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1	1	Cog.Eng. J. Lee Geiger	[signature]	1995 May 30	H4-64	L. H. Rodgers	[signature]	5-30-95	T5-54	1	1
1	1	Cog. Mgr. A. L. Ramble	D.S. Leach for ESM 5-26-95		H4-64						
		QA N/A									
1	1	Safety S. E. Nunn	[signature]	5-30-95	T3-01						
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1	1	Peer Review T. Chiao	Tony Chiao	5/25/95	H4-64						
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7. Abstract

This CSER covers the operation of the vertical denitrating calciner system at PFP. Criticality safety is achieved by using favorably sized and spaced equipment and by limiting the quantity of feed and product allowed in the calciner glovebox. Because the surrounding insulation can absorb water and act as a reflector, a limit of 7 kg is placed on the fissile material contained in the calciner, together with a limit of 2.5 kg in the filter section of the calciner.

8. RELEASE STAMP

CONTENTS

FIGURES

TABLES

LIST OF TERMS

1 pound can	A standard size slip-lid metal can used at Hanford, part number 42-1500-300.
k_{eff}	The effective neutron multiplication constant. The number of neutrons in one generation divided by the number in the previous generation. A system with k_{eff}=1 is critical.
PFP	The "Plutonium Finishing Plant," Building 234-5Z and supporting buildings. PFP once produced plutonium metal.
$^w/_o$	"Weight Percent." One hundred times the mass of the component, divided by the total mass.
$^v/_o$	"Volume Percent." One hundred times the volume of the component, divided by the total volume.

CSER 95-005

Prepared by: ______________________ Date: 1995 May 25
J. Lee Geiger Consequence Analysis

Reviewed by: ______________________ Date: 5/25/95
Allen L. Hess Consequence Analysis

Reviewed by: ______________________ Date: 5/25/95
Tang Chiao Consequence Analysis

Approved by: ______________________ Date: 5/25/95
Dirk S. Leach Consequence Analysis

1.0 INTRODUCTION AND SUMMARY

The Vertical Denitrating Calciner system will stabilize certain unique solutions containing fissile salts by removing the water and nitrate ion to produce a more easily stored powder. This end is achieved by high-firing the solution in the calciner. The resultant calcine is distinguished by particles which are larger and denser than those produced by the more conventional oxalate precipitation process.

This criticality safety evaluation report examines criticality safety for the denitration system, installed in glovebox 188-1 at PFP. The examination shows that, due to the incorporation of standard criticality safety design techniques, the glovebox can be maintained subcritical with minimal reliance on administrative controls. The examination also shows that, ignoring the necessary administrative controls can make a criticality possible in glovebox 188-1. Section 3.0 of this report lists the necessary administrative controls.

2.0 DESCRIPTION OF THE VERTICAL DENITRATING CALCINATION SYSTEM

The denitrating calcination system resides in the old 34-1 glove box at the Plutonium Finishing Plant (PFP), which has been renamed 188-1. The process begins when a 1-gallon, nominal (4 ℓ) polybottle of solution is bagged into the glove box. The solution is then poured into the feed tank. A diaphragm pump slowly transfers the solution from the feed tank into the calciner. The calcine produced by the calciner drops into the product receiver. After transferal into a loadout can, the calcine is bagged out of the glove box. The off-gases (water vapor, nitrogen oxides, and air drawn into the calciner from the glovebox) are drawn through filters to the scrub tank. In the scrub tank, which operates at a negative pressure, the gases bubble through a chilled basic solution. The chilled solution condenses water vapor and removes nitrogen oxides from the off-gases. The scrubbed gases pass through the building vacuum system. The overflow from the scrubber flows to one of the catch tanks, from which the spent scrub solution is transferred out of the glove box.

Because this system is built in an old glovebox in an old facility, exemption has been obtained from the requirement to use metric units in the design documents. Accordingly, this report regularly gives customary units first for dimensions derived from design documents. In other cases, metric units are given first.

2.1 THE GLOVE BOX

Glovebox 188-1 at PFP is described in drawing H-2-33764. The main section of the glovebox measures 8 ft (244 cm) long by 3 ft-8 in. (112 cm) wide by 6 ft-11 in. (211 cm) high. At one end, there are two narrower sections, 3 ft (91 cm) wide by 3 ft-1 in. (94 cm) long. The upper narrower section (mezzanine) is 2 ft-9 in. (84 cm) tall with a ceiling continuous with the main box. The lower narrow section (annex) is 3 ft (91 cm) tall, with a floor continuous with the floor of the main box. There is an intermediate floor in the main section, 5 ft-10 in. (178 cm) below the ceiling.

To protect against spills, the glovebox contains a bottom-mounted criticality drain, described in H-2-28536, as changed by ECN-125369 and ECN-185589. This 3-in. (7.6-cm) drain projects 2 in. (5 cm) into the glovebox, limiting the depth of liquid to no more than 5.1 cm during normal operation.

Figure 1 illustrates the glovebox.

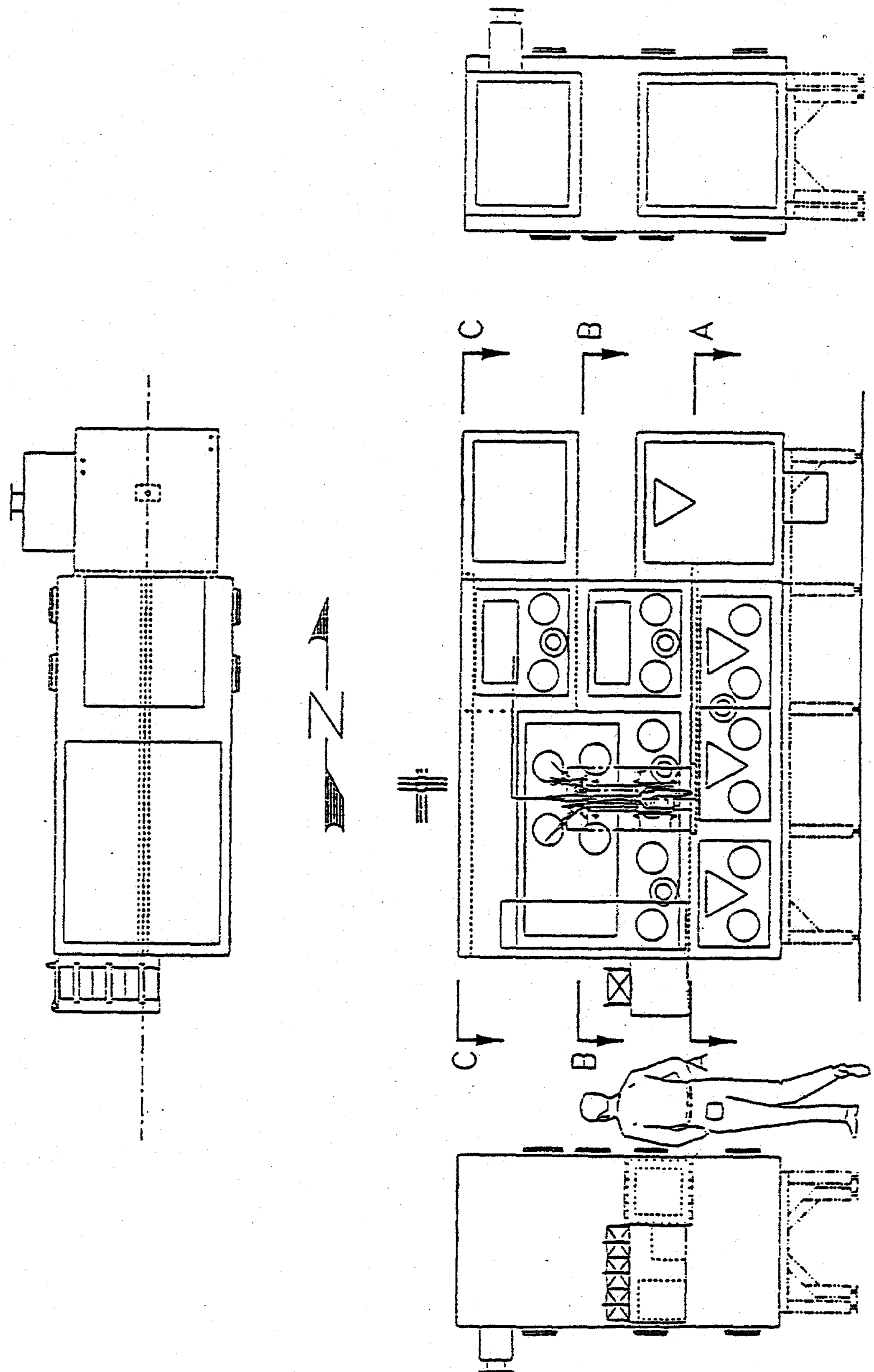
2.2 THE FEED POLYBOTTLE

The feed is contained in the 4.2-ℓ (nominally 1-gal.) polybottles described in Hess, 1994. The polybottle has an outer diameter of 6.0 in. (15.2 cm) and an effective height of 10.5 in. (26.7 cm) up to the bottom to the outlet neck. According to Appendix A, item 8 of Hess, 1994, the inside cross sectional area of the polybottle is 425 g water/inch, and the tare weight is 420 g low density polyethylene. The feed polybottle can be moved around the glovebox freely.

2.3 THE FEED TANK

The feed tank is made from a 12 in. (30.48 cm) section of 6-in. borosilicate glass pipe (inside radius of 7.856 cm, wall thickness of 0.502 cm). The top of the tank is open. The contained volume of the feed tank is 6 ℓ (6 qt). The feed tank is mounted on the intermediate floor of the glovebox, at a distance of at least 16 in. (40 cm) from both the calciner and the scrubber.

Figure 1: Perspective views of Glovebox 188-1 showing Location of Calciner



2.4 THE DIAPHRAGM FEED PUMP

The solution is fed from the feed tank into the calciner by a Milton Roy Liquid Metronics Division series C electronic metering pump. According to the drawings in the catalogue, the liquid end has a diameter of 5.76 in. (14.63 cm) and a thickness of 2.1 in (5.3 cm). The feed pump is located on the bottom floor of the glovebox.

