible if all of the fissile material in the cell comes together simultaneously under conditions of optimum water moderation and full water reflection; but normal activities preclude moderation to any degree, and sources of water to the cells are limited and virtually accident proof. Criticality controls governing RML and supporting activities are described in the following sections.

7.4.1 Receiving

RML work predominates in the post-irradiation fuel examination work but also involves work with various radioisotopes including encapsulations and the examination of experimental fuel capsules. Shielded casks used for SNM shipments or on-site transfers have received criticality analyses demonstrating

their safety either to receive NRC certification or to meet the requirements of License SNM-960.

Quarantine zones in the radioactive materials storage area (Hillside Storage) and the north side of Building 102 are used for incoming shipments from off site awaiting evaluation of the contents. Shipments are spaced according to DoT and NRC requirements.

Casks of irradiated material may be received on the Building 102 dock.

7.4.2 Storage

Irradiated special nuclear materials may be stored in shielded shipping or transfer casks (temporary), in the RML pool, or in the dry pit storage facility. When material is stored in casks, the spacing between casks and the number accumulated in a given area will be consistent with the DoT requirements for safe shipments.

Pool storage is limited to locations which have been analyzed both for the critical parameters of the accumulation of material in each storage location and the interaction between storage of uranium or mixed oxide irradiated fuel rods or fueled experimental capsules. All storage locations are isolated from one another by a minimum of 12 inches of water, and the locations have been analyzed for all varying degrees of interspersed moderation. The fuel rods/capsules stored in each rack are limited to 45% of the smallest estimate of the initial number of pins with consideration given to the fissile composition, pellet diameter, and enrichment. When two or more types of rods/capsules are stored in the same location, the limit for the most restrictive type is used. The pool is further limited so that criticality is not possible even if all the SNM in the pool came together simultaneously.

The dry pit limit is currently 300 grams fissile for each of the 19 positions. Each position has a minimum edge-to-edge spacing of 12 inches. Fuel rods or assemblies are sealed in aluminum waste liner cans similar in design to DoT Specification 2R containers which exclude water in the "as-stored" situation.

There are no credible means for rearranging the tube spacing. If the pit were flooded accidentally, even with optimum moderation within the sealed liner units, the fully loaded facility would be safe since each unit would be isolated by 12 inches of water.

7.4.3 Operations

Criticality controls for the hot cells and for cold limit areas are based on the principal of limiting the quantity of fissile materials in terms of 45% of the minimum critical mass or number of units for each limit area. In determining the minimum critical mass or number of units (e.g., irradiated fuel rods), such factors as the form (e.g., fuel rod, powder, solution), enrichment, and composition of the special nuclear material and the available moderation and reflection are considered.

The limit area control is implemented by an electronic data processing system. A perpetual inventory log is kept for each limit area showing the quantity of fissile material in each unit transferred to and from the limit area.

Each cell is isolated by 36 inches of concrete and from its interlock by a 15-inch-thick steel door.

The analytical services provided to RML by the Radiochemistry Laboratory necessitate only small samples of special nuclear material in the lab area. Simple mass control therefore is established. Not more than 300 grams U-235, nor more than 150 grams U-233 or 200 grams plutonium, are permitted within the confines of the Radiochemistry Laboratory at any time. If mixtures of these fissile isotopes are present, the lowest limit applicable is the limit for the entire laboratory.

7.4.4 Waste Disposal

Upon completion of hot cell work, fuel-bearing materials and components are sealed in prenumbered waste liners and removed to one of the storage locations described above and in accordance with the criticality control limits of the storage location or transferred to the Hillside Storage location in a shielded cask.

Other forms of waste materials are handled in previously described Building 102 liquid waste and ventilation systems.

