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TABLE 1.3-1 (Continued) Specific Locations of Authorized Activities

Location	SNM	Authorized Activity	Rev.
WUR Bldg.	Uranium Compounds (Up to 5 w/o U-235)	Mechanical operations involved in recovering uranium from solid wastes.	3
Packaged Radioactive Materials Storage Bldg.	Uranium Compounds (up to 5 w/o U-235)	Storage of closed, & externally free of significant contamination, containers, of product, scrap and waste materials.	
Materials Warehouse	UO_2 (up to 5 w/o U-235)	Storage of closed and sealed containers of UO_2 powder, pellets and fuel rods.	
Special Enriched Uranium Storage Trailer	UO_2 (5 to 19.99 w/o U-235)	Storage of closed containers of UO_2 powder which are externally free of significant contamination.	
Laundry Facility	Uranium Compounds (up to 5 w/o U-235	Dry-cleaning of contaminated protective clothing and equipment.	
UF_6 Cylinder Storage Areas	UF_6 (up to 5 w/o &-235)	Outside storage of UF_6 cylinders (full and empty).	
Packaged Fuel Storage Areas	UO_2 (up to 19.99 w/o U-235)	Outside storage of fuel packed for shipment; the transport containers are closed, sealed and properly labeled for shipment.	
Packaged Waste Storage Areas	Uranium Compounds (up to 19.99 w/o U-235)	Outside storage of packaged contaminated materials; the outer containers are DOT Specification containers, and they are closed, and adequately sealed and labeled.	

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FIGURE 2.3-2 APPROVAL & RESPONSIBILITY MATRIX

A - Prepare/Primary Responsibility
B - Approve/Accept/Concur
C - Implement/Execute
D - Inspect/Audit

A primed letter (e.g., A') signifies that the respective individual is responsible for the respective function only as it relates to his area of responsibility.

	Vice President & Executive-In-Charge Fuels Manufacturing	Manager, Manufacturing	Plant Managers	Manager, Manuracturing Engineering	Manager, Facilities & Equipment Engineering (ELO)	Manager, Maintenance	Manager, Auxiliary Operations	Manager, Plant Security	Industrial Safety Component	Plant Criticality Safety Engineer	Supervisor, Radiological Safety	Health Physics Technicians	Manager, Fuel Development & Testing(ET)	Manager, Logistics	Manager, Corporate Licensing & Compliance Department	Manager, Licensing & Compliance Operating Facilities	Health Physics Component	Criticality Safety Component	Nuclear Criticality Safety Specialist			Rev.
Position Responsibilities & Authorities	B	A'			A'								A'	A'	A'/B							
Position Professional Requirements		B'	A'	A'	A'	A'	A'						A'	A'	A'/B							
Radiation Protection Standards	B	B	B								C			B	B	B	A/C/D					
Radiation Safety Operating Procedures		B					B				A	C		B		B	D					
Radiation Work Procedures			B'/C'		B'/C'	B'/C'					A/D	D	B'/C'	B'/C'		B	D					
Nuclear Crit. Safety Bases & Criteria	B														B			B/C	A			
Nuclear Crit. Safety Standards	B	B	B							C/D					B	B		A/C/D	B			
Nuclear Crit. Safety Analyses										C								A/D				
Criticality Safety Specifications		B'	B'		B'					A/D			B'	B'		B		B/D				
Rad. & Crit. Safety Insp./Audit Programs							B'			A'/C	A'	C'				B'	A'/C	A'/C'				
Operating Procedures		B'	A'/C'		A'/C'								A'/C'	A'/C'								
Rad. Waste Treat. & Disposal Programs	B	A'	C'		A'/C'						D	D	A'/C'		B	B	D					
Environmental Surveillance Program	B														B	B/D	A/C					
Emergency Plan & Procedures	B	B	C'	C'	B'/C'	C'	A		C'		C'	C'	B'/C'	C'	B							
Access Controls		B'	A'/C'		A'/C'			A'/C'			D	D	A'/C'	A'/C'	B	B						
Training Programs		B'	A'/C'		A'/C'	A'/C'	B'	A'/C'	A'/C'	A'/C'	A'	C'	A'/C'	A'/C'			D'	D'				
Process & Equipment Changes		B'	B'	A'/C'	A'/C'	C'/D'			B'/D'	B'/D'	B'/D'	D'	A'/C'			B	B'	B'				
Process Test Authorizations		B'	B'	A'/B	B'		B			B'/D'	B'/D'	D'	B'			B	B'	B'/D'				3
Incident Investigations & Reporting	A	B'	B'		B'								B'	B'	B	B						
Records			A'	A'	A'	A'	A'	A'	A'	A'	A'	A'	A'	A'		A'	A'	A'				