2.5 THE VERTICAL CALCINER

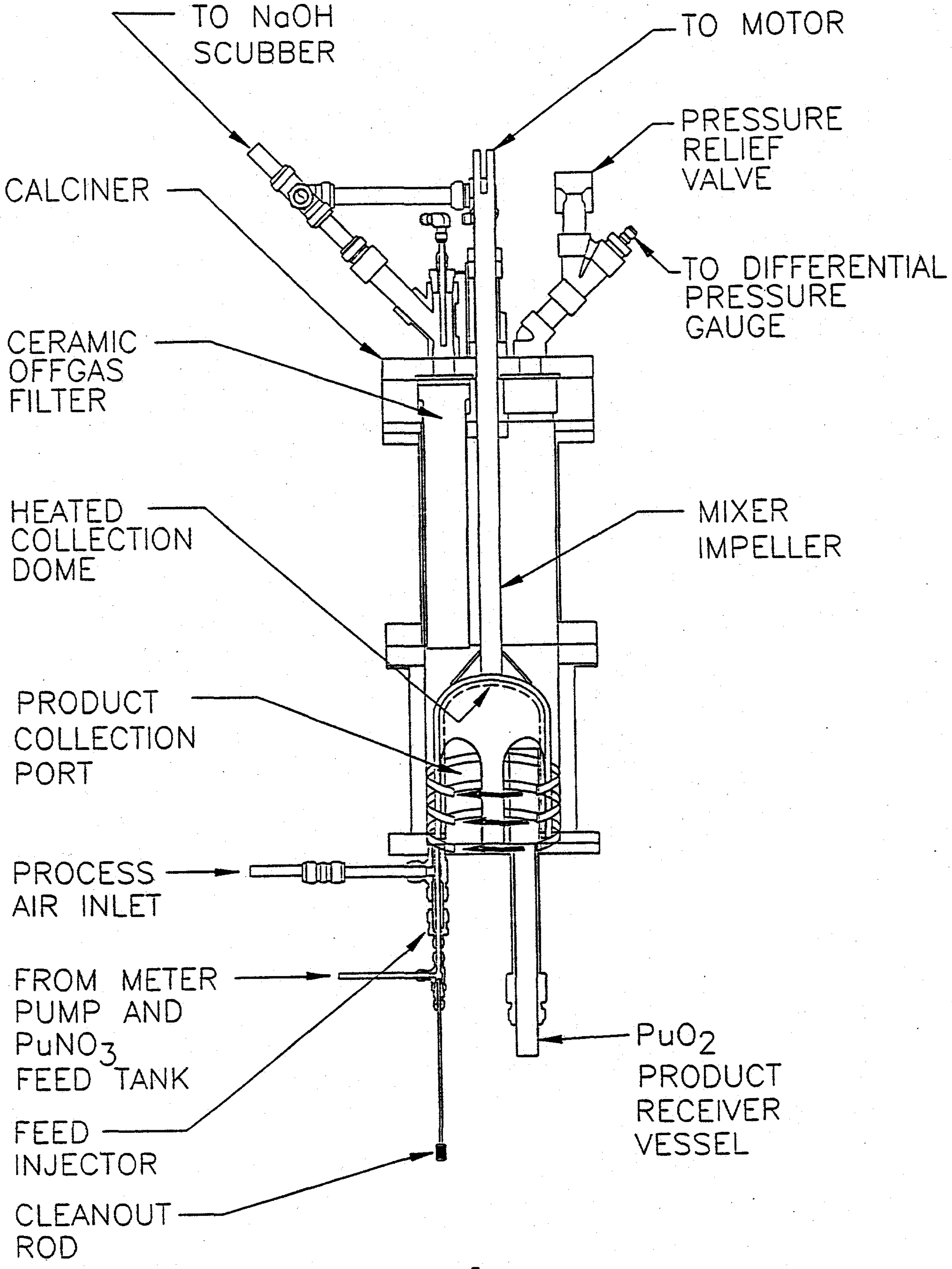
Due to the high temperatures employed in the calcination process and the presence of nitrates and nitrogen oxides in the off gases, the structure of the calciner is made of 310 stainless steel. The calciner consists of two functional units, bolted together to form a continuous void space. The lower calcining section should normally be the only part of the calciner with any significant quantity of calcine in it. The upper filtration section houses the off-gas filters. A stirring assembly in the lower calcining section is driven via a steel shaft which passes through the center line of the upper filtration section. Figure 2 illustrates the conceptual design of the calciner. The calciner is mounted on the intermediate floor of the glovebox at a distance of no less than 16 in. (40 cm) from both the feed tank and the scrubber. The downcomer penetrates the intermediate floor into the lower section of the glovebox.

2.5.1 The Lower Calcining Section

Calcination is accomplished in an annulus between the inner and outer walls of the lower calcining section. The outer wall is a 9 in. (23 cm) long section of 6-in. schedule 10 pipe made of 310 stainless steel, with flanges on each end. The inner wall is a 4-in. schedule 10, 310 stainless steel pipe with a pipe cap on the top. A stirrer, made of a section of pipe welded to a pipe cap and with several pieces cut out to produce long prongs, agitates the calcine. The top of the stirrer is welded to a power shaft that extends through the upper filtration section. The outer wall is surrounded by a heating element cast in porous insulation. The insulation has an inside diameter of 7-7/8 in. (20 cm), an outside diameter of 15-5/8 in. (39.7 cm), and a height of 8 in (20.2 cm). As described in Appendix E, the insulation is easily saturable with water.

Inside the inner annulus wall are a heating element and a calcine overflow downcomer. The downcomer is made of ½-in schedule 10, 310 stainless steel. The top of the downcomer is capped with a piece of 310 stainless steel plate. Where the downcomer parallels the inner annulus wall, the downcomer is sliced and bent open to form straight rectangular walls, separated by the inside diameter of the pipe. The straight walls are welded to a same-sized rectangular opening in the inner annulus wall. The downcomer protrudes through the bottom of the calciner. A smaller pipe, attached to the product receiver, fits into the downcomer and sets the overflow level for the calciner.

Figure 2: Conceptual Design of Vertical Denitration Calciner



2.5.2 The Upper Filtration Section

Like the lower section, the wall of the upper filtration section is a 6-inch schedule 10 pipe made of 310 stainless and surrounded with water absorbing insulation. A 1-in. (2.5-cm) diameter shaft passes down the centerline of this section to drive the stirrer in the lower section. The pipe is 10 in. (25 cm) long, with flanges on each end. Two plates above the upper flange, each 1 in. (2.5 cm) thick, hold the three silicon carbide filters, which extend the length of the filtration section. In place of a fourth filter is a pressure probe for the filtration section. This pressure is used, together with the indications from the inside of the filters, to determine when the filters are nearly loaded. The loaded filters are back-pulsed to clear them of dust.

2.6 THE SCRUBBER

The off-gas scrubber is a vertical section of 6-in. quartz pipe, filled with an alkaline scrub solution. The scrub solution is cooled by a 36 in. (91 cm) tall cooling coil of 1/2-in. (1.3-cm) diameter 304 stainless with a 0.035 in. (.089 cm) wall. The inside diameter of the cooling coil is 3-7/8 in (9.8 cm); the outside, 4-7/8 in (12.4 cm). The off-gas flows from the top of the scrubber through a pipe and a porous silicious plate into the scrub solution below the cooling coil. The gas bubbles entrain the scrub solution, flow up the inside of the cooling coil, and disengage at the top of the scrubber. The liquid flows down around the outside of the cooling coil. The scrubbed off-gas exits the top of the scrubber. A stand pipe of stainless steel tube (same specifications as the cooling coil) located between the cooling coil and the scrubber outer wall, protrudes 6 in. (15 cm) above the cooling coil and conducts scrub solution overflow out of the scrubber and into the scrub solution catch tanks. The scrubber is mounted on the intermediate floor, no less than 16 in. (40 cm) from both the calciner and the feed tank.

The silicon carbide filters in the calciner should prevent significant fissile contamination of the scrubber. Differential pressure detectors provide automatic system shutoff upon failure of a filter.

2.7 THE SCRUB SOLUTION CATCH TANKS

Each scrub solution catch tank is a 4-ft (122-cm) section of 6-in. borosilicate glass pipe. The axes of the two tanks are aligned along the long axis of the glove box. These tanks are located on the bottom floor, with a minimum of 16 in. (40 cm) between their outer surfaces.

2.8 THE PRODUCT RECEIVER

The product receiver is a 500-ml nominal (1-pt) borosilicate glass reaction kettle. The inside height is 6.0 in. (15.2 cm), and the inside diameter is 3.5 in. (8.9 cm). The glass walls are about 3/16 in. (0.5 cm) thick. The bottom is more rounded on the sides than a standard beaker, but is flat in the middle. The product receiver is removable from the calciner downcomer to allow emptying into the load out container.

2.9 THE LOAD OUT CONTAINER

The load out container for this system is part number 42-1500-300, commonly known as a "1 pound can." a pan located under the calciner includes storage spots for two of these containers to keep their normal spacing at no less than 16 in. (40 cm). Each load out container can, however, be moved freely about the glovebox.

3.0 REQUIREMENTS AND EXEMPTIONS

Except during cleaning operations, only the following containers may be in the glovebox at any one time:

1) in the upper section, either one feed polybottle, whether full or empty (An empty feed polybottle sufficiently perforated to preclude containing solution is not counted as a container);

2) in the lower section, no more than two loadout cans (1 pound slip lid can, part number 42-1500-300).

During cleaning operations, no more than one (1) 4.2-ℓ polybottle or smaller container shall be in the upper glovebox section, and no more than two (2) loadout cans or smaller containers or one (1) 1/2-ℓ (nominal) polyjar shall be in the lower glovebox section.

The plutonium in solutions to be processes shall contain at least $3^{w}/_{o}$ ^{240}Pu, and no more than $1^{w}/_{o}$ ^{241}Pu. The uranium in solutions to be processed shall be enriched to no more than $93.5^{w}/_{o}$ ^{235}U.

The total mass of plutonium and uranium-235 (^{235}U) in the calciner shall not exceed 7 kg. The total mass of plutonium and uranium-235 in the filter section of the calciner shall not exceed 2.5 kg. Other fissile nuclides can be accommodated using the equivalence conversions in WHC, 1994.

Accumulations of fissile material in the glovebox shall be limited to a depth of no more than 3/8 in. (0.95 cm) on the main floor of the glovebox and loadout tray, and no more than 0.3 cm (1/8 in.) of accumulation on the intermediate floor. (Accumulations below these levels will not violate the double contingency principle of criticality safety. Good conduct of operations would require cleaning up spills immediately if operating, or before continuing operations if not operating.)

The 3-in. (7.6 cm) criticality drain in the glovebox shall be maintained in a freely-flowable condition.

4.0 CRITICALITY SAFETY ASSESSMENT FOR SYSTEM COMPONENTS

The criticality safety of the vertical denitration calciner system was assessed using the computer code MONK6B. Appendix A discusses validation of the MONK6B code. This section presents the standard model of the denitrating calcination system, discussing each unit of the system in turn. Appendix B contains an input listing for the standard model. Appendix C presents a study of the effect of changing the location of the fission source in the model. The study, which concluded that the model was rather insensitive to different fission source locations, justifies the source used throughout the criticality safety assessment: a fission source distributed over the fissile material throughout the glovebox.

4.1 CONCENTRATION AND ISOTOPIC COMPOSITION OF THE FISSILE MATERIAL

The fissile material to be processed in this system is variable. Some solutions contain plutonium, with at least 3% ^{240}Pu (Hess, 1994). None of the solutions listed in Hess, 1994, contained more than 1% ^{241}Pu. To help account for additional fissionables and ensure conservativity, the actinide content in these solutions is assumed to be 3% ^{241}Pu and only 2% ^{240}Pu in the standard model. This assumption is highly conservative and yields a plutonium more reactive than could be derived from any un-enriched source.

Other solutions contain predominantly uranium, with enrichments up to 93.5%. Consequently, the system was also assessed with 93.5% ^{235}U (Hess, 1994).

The concentration of plutonium in the feed solution was chosen to minimize the radius of an infinite cylinder of the solution. Graph III.A.4.97-1 from ARH-600 (Carter et al., 1968) provides minima at 135 g plutonium/ℓ unreflected and 145 g plutonium/ℓ reflected for aqueous plutonium nitrate containing 3% ^{240}Pu and no excess acid. Therefore, a concentration of 140 g plutonium/ℓ was chosen for the plutonium feed solution model. Similarly, inspection of pages II.B.1-14 and III.B.4(93.5)-1 of Carter et al., 1968, led to a choice of 300 g uranium/ℓ for the uranium solution model.