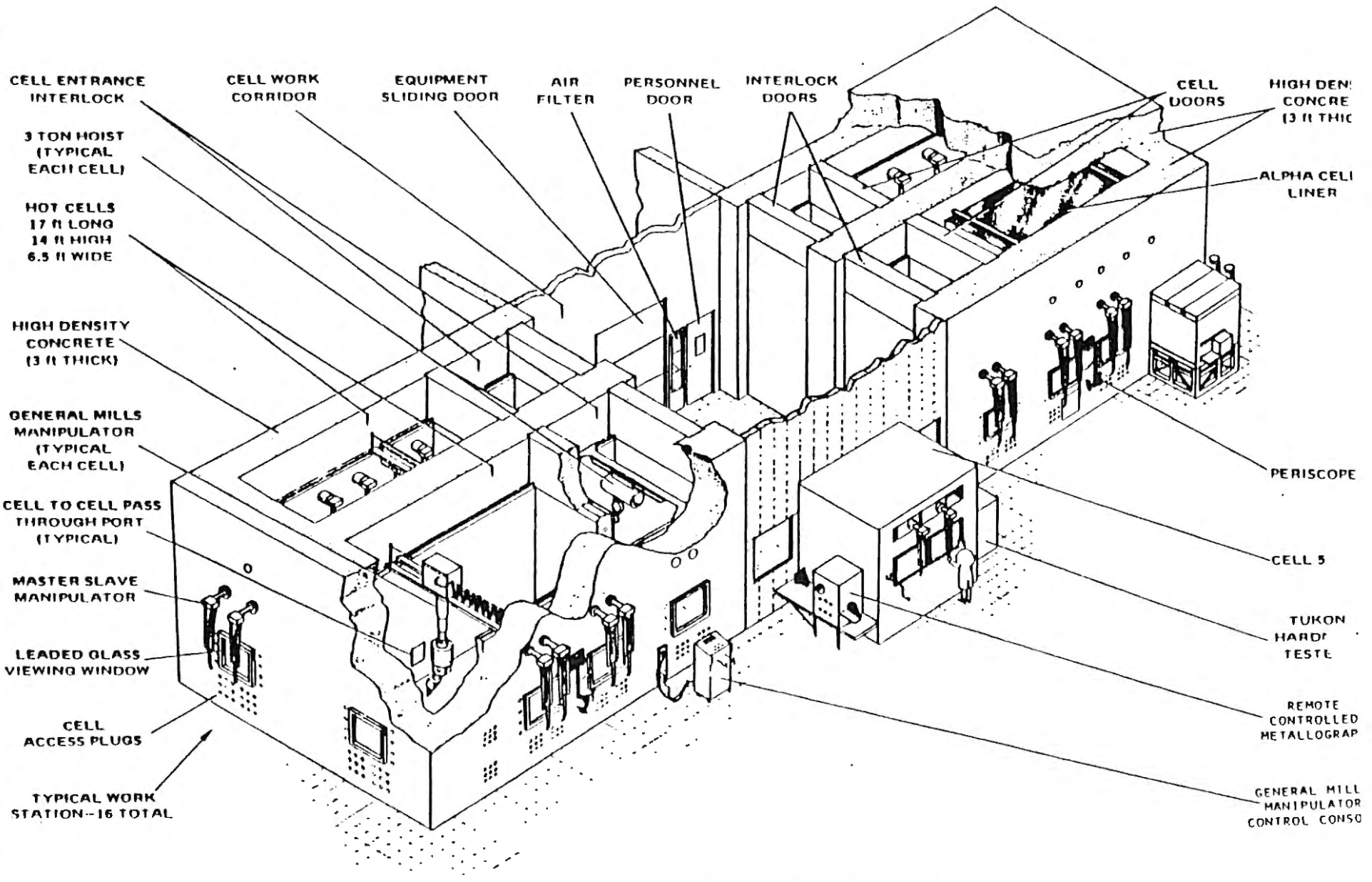

FIGURE 7.1. RADIOACTIVE MATERIALS LABORATORY HOT CELLS

sebacate (DOS). Air from the high bay area also is exhausted through high-efficiency filters. Airflows are shown by arrows in Figure 8.1.

From the individual filters the effluent air is collected in a central duct and exhausted through a 45-foot high stack after passing through a bank of up to 24 HEPA filters (normally, 18 filters are used). This exhaust operates at approximately 16,000 cubic feet per minute. If the primary exhaust system fails, 4,000 to 6,000 cubic feet per minute is available through a backup emergency exhaust system. This system has its own 45-foot high stack with a bank of six high-efficiency filters.

8.3.5 Radioactive Waste Facilities

Dry contaminated waste materials generated in the PC&RTL are packaged as described in Section 3.5.1 and transferred to the site radioactive material storage facility (Hillside Storage).

Liquid wastes containing only trace quantities of SNM are collected in a 1,000-gallon waste tank (Figure 8.1). The tank is emptied periodically and the contents transported in the portable site transfer tank to the site liquid waste evaporator.

Liquid wastes containing accountable quantities of SNM and liquid organic wastes are solidified at the PC&RTL for transfer to the site radioactive material storage facility.

8.3.6 Criticality

Building 400 meets the requirements of a subcritical area as defined in Section 3.14 of Appendix A to License SNM-960.

12.0 BUILDING 105

12.1 LOCATION AND GENERAL DESCRIPTION

Building 105 is located immediately north of the 102 Building in the 100 Area (Figure 6.1). The building houses facilities licensed pursuant to 10 CFR Part 50 associated with the Nuclear Test Reactor (NTR) and the Advanced Nuclear Applications Laboratory (Figure 12.1).

12.2 NTR FACILITIES

The Nuclear Test Reactor (NTR) is licensed pursuant to 10CFR50 (License R-33). SNM licensed pursuant to License SNM-960 is taken to the NTR North Room or the NTR South Cell (Figure 12.1) primarily for purposes of neutrographic examination. Such material is in the form of sealed units, and only one safe batch (< 45% of the minimum critical accumulation) is permitted in the North Room or South Cell at any one time. The materials are handled pursuant to the safety provisions and requirements of License R-33.

12.3 OTHER LABORATORY AREAS (ADVANCED NUCLEAR APPLICATIONS)

Other laboratory areas in Building 105 use SNM only as sealed sources, standards, foils, or as electronic components under general license and only in gram quantities.