3.2.2 Technical Practices

Wherever practicable, nuclear criticality safety will depend as little as possible upon decisions or actions of personnel, especially for routine activities. This normally means processing in geometrically favorable equipment insofar as practicable. The following general criteria form the bases for the Exxon Nuclear criticality safety controls and procedures.

3.2.2.1 Double Contingency Policy

Process and equipment designs and operating procedures incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent errors, accidents, equipment malfunctions, or changes in process conditions before a criticality accident is possible.

3.2.2.2 Limits on Maximum Multiplication Factors

The k_{eff} to be used as the permissible upper limit for single units or multi-unit arrays at the worst foreseeable accident conditions, including appropriate allowances for uncertainties in the data and methods used to demonstrate safety, is defined as follows: 3

a) Where reliable experimental data exists for closely similar systems and adequate calculational techniques exist for relatively small extrapolation of data, k_{eff} shall not exceed 0.95 at the 95 percent confidence level.

b) If limited experimental data exists for a similar system and relatively large but reasonable extrapolations are necessary, or where calculational methods compare less favorably with experimental data the k_{eff} of the system shall not exceed 0.90 at the 95 percent confidence level.

3.2.2.3 Geometry

Wherever practicable, reliance is placed on equipment designs which physically limit the dimensions of units containing special nuclear material.

Safe dimensions may be established by utilizing the following safety factors:

a) The k_{eff} of the unit may be established by using the guidelines given in Section 3.2.2.2.

b) Critical dimensions multiplied by the applicable safety factors given in Tables 3.2-1 and 3.2-2.

Where applicable, dimensional limitations include an allowance for fabrication tolerance and/or potential dimensional changes from corrosion or mechanical distortion. 3

3.2.2.4 Neutron Absorbers

Criticality safety may be assured through the use of fixed neutron absorbers, such as cadmium, boron, etc., provided that:

a) Neutron absorbers are designed and fabricated as an integral part of the equipment.

b) Inspections to verify the continued integrity of the equipment and neutron absorber structure are performed on established time frequencies sufficient to insure their affectiveness. Results of these inspections, and the basis for the inspection frequencies are recorded and audited.

c) Viable alternatives to the use of fixed neutron absorbers to assure criticality safety do not exist.

3.2.2.5 Concentration Control

Reliance for primary criticality control may be placed on concentration controls in areas where geometry control is not practicable, and where the nature of the process and operations make violation of the concentration limit unlikely even after failure of any single control. Concentration control may be applied to both overmoderated and undermoderated accumulations of material as described below.

3.2.2.5.1 Concentration Control - Solutions

The concentration of fissile material dispersed or dissolved in another medium may be limited to prevent criticality, provided that:

a) The permitted concentration of fissile material in solution shall be equal to or less than fifty percent of the minimum critical concentration in the vessel.

b) The k_{eff} of the system at the maximum allowable concentration shall be limited by using the guidelines given in Section 3.2.2.2.

c) For individual tanks (non-geometrically safe) using concentration control, the mass shall be limited such that k_{eff} is limited by the guidlines given in Section 3.2.2.2 for the maximum uranium mass accumulated in the tank under the worst conditions attainable by inadvertent concentration of the fissile material. For large storage systems where concentration of the fissile material is not a credible condition, or where administrative practices are implemented to prevent concentration of the fissile material, the above requirement may be disregarded.