4.2 THE GLOVEBOX

The glovebox is modeled as a box of 304L stainless steel, with the dimensions described above. The atomic concentrations listed in Carter et al., 1968 (p. II.F.1-6) are used for this material. Because Carter et al., 1968 (p. II.E-2) shows that reflector savings does not increase with more than 15 cm (6 in) of water, the glovebox is surrounded by a minimum of 15 cm of water. The intermediate floor of the glovebox is assumed to be coated on top with 0.3 cm of plutonium or uranium nitrate. The criticality drain in the bottom of the glovebox limits the static depth of water in the glovebox to 2 in. (5.08 cm). Consequently, the bottom of the glovebox is assumed to be 5.08 cm (2 in.) deep in water, with 0.9525 cm (3/8 in) of plutonium or uranium oxide on the bottom. With these assumptions, the glovebox sump can hold 180 ℓ of solution (with no calcine) or 144 ℓ of liquid on top of the mud. A layer of calcine 3/8 in deep would contain 168 kg of plutonium or uranium.

The plutonium model yielded 658 ± 15 neutrons produced in the nitrate layer and 3365 ± 71 in the submerged oxide per 10,000 source neutrons. For the uranium model, the production rates were 490 ± 12 in the nitrate layer and 3325 ± 58 in the submerged oxide layer. The nitrate layer on the intermediate floor therefore contributes little to the reactivity of the glovebox. The assumed inventory on the glovebox floor, however, contributes more than one-third of the reactivity in the standard model.

4.3 THE FEED POLYBOTTLE

The feed polybottle is described on page 28 of Hess, 1994. The outside diameter is given as 6 in. The inside dimension is expressed as 425 g of water per inch of height. Assuming 1 g of water takes up exactly 1 cm^3, the internal radius of the container is 7.298 cm (2.873 in), and the wall thickness is 0.322 cm (0.127 in). The completely full volume of the polybottle is given as 4.20 ℓ. Assuming the inside is perfectly cylindrical, this gives a solution cylinder height of 25.101 cm (9.882 in). Assuming a constant wall thickness, the outside height of the polybottle is 25.745 cm (10.136 in), and the wall volume is 496 cm^3 (1.05 pt). The tare mass of the polybottle is given as 420 g, which yields a density of 0.846 g/cm^3 - a reasonable value for low density polyethylene.

Accordingly, the polybottle is modeled as two concentric cylinders, with an inner cylinder of solution 25.101 cm tall with a radius of 7.298 cm, surrounded by a low density polyethylene cylinder 25.745 cm tall with a radius of 7.620 cm. The concentrations of carbon and hydrogen in the polyethylene are taken as 0.036333 and 0.072666 nuclei/barn-cm, respectively.

With a volume of 4.2 ℓ, a polybottle would hold .59 kg of plutonium or 1.26 kg of uranium, assuming worst-case solutions. To maximize the reactivity contribution of the polybottle, the standard model, assumes it touches both the feed tank and the outer surface of the insulation surrounding the calciner.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 115 ± 12 in the feed polybottle. The uranium model yielded 100 ± 14. These production rates show that the fissile material in the feed polybottle contributes negligibly to the reactivity of the glovebox.

4.4 THE FEED TANK

The feed tank is a 6 ℓ nominal capacity (6 qt) cylinder of borosilicate glass, consisting of a standard sized 6 in. diameter, 12 in. long pipe. This translates into an inside radius of 7.856 cm, a wall thickness of 0.502 cm, and a height of 30.480 cm. The feed tank is open at the top. The wall composition is taken from page II.F.1-6 of Carter et al., 1968. The design drawing shows the pipe sitting on a slab of polyvinyl chloride 1 in. thick. This slab is modeled as a disk of polyvinyl chloride, 2.54 cm thick with a radius of 13.970 cm.

With a volume of 5.9 ℓ, the feed tank can hold .8 kg of plutonium or 1.8 kg of uranium.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 98 ± 11 in the feed tank. The uranium model yielded 142 ± 19. The fissile material in the feed tank therefore contributes negligibly to the reactivity of the glove box.

4.5 THE DIAPHRAGM FEED PUMP

Information on the feed pump is rather scanty. The manufacturers catalogue gives dimensions for the largest diaphragm chamber only, while noting that some pumps are smaller. Accordingly, the pump is modeled at the maximum size: a fissile solution cylinder with a diameter of 7.315 cm and a horizontal axis of 5.334 cm. This corresponds to a volume of 0.9 ℓ, with a worst-case holdup of .13 kg of plutonium or .27 kg of uranium.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 17 ± 3 in the feed pump. The uranium model yielded 20 ± 3. The fissile material in the feed pump therefore contributes negligibly to the reactivity of the glove box.

4.6 THE VERTICAL CALCINER

The model of the calciner closely matches the description in section 3. Notable departures are the filters (which are modeled as solid silicon carbide instead of porous), the calcining region (which is filled with calcined powder and does not include the mixer), and the inside plug of the annulus (which is left empty of everything, including the heating element). The filtering segment of the calciner is modeled as surrounded with 7.62 cm (3 in.) of water-saturated 10% alumina-and-silica insulation, with the physical and chemical properties of the calcining section insulation. The calcined powder is assumed to be pure fissile oxide (PuO_2 or UO_3), with a density of 5 g/cm^3 of plutonium or uranium.

The filtering section of the calciner has a volume of 4.2 ℓ available to calcined powder, and can therefore contain 21 kg of actinide at 5 g/cm^3. The calcination section has an available volume of 2 ℓ and a capacity of 10 kg. Therefore, the calciner can hold a total of 31 kg of calcined actinide.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 523 ± 51 in the calciner. The uranium model yielded 86 ± 10. These low contributions to total reactivity show the effect of low moderation on even significant quantities of fissile material.

4.7 THE SCRUBBER

The silicon carbide filters should keep fissile material out of the scrubber. Nevertheless, the scrub solution is modeled as feed solution. The cooling coil is modeled as a stack of 304 stainless tori with water in each core. Because the scrub solution is basic, solids may accumulate in the bottom. These were modeled as a mixture of oxide (2 g/cm^2 of plutonium or uranium) with the void space filled by feed solution.

Ignoring the glass inside, the scrubber contains 21 ℓ of liquid. The silicon carbide filters should keep the contamination levels in the scrubber quite low. However, were it filled with worst-case solution, the scrubber could contain 3 kg of plutonium or 6.4 kg of uranium.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 768 ± 28 in the scrubber. The uranium model yielded 235 ± 21.

The scrubber therefore contributes less than 10% of the reactivity in the glovebox.

4.8 THE SCRUB SOLUTION CATCH TANKS

In the standard model, the catch tanks are 6 in. diameter standard borosilicate pipes (inside radius of 7.856 cm, wall thickness of 0.502 cm), both full of feed solution. The spacing of the tanks is 16 in. (41 cm), outer edge to outer edge. Combined, the tanks have a volume capacity of 47 ℓ. Were the tanks to be filled with worst-case feed solution, they would contain 6.6 kg of plutonium or 14 kg of uranium.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 2469 ± 75 in the catch tanks. The uranium model yielded 3753 ± 68. This conservative model of catch tanks with the most reactive solution expected in the glovebox, located adjacent to quantities of wet, spilled calcine that, if allowed to accumulate, would be indicative of a sever housekeeping problem, account for 1/4 to 45% of the standard model reactivity.

4.9 THE PRODUCT RECEIVER

The product receiver is modeled as full of 5 g/cm^3 of absolutely dry PuO_2 or UO_3. The walls are modeled with the same composition as the feed tank. For conservatism, the model does not take the bottom rounding into account. The inside is modeled as a cylinder of radius 4.445 cm and height 15.24 cm. The external dimensions of the model are 15.716 cm high with a radius of 4.921 cm. This model yields an internal volume of .95 ℓ and a mass capacity of 4.7 kg of actinide.

The plutonium model yielded a neutron production rate per 10,000 source neutron of 22 ± 4 in the product receiver. The uranium model yielded 13 ± 2. When full of dry calcine, the receiver therefore contributes negligibly to the reactivity of the glove box.

4.10 THE LOAD OUT CONTAINER

The load out container, a 1 pound slip lid can, is a steel cylinder 3½ in tall and 3½ in. in diameter, with a capacity of 0.55 ℓ. For conservatism, the inside is modeled as a cylinder 8.89 cm in height with a radius of 4.445 cm. The outside dimensions are 8.99 cm tall and 4.495 cm radius. There are two of these containers, one on each vertex of the triangular loadout pan away from the product receiver. Together, the load out containers have a volume of 1.1 ℓ, and a capacity of 5.5 kg of actinide.

The plutonium model yielded a neutron production rate per 10,000 source neutrons of 29 ± 3 in the load out containers. The uranium model yielded 16 ± 2. Because the contained fissile material is dry, the load-out container contributes negligibly to the reactivity of the glove box.

4.11 THE ENTIRE SYSTEM

The tanks and vessels in the glovebox can contain a total of 91 ℓ, compared to the minimum 144 ℓ sump capacity of the glovebox floor. Therefore, if all of the vessels spill into a dry glovebox, there will be less liquid in the glovebox sump than is assumed in the standard model. Furthermore, nothing will flow out of the glovebox onto the floor of the room.

For the entire system, the standard plutonium model yielded a neutron production rate per 10,000 source neutrons of 8137 ± 43 and a k_{eff} of 0.8151 ± 0.003. The standard uranium model yielded 8227 ± 41 neutrons for a k_{eff} of 0.8234 ± 0.0037. Both these values are well below the allowable k_{eff} of .935 for these systems (see Appendix A).

5.0 CONTINGENCY ANALYSIS

Contingency analyses were performed using the computer code MONK6B[1]. Table 1 summarizes the results. The analyses are organized into seven scenarios. For each scenario, analyses are included for both plutonium loadings and uranium loadings.

5.1 DOUBLE BATCHING OF FEED POLYBOTTLES

For this contingency, it is assumed that two 4.2-ℓ polybottles, each full of maximum reactivity solution, are placed adjacent to the feed tank and the calciner. Except for the inclusion of a second full polybottle, the configuration is the same as in the standard model. The plutonium case yielded a calculated k_{eff} of 0.84. The uranium model yielded a calculated k_{eff} of 0.83. Both of these results are well below the allowable k_{eff} of 0.935.

5.2 FEED TANK SPILL

For this contingency, it is assumed that both the entire contents of the 6-ℓ feed tank and a 4.2-ℓ polybottle spill onto the intermediate floor of the glovebox. Sufficient liquid flows into the load-out containers to displace all the air, and the rest of the liquid flows onto the bottom floor of the glovebox. The two load-out containers are assumed to have been filled with calcine, so that the addition of liquid produces mud.

5.2.1 Falling Solution

Initially, the solution will be draining from the intermediate floor of the glovebox, and therefore will be distributed through the air. For this analysis, the solution is assumed to be above the load-out tray and partially surrounding the load-out cans; except for this change, the configuration is the same as in the standard model. The plutonium model yielded a calculated k_{eff} of 0.87; the uranium model 0.84. Both of these values are acceptably low to ensure subcriticality during this portion of the accident.

[1] MONK6B is a trademark of the United Kingdom Atomic Energy Authority, Dorchester, England, United Kingdom.

Table 1: Contingency Analysis Results

Contingency	Computer Code Run Number	Discussion Section	Calculated k_{eff}
#1, Feed Polybottle Double Batch	DeNO3a1 DeNO3u1	5.1	0.8380 ± 0.0039 0.8281 ± 0.0039
#2, Feed Tank and Polybottle Spill	DeNO3a2 DeNO3u2	5.2.1	0.8688 ± 0.0039 0.8399 ± 0.0038
	DeNO3A2 DeNO3U2	5.2.2	0.8666 ± 0.0039 0.8176 ± 0.0037
	DeNO3AT DeNO3UT	5.2.3	0.8660 ± 0.0039 0.8192 ± 0.0038
#3, Loadout Overbatch	DeNO3a3 DeNO3u3	5.3	0.8604 ± 0.0038 0.8206 ± 0.0035
#4, Glovebox Floor Accumulation Overbatch	DeNO3a4 DeNO3u4	5.4	0.8816 ± 0.0034 0.8597 ± 0.0033
	DeNO3po	5.4	0.9292 ± 0.0033
#5, Calciner Flood	DeNO3c5 DeNO3u5	5.5	1.0551 ± 0.0041 0.8201 ± 0.0036
	fillf4 fillf5	5.5	0.9244 ± 0.0043 0.9596 ± 0.0042
#6, Glovebox Flood	DeNO3A6 DeNOU6	5.6.1	0.8462 ± 0.0036 0.8450 ± 0.0034
	DeNO3a6 DeNO3u6	5.6.2	1.0118 ± 0.0034 0.9514 ± 0.0033
#7, Scrubber Solids Overbatch	DeNO3a7 DeNO3u7	5.7	0.8295 ± 0.0037 0.8235 ± 0.0036

5.2.2 Spilled Mud

The force of the falling liquid can be expected to move the powder around, potentially causing a less favorable geometry. In this analysis, the powder from the cans is assumed to be added to the powder from the floor of the load-out tray, and distributed in a right cone on top of the maximum allowed layer wet powder ("mud") on the bottom of the glovebox. The water covering the mud (limited to 2 in. above the bottom of the glovebox by the criticality drain) is replaced with feed solution in the vicinity of the cone of mud. For ease of analysis, the load out tray is also removed. Except for these changes, the configuration is the same as in the standard model. The plutonium model yielded a calculated k_{eff} of 0.87; the uranium model, 0.82. Thus, after the spilled feed solution has washed the calcine to the floor, the system is still acceptably subcritical.

5.2.3 Lower-Density Mud

In addition to moving the calcine around, the liquid may also reduce its density. In this analysis, the powder is assumed to distribute as above, but to have a lowered density of 3 g/cm^3 of plutonium or uranium. The rest of the glovebox configuration remains the same. The plutonium model yielded a calculated k_{eff} of 0.87; the uranium model, 0.82. Thus, the system will remain acceptably sub-critical in case of a feed solution spill.

5.3 OVER-BATCHING OF LOAD-OUT CONTAINERS

For this contingency, it is assumed that the entire load-out tray is filled with 1-pound cans full of calcine (more than 10 cans). For purposes of modeling, only the two cans placed in the load-out can spots are completely modeled. The entire tray is covered with a right (non-circular) cylinder of dry calcine to a depth of 10 cm. (This depth was chosen because it is deeper than the 1 pound can used for load-out, and is approximately 4 in). The rest of the glovebox has the same configuration as in the standard model. The plutonium model yielded a calculated k_{eff} of 0.86; the uranium model, 0.82.

5.4 DOUBLE BATCHING OF CONTAMINATION ON GLOVEBOX FLOOR

This contingency assumes that, due to protracted poor housekeeping, the allowable levels of solid material on the glovebox floor are exceeded by twice. Calculation of the k_{eff} for various cases provides the basis for the limitations on floor accumulations. In each case, the calcine on the bottom floor of the glovebox is assumed to be covered with water to a depth of 2 in above the glovebox floor. Consequently, the calcine on the glovebox floor and loadout shelf is modeled as "mud," PuO_2 or UO_3 with a density of 5 g/cm^3 (plutonium or uranium) saturated with water.

It is expected that the method of fissile deposition on the intermediate floor will be by spills of feed solution, with most running off but some solute drying on the intermediate floor. Consequently, the intermediate floor accumulation is modeled as $Pu(NO_3)_4 \cdot 5H_2O$ or $UO_2(NO_3)_2 \cdot 6H_2O$, distributed in a much thinner layer than the accumulation on the bottom floor. With the exception of variable accumulations of actinide oxide and nitrate, the glovebox models in this configuration are the same as in the standard model.

Computer run DeNO3a4, which assumed 3/4 in of accumulated calcine on the bottom floor and 6 mm of nitrate accumulation on the intermediate floor, calculated a k_{eff} of 0.88. The uranium model calculated a k_{eff} of 0.86. These values are acceptably low to ensure subcriticality as a contingency, and support a limit of no more than 3/8 in. accumulation of calcine on the bottom floor and load-out shelf, and no more than 3 mm accumulation of nitrate on the intermediate floor.

5.5 FLOODING OF THE CALCINER AND PRODUCT RECEIVER

For this scenario, it is assumed that the temperature interlock on the vertical calciner fails, allowing the feed pump to continue providing fresh solution into a cold calciner. For this scenario, the feed is assumed to be pure water. Initial exploratory modeling showed that the k_{eff} would remain acceptably low for a flooded calciner full of plutonium oxide only if the insulation around the calciner remained dry. However, experimentation with the insulation for the calciner section showed that it absorbs water aggressively and that its dryness can not be verified visually (see Appendix E). Operation with wet insulation around the calciner was made acceptable by placing limits on the fissile material content of the entire calciner and the filter section, and on the isotopic composition of the fissionable elements. The models for this contingency differ from the standard model in that the insulation is more accurately modeled, the calciner is only partially filled with calcine, and the standard plutonium composition is replaced with one more closely matching the proposed feed streams described in Hess, 1994, namely, $3^{w}/_{o}$ ^{240}Pu and $1^{w}/_{o}$ ^{241}Pu.

Because insulation dryness cannot be verified, the analysis focuses on limiting the contents of the calciner, which can be accomplished by tracking the calciner fissile inventory. Figure 3 graphs the results of filling the calciner with water-saturated calcine (mud), assuming that the insulation is saturated to $90^{v}/_{o}$ with water, and that the three silicon carbide filter cartridges contain feed solution. As long as there is no mud in the filter section, the k_{eff} of the glovebox stays nearly constant at about 0.80. With the calciner section full of mud, the addition of 10.16 cm (4.000 in.) of mud into the bottom of the filter section yielded a calculated k_{eff} of 0.92 in run fillf4; 12.70 cm (5.000 in.) yielded 0.96 in fillf5. The extreme importance of the filter section to criticality safety was shown by emptying the calciner section and filling the filter section from the top with only 16.11 cm (6.343 in) of mud, yielding a calculated k_{eff} of 0.93.

Interpolation between runs fillf4 and fillf5 to find a k_{eff} of 0.93 yields a mud height of 10.5 cm in the filter section, assuming the calciner section is filled with mud. This height translates to 6.0 kg of plutonium in the filter section. The limiting plutonium content in the filter section is found by applying the standard of 45% of a critical mass (WHC, 1994, chapter 2, section 5.1.2.2), yielding a maximum of 2.7 kg of plutonium in the filter section, and rounding down to 2.5 kg.

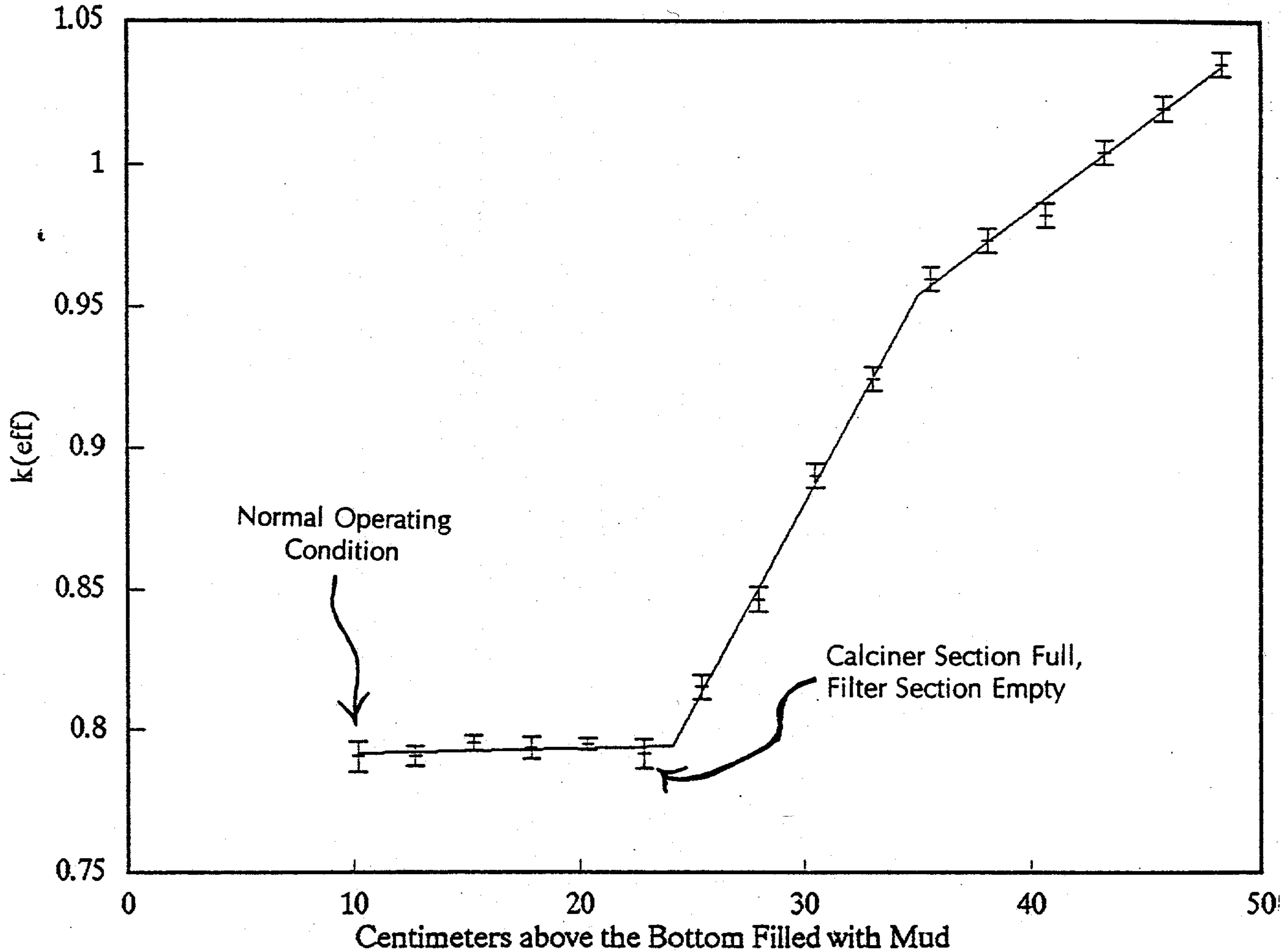
The calciner section is not expected to contain more than 4 in. (10 cm) of calcine at any one time. Furthermore, normal operation of the calciner is expected to generate a bed of calcine 4 in. deep, set by the inner tube in the downcomer. Filling this expected volume with 5 kg/ℓ plutonium in the form of

Figure 3: Effect of Filling the Calciner with Wet Calcine.