3.2.2.5.2 Concentration Control - Powders and Pellets

The concentration of hydrogenous material within the fissile material may be limited to a small percentage by weight of the fissile material (moderation control) to prevent criticality, provided that:

a) The permitted concentration of hydrogenous material shall be equal to or less than fifty percent of the critical concentration for the system in question; and

b) The maximum reactivity of the system full of the material in question, under the worst credible accident conditions, shall be limited by the guidelines given in Section 3.2.2.2; and

c) Where practicable, the material shall be contained within a fireproof barrier or in a process area containing limited sources of hydrogenous material. In the absence of a fireproof barrier, special controls shall be used to prevent fires and to control the use of moderators in fire fighting in such process areas.

3.2.2.6 Multi-Unit Arrays

The spacing between units within an array is limited by mechanical means such that the following requirements are met.

a) The k_{eff} of the array under the maximum credible accident conditions shall be limited by the guidelines given section 3.2.2.2.

b) For multi-unit arrays where k_{eff} is not used as a basis, the number of units in the array shall not exceed 50 percent of the calculated critical number.

The mechanical design of equipment or storage arrays in which deformation or rearrangement could result in the loss of a contingency, shall be reviewed by a person competent in mechanical engineering.

3.2.2.7 Criticality Safety Parameters

A) Criticality Data

Critical parameters used to establish primary criticality safety limits shall be based on one or more of the following (see Section 3.2.2.8 for sources of data currently acceptable to Exxon Nuclear):

1) Criticality parameters obtained directly from experimental measurements.

2) Criticality parameters derived from experimental measurements.

3) Theoretical calculations using methods shown to be accurate by validation according to Regulatory Guide 3.14, "Validation of Calculational Methods for Nuclear Criticality Safety."

B) Enrichment Levels

Design isotopic compositions shall be established and appropriate criticality safety controls implemented to assure conformance with the respective fissile element composition prior to initiating respective activities.

Normally, equipment is designed to assure criticality safety by geometry control. Where batch control is utilized, enrichment level or other isotopic composition limits are clearly posted at the respective equipment or location.

C) Moderation

Critical parameters shall be based on optimum water moderation unless other than optimum moderation can be assured under both normal and credible abnormal conditions. If used in conjunction with other primary criticality safety parameters, the hydrogen-to-fissile atom ration shall be maintained such that the resulting k_{eff} of the unit shall be limited by the guidelines given in Section 3.2.2.2.

D) Reflection

Critical values shall be based on full water reflection unless less-than-full reflection can be assured under both normal and credible abnormal conditions. Consideration shall be given to other reflectors in the immediate vicinity which could result in a reactivity greater than that for a water-reflected system.

E) Neutron Interaction

Neutron interaction (exchange between individually subcritical units shall be considered. Consideration of the interaction between units or arrays of special nuclear material may be accomplished through the use of the Solid Angle method.

The Solid Angle method is applied according to the constraints in the "Nuclear Safety Guide." TID-7016, Rev. 2, except for the use of the nominally reflected solid angle acceptance criteria. The nominally reflected solid angle acceptance criteria is used to limit the allowable solid angle for arrangements of individually subcritical units provided that:

1) Boundary conditions for the spacing between concrete walls and the array are as stated in Table 1 of Reference (b'), except that a minimum separation of six (6) inches shall be required;

2) Concrete walls are $\leq$ seven (7) inches in thickness;

3) Separation distances given in Table 1 of Reference (b') are measured from the outermost vessel in the array to the closest wall;

4) The array shall be limited in both number and size of vessels to arrays that are reasonable extrapolations of the conditions assumed in Reference (b'); and

5) All vessels within the array shall be subcritical when fully reflected by water and shall have a minimum edge-to-edge separation of twelve (12) inches.

For arrays that violate any of the five (5) conditions stated above, | 3
additional analyses will be necessary to (1) demonstrate the

safety of the particular array in question, or (2) demonstrate the continued acceptability of using the nominally reflected solid angle acceptance criteria.

The above methods will have been validated according to Regulatory Guide 3.14, "Validation of Calculational Methods for Nuclear Criticality Safety".