All Insulation Saturated to 90 $^{v}/_{o}$ Water.

Filter Cartridges Full of Feed Solution.

$3^{w}/_{o}$ ^{240}Pu, $1^{w}/_{o}$ ^{241}Pu



oxide yields a normal mass of 4.7 kg of plutonium in the calciner section. The limit on total plutonium in the calciner of 7 kg is obtained by rounding down the sum (7.2 kg) of the expected calciner content of 4.7 kg and the maximum allowed filter content of 2.5 kg.

It should be emphasized that, although significant quantities of calcine are not expected there, the filter section of the calciner is extremely sensitive to moderated buildups. Furthermore, the calciner and filter sections constitute a continuous space with no barriers to prevent the level of material from accumulating from the bottom of the calcining section to the top of the filter section. Suspected buildups of fissile material in the filter section therefore represent a serious potential for criticality which must be controlled.

5.6 FLOODING OF THE ENTIRE GLOVEBOX

For this scenario, it is assumed that an unlimited amount of water is delivered to the glovebox, converting the powder in the load out cans and on the load out tray to mud and adding water throughout the void space of the glovebox, but with no other changes from the standard model. Appendix D demonstrates that the highest reactivity occurs with a plugged criticality drain causing the entire glovebox to fill with water.

5.6.1 Operable Criticality Drain

Hammelman, 1974, did not find inflow rates to any PFP gloveboxes greater than 6 gpm (.4 ℓ/s) to be credible. Lehmkuhl, 1974, demonstrated that even a water inflow rate of 6 gpm (.4 ℓ/s) will increase the water level by less than 1/4 in. (.6 cm). above a 3-in. (7.6-cm) bottom-mounted criticality drain. Therefore, the liquid level in the glovebox will not significantly exceed 2 in. if the 3-in. (7.6-cm) bottom-mounted criticality drain is operable. However, the air may contain significant quantities of falling water. Accordingly, the single contingency case is modeled by filling the glovebox with a mist containing 10% water and 90% air (void). Both the plutonium model and the uranium model yielded a calculated k_{eff} of 0.85 for this single contingency scenario.

5.6.2 Plugged Criticality Drain

Assuming that the criticality drain also gets plugged (two contingencies), the glovebox fills with water. For a glovebox completely filled with water, the plutonium model yielded a k_{eff} of 1.01, and the uranium model 0.95. Because these calculated values are not less than 0.935, the analyzed system is not acceptably subcritical for this scenario. Consequently, the criticality drain must be maintained in a freely flowable condition to make a complete glovebox flood a two-contingency accident.

5.7 SCRUBBER SOLIDS OVERBATCH

For this contingency, it is assumed that the scrubber accumulates more than twice the 10 in. limit of solids (3 g/l plutonium or uranium), but that no other changes are made to the standard model. The plutonium model yields a calculated k_{eff} of 0.83; the uranium model, 0.82. Therefore, a scrubber solids overbatch remains acceptably subcritical.

6.0 CONCLUSIONS

A set of conditions are put forward to ensure that an unplanned criticality does not occur in the vertical denitrating calciner glovebox:

- Containers in the upper section of the glovebox shall include no more than either one feed polybottle or one 1/2-ℓ (nominal) polyjar at any one time.
- Containers in the lower section of the glovebox shall include nor more than two 1 pound cans or one 1/2-ℓ (nominal) polyjar at any one time.
- Accumulations on the bottom floor and loadout shelf shall not exceed 3/8 in. Accumulations on the middle floor shall not exceed 0.3 cm (1/8 in). (Consequence Analysis is not endorsing operating with accumulations on the glovebox floor, but merely stating boundaries at which accumulations become a cause for concern from the standpoint of criticality safety. Regular cleaning of the glovebox, consistent with good conduct of operations, will limit accumulations.)
- The total mass of plutonium and uranium-235 (^{235}U) in the calciner shall be less than 7 kg. The total mass of plutonium and uranium-235 (^{235}U) in the filter section of the calciner shall be less than 2.5 kg. Other fissile nuclides can be accommodated only by using the equivalence conversions in WHC, 1994.
- The criticality drain shall be maintained in a freely-flowable condition.

Based on calculations and analyses for the system, these conditions will provide adequate double contingency assurance of criticality safety.

7.0 PEER REVIEWER'S COMMENTS

T. Chiao of Criticality Radiological Analyses carried out the independent technical review of "CSER 95-05, PFP Vertical Denitration Calciner" and provided the following comments.

The criticality safety evaluation was reviewed for technical adequacy with respect to Criticality Safety considerations for PFP Vertical Denitration Calciner. The references and logic were confirmed to establish the intended conclusions. Some editorial comments and suggested clarifications were discussed with the author of this CSER. Additional comments are provided below.

The calculational model is much more conservative than the Calciner to be built. For example, the scrubber in the model was filled with $Pu(NO_3)_4$ solution which is more conservative than real operative case. The actinide content in the solution is assumed to be 3% ^{241}Pu and 2% ^{240}Pu. Usually the ^{241}Pu is much less than ^{240}Pu. The assumption made in this CSER does not represent the real composition of the fissile material. However, the k_{eff} value with this assumption will be more conservative.

The atomic number density for ^{239}Pu for Pu solids (2g Pu/cc in feed) should be 0.004787. Instead, the number density in the model is 0.00745605. This error leads to a more conservative k_{eff} value for the system.

APPENDIX C (FISSION SOURCE STUDY) has provided an in depth study on the effects of k_{eff} value from different neutron starting locations in a multi-fission source system. The results of this study convinces that the neutron starting location does not cause any significant effect on the k_{eff} value. **APPENDIX C is a piece of work of excellence, indeed!**

8.0 REFERENCES

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APPENDIX A: COMPUTER CODE VALIDATION

A.1 VALIDATION PROCEDURE

The validation of the methods used in the analysis consists of testing the ability of the code and neutron cross-sections in calculations of known critical configurations, which are various benchmark experiments with the fissile material in question. Such analyses determine a calculational bias (the deviations of calculated k_{eff} values from unity for the benchmark cases) and the uncertainties culminating from the experimental and calculational errors.

The safety criteria for future calculations on undetermined systems requires that the bias-adjusted k_{eff} does not exceed 0.95 at the 95% confidence level. This is expressed by the following formula:

$$k_{eff} = k_{calc} - \text{bias} + (U_b^2 + U_c^2)^{1/2} \leq 0.95$$

where k_{calc} = k value given by calculation for system in question,
bias = mean difference (k_{calc} - 1.0) for benchmark criticals
U_b = 95% confidence level uncertainty in the bias determination,
and U_c = 95% confidence level uncertainty in new calculation.

Thus, the bias-adjusted k_{eff} includes the statistical uncertainties.

A.2 GENERIC VALIDATION FOR PLUTONIUM SYSTEMS

A report by L. L. Macklin and E. M. Miller, *MONK6A Pu Validation* (Macklin and Miller 1992), presents the results of calculations to determine a generic bias for plutonium configurations, as encountered in the Plutonium Finishing Plant. Seventy benchmark experiments were calculated, ranging from simple metal spheres to highly dilute (9 g plutonium/ℓ) plutonium nitrate solution spheres, and also compacts of PuO_2 blended with polystyrene. A mean k_{eff} value of 1.0047 was determined over the full experimental range, with an overall standard deviation of 0.0097.

The direct calculational bias is thus +0.0047 (average k_{eff} greater than unity). Accounting for the uncertainties using a tolerance limit analysis, the report then concludes that

> At least 95% of all critical experiments of this type computed by the MONK6A code will produce calculated k_{eff} values greater than 0.9857 with 95 % confidence.

For a standard deviation (σ) of 0.01 or less for the convergence of a future calculation (U_c), the 0.9857 value is lowered to 0.9855. Rounded conservatively, a value of +0.015 can be used for [-bias + $(U_b^2 + U_c^2)^{1/2}$]. On this basis, it is determined that the true k_{eff} of an analyzed configuration with plutonium will not exceed 0.95 with a 95% confidence level if the calculated value (k_{calc}, $\sigma \leq 0.01$) is limited to a maximum value of **0.935**.

The 95% confidence level on 99.9% of the data is 0.9699. So a subcritical margin of 5% is 3.5% larger than the uncertainties between the 95.0% and 99.9% coverage of the benchmark data.

A.3 VALIDATION OF MONK6B FOR 235U SYSTEMS

No benchmark calculations using the MONK6B code have been carried out at WHC for uranium solution experiments as of this writing. However, a number of validation calculations for the basic MONK6 code were reported in the supporting documentation provided by the ANSWERS[2] group at the United Kingdom Atomic Energy Authority, the code's developers. Table A-1 contains benchmark calculation results extracted from the MONK6 report (ANSWERS, 1992). The QA Plan for adopting MONK6B on the SUN computers at the WHC Science and Engineering Computational Center (Miller, 1994b) includes a copy of Chapter 1 from ANSWERS, 1992, as an attachment.

The first five cases presented in table A-1 were calculations on enriched uranium solution experiments. It is seen that the k values differ from unity within a range between -0.5% and +1.5%. These results are quite similar to the agreement with experiments noted above for the calculations on plutonium benchmark experiments. In general, the results reported in the MONK6 reference for metallic uranium benchmark critical experiments give slightly higher k values than for plutonium systems.

The later four cases in table A-1 are mixed plutonium-natural uranium solution experiments. Again, the results are within 1% of unity, indicating that the cross-section data adopted for uranium have the same order of accuracy as the data used for plutonium.

Overall, the evidence given here, and also in the referenced report results for metallic rod experiments, indicate that the cross-sections for the principal uranium isotopes are as accurate as those for plutonium. It is thus adequate to consider the bias and uncertainty assessments for the plutonium as applicable to solutions of enriched uranium and to mixed uranium-plutonium solutions.

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[2] ANSWERS is a trademark of the United Kingdom Atomic Energy Authority.

Table A-1: MONK6 Validation Calculations for Uranium Solutions

Ref. Chapt. 1 Table #	Calc. Ident.	Description of Critical Experiment	k_{eff}	σ
2.1	D3UAR	3x3x3 array of 5-ℓ Plexiglass cylinders containing 92.6% uranyl nitrate solution, surface to surface separation 8.76 cm. Uranium concentration 415 g/ℓ. Plexiglass reflector 1.27 cm thick.	0.9950	0.0027
2.1	QUAD1	Plexiglass cross containing 5% uranyl fluoride solution. Solution concentration 907 g/ℓ uranium. Solution level 24.1 cm above center of intersection. Average of first and second experiments	1.0137	0.0026
2.1	UOFBO1	Uranyl fluoride (4.98%) solution sphere clad in stainless steel. Sphere inner diameter = 50.7764 cm, wall thickness = 0.0508 cm.	1.0139	0.0026
2.1	UOFCRO1	Uranyl fluoride (93.2%) solution in annulus. Critical solution height 21.8 cm, full water reflection to this height. Annulus thickness 10.16 cm.	1.0047	0.0027
2.1	UOFCBO1	Uranyl fluoride (93.2%) solution in annulus. Critical solution height 36.3 cm, no water reflection. Annulus thickness 12.7 cm.	1.0056	0.0027
2.3	SCAMP1A	Water reflected cylinder of mixed nitrate solution. Plutonium content 30.7%. ^{240}Pu content 5.65%. H/Pu = 224.	1.0093	0.0027
2.3	SCAMP2A	Like SCAMP1A but with more dilute solution: H/Pu = 1372.	1.0067	0.0027
2.3	MB5	Mixed plutonium/uranium solution in cylindrical vessel reflected by water on sides and bottom. Solution was 32.7 $^{w}/_{o}$ plutonium, 67.3 $^{w}/_{o}$ uranium. Plutonium contained 5.86% ^{240}Pu. H/(U+Pu) = 357.2.	0.9951	0.0026
2.3	MB7	Similar to MB5: solution contained 29.3% plutonium, 70.7% uranium, and was more dilute with H/(U+Pu) = 357.3.	1.0041	0.0027

From ANSWERS, 1992.

A.4 VALIDATION OF MONK6B

The validation of the MONK6B code on the SUN microcomputers was documented in Miller, 1994a. The essence of the validation was cross-correlation of calculational results obtained with this code version and computer with results for identical input models done on the CRAY machine with MONK6A, as reported in the previous subsection. Also, the equivalence of MONK6B to MONK6A was well documented by the code vendors, the United Kingdom Atomic Energy Authority, in the verification package supplied with the software.

The abstract from CCVR 94-001 summarizes the validation study as follows;

> The MONK6B validation for bare plutonium and plutonium water systems on the SUN computer and operating system is established in this report. Because the calculational method and nuclear cross-sections have not changed from the MONK6A code to the MONK6B code, the bias determination done for MONK6A is valid for MONK6B.

Macklin, L. L., and E. M. Miller, 1992, CCVR 91-001; *MONK6A Pu Validation*, WHC-SD-SQA-CSWD-20015, Westinghouse Hanford Company, Richland, Washington.

Miller, E. M., 1994a, CCVR 94-001; *MONK6B Pu Validation*, WHC-SD-SQA-CSWD-20019, Westinghouse Hanford Company, Richland, Washington

Miller, E. M., 1994b, CCVR 94-002; *MONK6B - Software Quality Assurance Plan*, WHC-SD-SQA-CSWD-20017

ANSWERS, 1992, *MONK6 - A Monte Carlo Code for Criticality Calculations*, Rev. 5, AEEW R2248, United Kingdom Atomic Energy Authority.

APPENDIX B: STANDARD CONFIGURATION INPUT

```
* Denitrating Calciner Glovebox - PFP Pilot Plant - Standard Config.
* Model by J. Lee Geiger,  1995 March 15
* The name of the input file is DeNO3as
* This file models the standard condition in the Glovebox.
*
*  Glovebox 188-1 in 234-Z is fitted out to contain the
*  denitrating calciner process.  The calciner is built of 310
*  Stainless Steel, with SiC air filters in the upper portion.  The
*  material to be stabilized may have as little as 3% Pu240, or as
*  much as 12%.  The calciner is surounded by fiberous insulation.
*  The calciner will be fed from a 6 liter borosilicate glass feed
*  tank, which will be hand filled from 4.2-liter (1 gallon, nom.)
*  polyethylene jars.  Off gases will go through a glass scrubber.
*  Powder will be collected in a jar below the calciner, transferred
*  to a 1 pound can, and bagged out.
*
* Material 1:  310 Stainless Steel.
* Specs say:  8.00 g/cc, .25%C max, 24-26%Cr, 19-22% Ni
* Model: .25 w/o C      24 w/o Cr     19 w/o Ni     56.75 w/o Fe
*
* Material 2:  PuO2.  Bulk Density=5g/cc Assume 2% 240, 3% 241, 95% 239
*
* Material 3:  PuNO3 Solution, 140 g/l Pu
*
* Material 4:  Insulation.  Assume 10 v/o SiO2, 90 v/o water.
*              SpG of quartz = 2.26 (Perry, Ed 6)
*
* Material 5: Insulation
*
* Material 6:  SiC Filter Medium    SpG=3.17 (Perry, Ed 6)
*
* Material 7: Borosilicate Glass per ARE-600 II.F.1-4
*  Depleted by 20% to yield 15.84 a/o B10
*
* Material 8: Water
*
* Material 9: Quartz
*
* Material 10: 304L Stainless Steel
*
* Material 11: "Mud" - PuO2 saturated with water
*
* Material 12: Low Density Polyethylene per measurements in CSER 94-006
*
* Material 13: Carbon Steel (slip lid can)
*
* Material 14: Crystalized Pu(NO3)4*5H2O per ARE-600, II.C.2-1
*
* Material 15: Polyvinyl Chloride
*
* Material 16: Pu Solids (2g Pu/l in feed) <-- 2kg/l
*
* Material 17: "Fluffy" mud, 3g Pu/l in water <-- 3kg/l
*
FISSION
*
* # of Materials     # of Nuclides
    17                    16             NUCNAMES
*Material 1:  310 Stainless Steel.  8.00 g/cc, C<.25%C, 24-26%Cr, 19-22% Ni
CONC     C 0.001003    CR 0.022237  NI 0.015591     FE 0.048955
*Material 2:  Denitrated 2% PuO2       Density = 5 g/cc
*Model:   95 w/o 239      2 w/o 240          3 w/o 241     2 mol O/mol Pu
CONC  PU239 0.0119658  PU240 0.0002509  PU241 0.0003747  O 0.0251828
*Material 3:  140 g/l 2% Pu as Aqueous Nitrate Solution
```

```
CONC HINH2O 0.063457  N 0.0014102  O 0.0359593
     PU239 0.000335042   PU240 0.000007024   PU241 0.000010492
*Material 4:  Insulation (soaked with water)
CONC HINH2O 0.060168    O 0.034616   SI 0.002266
*Material 5:  Dry Insulation
CONC        O 0.004532   SI 0.002266
*Material 6:  SiC Filter Medium  SpG=3.17 (Perry Ed. 6)
CONC   C  0.047641   SI   0.047641
*Material 7:  Borosilicate Glass per ARE-600.  80% depleted
CONC  O  0.04492    SI 0.01802    B10 0.000727  B11 0.00386
      AL27 0.00053 NA23 0.00238
*Material 8:  Water
CONC  O 0.033427      HINH2O  0.066854
*Material 9: Quartz
CONC  O 0.045320      SI  0.022660
*Material 10: 304L SS after ARE-600 p. II.F.1-6
CONC  FE 0.06331     CR 0.01654    NI 0.00651
*Material 11: 5 g Pu/L PuO2 Saturated with Water:  "Mud" <- 5 kg/l
CONC  HINH2O 0.037686  O 0.044026
      PU239 0.011966   PU240 0.000251  PU241 0.000375
*Material 12: Low Density Polyethylene, .846g/cc
CONC  HINH2O 0.072666  C 0.036333
*Material 13: Mild Steel, modeled as pure iron, SpG=7.86
CONC  FE      0.084755
*Material 14: Plutonium (IV) nitrate pentahydrate.  3%241, 2%240
CONC  PU239 0.00287554 PU240 0.00006029 PU241 0.00009005
      HINH2O 0.030259  N 0.012104 O 0.051440
*Material 15: Polyvinyl Chloride, SpG=1.5
CONC  HINH2O 0.043359  C 0.028906 CL 0.014453
*Material 16: Pu Solids (2g Pu/l) in feed <- 2 kg/l
CONC  PU239 0.00745605 PU240 0.00010614 PU241 0.00015855
      HINH2O 0.0523826 N 0.0011641 O 0.0397568          SHOULD BE
*Material 17: Fluffy Mud (3g Pu/l in water) <- 3 kg/l       0.004787
CONC  PU239 0.00717948 PU240 0.00015052 PU241 0.00022484    SEE P. 19
      HINH2O 0.0493531 O 0.0397862
* Distance Unit
        CM
*
* Part 1 is the glovebox itself, fully reflected outside by water.
*
NEST 2
CUBOID P 2 111.76 337.82 167.32 0.0 0.0 -53.5
CUBOID 8   126.76 352.82 182.32 -15 -15 -68.5
*
* Part 2 is the cluster inside the glovebox.  Glovebox dimensions come
* from drawing H-2-33764, sh 2/3 "GLOVE BOX 34-1 DETAILS"
*
CLUSTER 29
* The Calciner
1  ZCYL ORIGIN 70  100  1.27  P 4  16.03375  64.77  -17.7165
    OVERLAP 4    7  8  9 10
    41
* Product Receiver, attached to Downcomer from the Calciner
2  ZROD ORIGIN 70 103.74015 -32.5625 P17 4.921 16.116
    OVERLAP 2    9  10
    42
* The Feed Tank
3  ZROD ORIGIN 32  100 8.89 P 3  8.358 30.48
    OVERLAP 2    9  10
    43
* The Feed Tank Base: PVC (ref SK-2-300307)
4  ZROD ORIGIN 32  100 6.35 15 13.97 2.54
    OVERLAP 2    9  10
    11
* A Load-in Jug: 1 Gallon (nom.) Polybottle   STANDARD POSITION
5  ZROD ORIGIN 46.997 94.487 8.89  P15 7.62 25.745
    OVERLAP 2    9  10
```

```
    44
* The Scrubber
6  ZCYL ORIGIN 70 21.56 16.24  P 7  8.358  112.68 -6.08
    OVERLAP 2   9  10
    45
* Intermediate "Floor" of 3041 SS
7  CUBOID 10 111.125 243.205 0.0  0.635 0.635 -0.635
    OVERLAP 3   1  9 10
    10
* Three mm of plutonium(IV) nitrate pentahydrate on Intermediate Floor
8  CUBOID 14 111.125 243.205 0.3 0.635 0.635  0.0
    OVERLAP 3   1  9 10
    8
* Empty space in the Box
9  CUBOID  0 111.125 243.205 166.685 0.635 0.635 -52.965
    OVERLAP 21  1  2  3  4  5  6  7  8     10 17 18 19
                20 21 22 23 24 25 26 27 28                3
* Main Glovebox Section
10 CUBOID 10 111.76  243.84  167.32  0.0 0.0 -53.5
    OVERLAP 27  1  2  3  4  5  6  7  8  9   11 12 13 14 15 16 17 18
                19 20 21 22 23 24 25 26 27 28              2
* Space in Mezanine
11 CUBOID  0 100.965 337.185 166.685  9.525 243.205  81.755
    OVERLAP 2     10   12
    5
* SS Plate around Mezanine
12 CUBOID 10 101.6   337.82  167.32  10.16  243.205  81.12
    OVERLAP 2    10 11
    4
* Space in Annex
13 CUBOID  0 100.965 337.185  42.395  9.525 243.205 -52.965
    OVERLAP 6     10          14 15 16 19 20
    5
* SS Plate around Annex
14 CUBOID 10 101.6   337.82   43.02  10.16  243.205 -53.5
    OVERLAP 6    10 13 15 16 19 20
    4
* "Mud" on Floor of Annex - 3/8"
15 CUBOID 11 100.965 337.185 -52.0125 9.525 243.205 -52.965
    OVERLAP 4    10 13 14 16
    7
* Water covering mud to depth of 2" above Floor
16 CUBOID 8  100.965 337.185 -47.885  9.525 243.205 -52.965
    OVERLAP 4    10 13 14 15
    6
* "Mud" on Floor of Glovebox - 3/8"
17 CUBOID 11 111.125 243.205 -52.0125 0.635 0.635 -52.965
    OVERLAP 4     9 10 18 21
    7
* Water covering mud to depth of  2" above Floor
18 CUBOID 8  111.125 243.205 -47.885 0.635 0.635 -52.965
    OVERLAP 4    9 10 17 21
    6
* Scrubber Waste Tank 1
19 YROD ORIGIN 27.24 159.8 -34.485 P 13  8.32 122.92
    OVERLAP 4    9 10 13 14
    46
* Scrubber Waste Tank 2
20 YROD ORIGIN 84.52 159.8 -34.485 P 13  8.32 122.92
    OVERLAP 4    9 10 13 14
    46
* Diaphragm Pump
21 YROD ORIGIN 32  98 -45          P 14  7.3152 5.334
    OVERLAP 4    9 10 17 18
    47
* Loadout Tray
22 +XYPRISM  ORIGIN 46.1237 67.22765  -41.535
```

```
          P18  47.755 55.917 0.152 66.8777 66.8777
    OVERLAP 2    9 10                40
* One Loadout Vessel, in Back Loadout Spot
23 ZROD ORIGIN 52.855 71.672765 -40.4305  P16 4.495 8.99
    OVERLAP 2    9 10                39
* One Loadout Vessel, in Front Loadout Spot
24 ZROD ORIGIN 87.1449 71.67265 -40.4305 P16 4.495 8.99
    OVERLAP 2    9 10                39
* Pile of Calcine on Loadout Tray under PR Vessel, 3/8"
25 ZROD ORIGIN 70 103.74015 -41.383
           2 7.620 0.9525
    OVERLAP 3    9 10 26             38
* Calcine Trapezoid by all three ZRODs
26 -XYPRISM ORIGIN 62.9912 106.73325 -41.383
            2 14.015 33.314 0.9525 113.1223 113.1223
    OVERLAP 3    9 10     25         38
* Calcine Trapezoid by Left Can
27 +XYPRISM ORIGIN 52.85415 67.22855 -41.383
            2 18.1451 6.1905 0.9525 123.43879 90
    OVERLAP 3  9 10    28            38
* Calcine Trapezoid by Right Can
28 +XYPRISM ORIGIN 68.99905 67.22855 -41.383
            2   18.1450 6.1905 0.9525 90 123.43879
    OVERLAP 3  9 10 27               38
* Water Reflector around the Outside of the Glovebox
29 CUBOID  8 111.76  337.82  167.32  0.0 0.0 -53.5
*
* Part 3 is the feed tank.  REF SK-2-300307
*
NEST   2
* Borosilicate Glass Tank
ZROD 3   7.856  30.48
*Full of Pu solution
ZROD 7   8.358  30.48
*
* Part 4 is the calciner.
*
CLUSTER 10
* The Filter Section
1 ZCYL ORIGIN 0.0 0.0 22.86 P 5 8.41375 34.29 0.0
     OVERLAP 3     2  3  4                      20
* Flanges Connecting the Two Sections
* 10" Dia. per SK-2-300303 SH 5 REV 0 ZN 6F
2 ZCYL 1 12.7    24.13 21.59
     OVERLAP 4  1     3      5    7             18
* Water soaked Insulation, 3" Thick (=7.62cm)
3 ZCYL 4 16.03375 64.77 22.86
     OVERLAP 3  1  2     4                      10
* Upper Flanges on Filter Section
4  ZCYL 1 12.7    57.15  49.53
     OVERLAP 2  1     3                         15
* The lower Calciner Section
5  ZCYL P 8 8.41375 22.86 -17.7165
     OVERLAP 5     2           6  7  8  9       21
* Lower Flange
6  ZCYL 1 12.7 0  -1.27
     OVERLAP 3              5     7     9       5
* Dry Insulation around Heated Section
7  ZCYL 5 16.03375 22.86 -1.27
     OVERLAP 4     2        5  6        9       4
* Glovebox Intermediate Floor
8  ZCYL 10 16.03375 -1.27 -1.905
     OVERLAP 1              5                   3
* Nitrate on Intermediate Floor
9  ZCYL 14 16.03375 -0.3175 -1.27
     OVERLAP 3              5  6  7             2
* "Container" for Calciner Equipment Piece
```

```
10 ZCYL 0 16.03375  64.77 -17.7165
*
* Part 5 is the top (filter) section of the calciner
*
CLUSTER 8
* Agitator Shaft
ZCYL 1 1.27    34.29  0.0  OVERLAP 3     2  3  4                      10
* Top Flanges (which retain the Filters)
ZCYL 1 8.41375 34.29 29.21 OVERLAP 4  1           5  6  7              3
* Pack the calciner side with Powder
ZCYL 2 8.07339 29.21  0.0  OVERLAP 5  1        4  5  6  7              5
* Stainless Steel Wall of Filter Section
ZCYL 1 8.41375 29.21  0.0  OVERLAP 5  1     3     5  6  7              4
* Three Filters:
ZCYL ORIGIN 0.0 -4.672 2.55 P 6 3.1 30.5 0.0 OVERLAP 3  2  3  4      6
ZCYL ORIGIN  4.672 0.0 2.55 P 6 3.1 30.5 0.0 OVERLAP 3  2  3  4      6
ZCYL ORIGIN -4.672 0.0 2.55 P 6 3.1 30.5 0.0 OVERLAP 3  2  3  4      6
* Contain it in Wet Insulation (zero thickness)
ZCYL 4 8.41375 34.29  0.0
*
* Part 6 is a SiC offgas filter packed in powder
*
CLUSTER 5
* Void down Center of Filter
ZCYL 0 2.0  30.5  1.5  OVERLAP 3     2  3  4   5
* Main Body of Filter
ZCYL 6 2.55 30.5  0.0  OVERLAP 3  1     3  4   4
* Retaining Collar of Filter
ZCYL 6 3.1  30.5 29.0  OVERLAP 2  1  2         3
* Stainless Steel Overlap around Retaining Collar
ZCYL 1 3.1  29.0 26.69 OVERLAP 2  1  2         2
* Container packed in Powder
ZCYL 2 3.1  30.5  0.0
*
* Part 7 is the scrubber, ref. SK-2-300306
*"10L / CALCINER SCRUBBER ASSEMBLY"
*
CLUSTER 10
* Inside of Feed Pipe
1  ZCYL 0 0.80    112.68   0.0
OVERLAP 6    2 3 4 5     8 9 10
* Wall of Feed Pipe
2  ZCYL 9 0.95    112.68   0.0
OVERLAP 6  1   3 4 5     8 9 8
* Solution in the Tank
3  ZCYL 3 7.856   106.68  22.86
OVERLAP 6  1 2   4 5 6 7     3
* Wall of the Scrubber Tank
4  ZCYL 9 8.358   112.68  -5.08
OVERLAP 8  1 2 3   5 6 7 8 9 1
* Stack of Torroidal Coils with Feed Pipe Included
5  ZCYL P 9 6.19125 91.44 0.0
OVERLAP 5  1 2 3 4         9 11
* Overflow Pipe full of Solution
6  ZCYL ORIGIN 0 7 0 3 .5461 106.68 -6.08
OVERLAP 4      3 4     7   9 6
* Wall of Overflow Pipe
7  ZCYL ORIGIN 0 7 0 10 .635 106.68 -6.08
OVERLAP 4      3 4   6     9 5
*  Void Above Top of Solution
8  ZCYL 0 7.70255 111.68 106.68
OVERLAP 3  1 2   4           2
* Solids in bottom of Scrubber
9  ZCYL 16 7.856 22.86 -2.54
OVERLAP 6  1 2   4 5 6 7     4
* Container for Scrubber Equipment Piece
10 ZCYL 0 8.358   112.68  -6.08
```

```
*
* Part 8 is the lower section of the calciner
*
CLUSTER 12
*Inside of Annulus
1  ZCYL 0 5.4102  14.7686 -0.9525
      OVERLAP 8     2  3  4  5  6  7  8    10                10
*Inner Annular Pipe
2  ZCYL 1 5.715  14.7686 -0.9525
      OVERLAP 8  1     3  4  5  6  7  8    10                 9
* Inside of Powder Downcomer
3  ZCYL ORIGIN 0.0 3.74015 0.0 2 1.39319  11.1125 -17.7165
      OVERLAP 9  1  2     4  5  6  7  8  9 10                20
* Wall of Powder Downcommer
4  ZCYL ORIGIN 0.0 3.74015 0.0 1 1.67105 11.4300 -17.7165
      OVERLAP 9  1  2  3     5  6  7  8  9 10                19
* Hole in Annulus to let Powder into Downcommer
5  CUBOID 2  1.39319 5.4102 11.1125 -1.39319 3.7465 1.27
      OVERLAP 7  1  2  3  4     6  7  8                      25
* Spread Pipe Wall (See Note 5 of Blue Print)
6  CUBOID 1  1.67105 5.4102 11.1125 -1.67105 3.7465 1.27
      OVERLAP 7  1  2  3  4  5     7  8                      22
* Powder Annulus
7  ZCYL 2 8.07339 22.86 1.27
      OVERLAP 8  1  2  3  4  5  6     8       11              8
* Outer Wall of Calciner
8  ZCYL 1 8.41375 22.86 0
      OVERLAP 9  1  2  3  4  5  6  7       10 11              4
* Floor of Heater Compartment
9  ZCYL 1 8.41375  -.9525 -1.27
      OVERLAP 2        3  4                                   3
* Depression inside Heater Compartment Floor
10 ZCYL 0 5.715 1.27 -0.9525
      OVERLAP 5  1  2  3  4           8                       5
* Pipe Cap Dome on Annulus Inner Pipe
11 ZROD ORIGIN 0 0 14.7686 P 12 5.715 2.2240
      OVERLAP 2                    7  8                      14
* Assembly "Container"
12 ZCYL 0 8.41375 22.86  -17.7165
*
* Part 9 is the cooling coil in the scrubber, modeled as a stack of tori
*
CLUSTER 10
ZCYL ORIGIN 0  0   0.00 P 19 6.19125 11.43 0.0 OVERLAP 1 9 2
ZCYL ORIGIN 0  0  11.43 P 19 6.19125 11.43 0.0
ZCYL ORIGIN 0  0  22.86 P 10 6.19125 11.43 0.0
ZCYL ORIGIN 0  0  34.29 P 10 6.19125 11.43 0.0
ZCYL ORIGIN 0  0  45.72 P 10 6.19125 11.43 0.0
ZCYL ORIGIN 0  0  57.15 P 10 6.19125 11.43 0.0
ZCYL ORIGIN 0  0  68.58 P 10 6.19125 11.43 0.0
ZCYL ORIGIN 0  0  80.01 P 10 6.19125 11.43 0.0
ZCYL ORIGIN 0  0    0      16 6.19125 11.43 0.0 OVERLAP 1 1 1
ZCYL 3 6.19125    91.44  0.0
*
* Part 10 is a stack of cooling coil tori, used in Part 9
*
CLUSTER 10
* Nine Coils modeled as a Stack of Torroidal Pipes
ZCYL ORIGIN 0 0  0.00 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  1.27 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  2.54 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  3.81 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  5.08 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  6.35 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  7.62 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  8.89 P 11 6.19125 1.27 0.00
ZCYL ORIGIN 0 0 10.16 P 11 6.19125 1.27 0.00
```

```
ZCYL 16 6.19125  11.43 0.0
*
* Part 11 is a single torus of water-filled pipe, used in Part 10.
*
CLUSTER 3
* Inside of Feed Pipe
1 ZCYL 0 1.07 1.27 0.0                          OVERLAP 1     2        5
*  Wall of Feed Pipe
2 ZCYL 1 1.27 1.27 0.0                          OVERLAP 1  1           4
* One Pipe Torus
3 ZCYL ORIGIN 0 0  0.00 H 1 6.19125 1.27 0.00
*
* Part 12 is the Pipe Cap Dome on the Calciner Annulus Inner Pipe
*
CLUSTER 3
* Void inside the Cap
1 SPHERE ORIGIN 0 0 -6.666 0  8.7852  OVERLAP 2     2  3  50
* Wall of the Cap
2 SPHERE ORIGIN 0 0 -6.666 1  8.89    OVERLAP 2  1     3  40
* Powder outside the Cap
4 ZCYL 2 5.715 2.224 0                OVERLAP 2  1  2     30
*
* Part 13 is a waste scrub solution storage tank.  Used twice.
*
NEST 2
* Full of 140 g/l Pu(NO3)4 solution
YCYL 3   7.82 122.42 0.5
* Pyrex(r) Walled Tank
YROD 7   8.32 122.92
*
* Part 14 is the diaphragm pump
* Milton Roy series C electronic metering pump.  Information in the catalogue
* is scanty -- some liquid ends are smaller.  Took largest dimensions.
*
NEST 1
YROD 3 7.3152 5.334
*
* Part 15 is a 1 gallon (4.2L) polyjar full of feed solution
*
NEST 2
* Solution Cylinder...
ZCYL 3 7.298 25.423 0.322
* ... Surrounded by low density polyethene
ZROD 12 7.62 25.745
*
* Part 16 is a 1 pound slip lid can (The load out vessel)
*
NEST 2
* Filled with Calcined Powder.
ZCYL  2 4.445 8.94 0.05
* Surrounded by mild steel (pure iron)
ZROD 13 4.495 8.99
*
* Part 17 is the Product Receiver - a 500ml (nom.) Reaction Kettle.
*
CLUSTER 4
* Calcined Powder filling Product Receiver
1 ZCYL 2 4.445 15.716 0.476
* SS Flange on Top of Product Receiver
2 ZCYL 1 4.921 16.116 15.716
OVERLAP 1        3  5
* Powder filling Inside of Flange
3 ZCYL 2 1.39319 16.116 15.716
OVERLAP 1     2     9
* Wrapper:  Borosilicate Glass Wall of Product Receiver
4 ZROD 7 4.921 16.116
*
```

```
* Part 18 is the Load Out Shelf
*
CLUSTER 7
*
* Circular Region under Product Receiver
1 ZROD ORIGIN 23.8763 36.5125 0 10 7.62  0.152
OVERLAP 1            4            30
* Circular Region under Left Load Out Can
2 ZROD ORIGIN  6.7313  4.445 0 10 4.445 0.152
OVERLAP 2            4  5         25
* Circular Region under Right Load Out Can
3 ZROD ORIGIN 41.0212  4.445 0 10 4.445 0.152
OVERLAP 2            4     6      20
* Trapezoid under All Three ZRODs
4 -XYPRISM ORIGIN 16.86835 39.5047 0
          10 14.0158 33.314 0.152 113.1223 113.1223
OVERLAP 3   1  2  3               15
* Trapezoid on the Left
5 +XYPRISM ORIGIN 6.7313 0 0 10 18.1451 6.1905 0.152 123.43879 90
OVERLAP 2      2       6          10
* Trapezoid on the Right
6 +XYPRISM ORIGIN 22.8762 0 0 10 18.1450 6.1905 0.152 90 123.43879
OVERLAP 2         3    5           5
* Container:  an Empty Triangle
7 +XYPRISM 0  47.755 55.917 0.152 66.8777 66.8777
*
* Part 19 is a stack of cooling coil tori, used in Part 9
*
CLUSTER 10
* Nine Coils modeled as a Stack of Torroidal Pipes
ZCYL ORIGIN 0 0  0.00 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  1.27 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  2.54 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  3.81 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  5.08 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  6.35 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  7.62 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0  8.89 P 20 6.19125 1.27 0.00
ZCYL ORIGIN 0 0 10.16 P 20 6.19125 1.27 0.00
ZCYL 3 6.19125  11.43 0.0
*
* Part 20 is a single torus of water-filled pipe, used in Part 10.
*
CLUSTER 3
* Inside of Feed Pipe
1 ZCYL 0 1.07 1.27 0.0                      OVERLAP 1     2        5
*  Wall of Feed Pipe
2 ZCYL 1 1.27 1.27 0.0                      OVERLAP 1  1           4
* One Pipe Torus
3 ZCYL ORIGIN 0 0  0.00 H 2 6.19125 1.27 0.00
*
* Hole 1 is a torroidal pipe containing water in Feed
*
QUADRIC 3 3 8 10
0.0 0.0 0.635
0.0 0.0 1.0
1.0 0.0 0.0
1.0 1.0 1.0 5.55625 2
8  0.5461
10 0.635 3
*
* Hole 2 is a torroidal pipe containing water in Solids
*
QUADRIC 3 16 8 10
0.0 0.0 0.635
0.0 0.0 1.0
1.0 0.0 0.0
```

```
1.0 1.0 1.0 5.55625 2
8  0.5461
10 0.635 16
*  First Stage      Last Stage      # Superhistories     Time Limit
    -3              10                1000                 300
* Start fissions throughout box in fissile material
 -1 FISSILE REGION 1 IN PART 1
END
NOCODE
23  100 40 41  100 40 23   100 -53
*Vertical X-Sect. of Feed Tank and Pump
23     91   23  41     91     23  23    109  23
*Horizontal X-Sect of Feed Tank
70   86 65 70 114 65 70  86 -34
*Vertical X-Sect of Calciner, Product Receiver
46 120 -41.50 94 120 -41.50 46 62 -41.50
*H Through Load Out Tray
46 120 -41     94 120 -41     46 62 -41
*H Through Powder Layer on Load Out Tray
46 120 -32.4  94 120 -32.4  46 62 -32.4
*H Through Powder Cans and Product Receiver
102.0675 80 -31 102.0675 126 -31 102.0675 80 -54
*V Through Powder Cans and Powder Layer
46 71.67265 -30   94 71.67265 -30   46 71.67265 -54
*V Through Product Receiver and Load Out Tray
46 83 52 87 83 52 46 117 52
*Horizontal X-Sect of Filter Section of Calciner
23 130 14    99 130 14   23 70 14
*H through Calciner, Feed Tank, Feed Bottle
10  40  42  10  130  42  110 40  42
*Horizontal X-Sect Through Feed Tank and Filters
70 13.20 130 70 29.92 130 70 13.20  9
*Vert. X-Sect through Scrubber.
61 12.56 16.875 61 30.56 16.875 79 12.56 16.875
*Horiz X-Sect through Scrubber.
10 280 -20 100 280 -20 10 280 -55
*Vert through Scrubber Waste Storage Tanks.
10 155 -34.485 100 155 -34.485 10 285 -34.485
*Horiz. Through Waste Storage Tanks.  +X is Left.
0.1  0.1  30  0.1  337.8  30  111.7 0.1  30
*Whole Box, Horizontal
70  -15  182  70 352 182 70 -15 -68
*Whole Box, Vert. through Calciner and Scrubber Centerlines
END
```

Figure B-1: Horizontal Section of Filter Section of Calciner

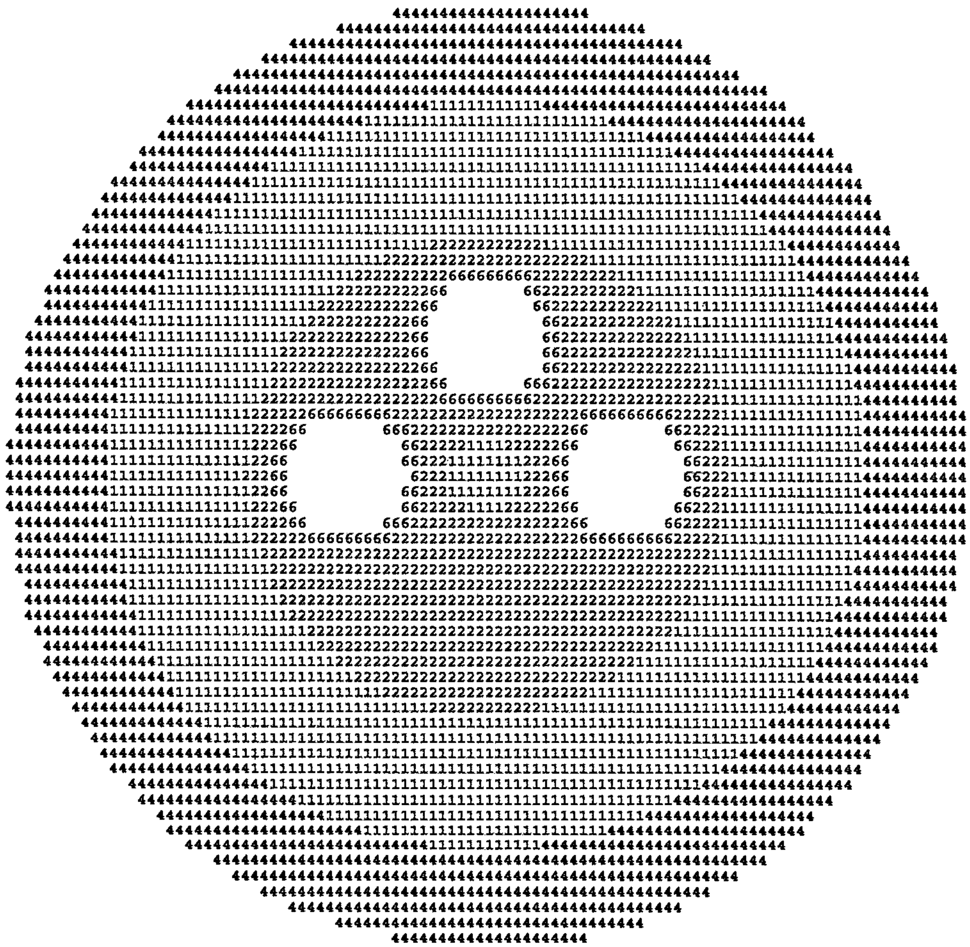

Figure B-2: Cross Section of Calciner Model, Page 1 of 3

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Figure B-2: Cross Section of Calciner Model, Page 2 of 3

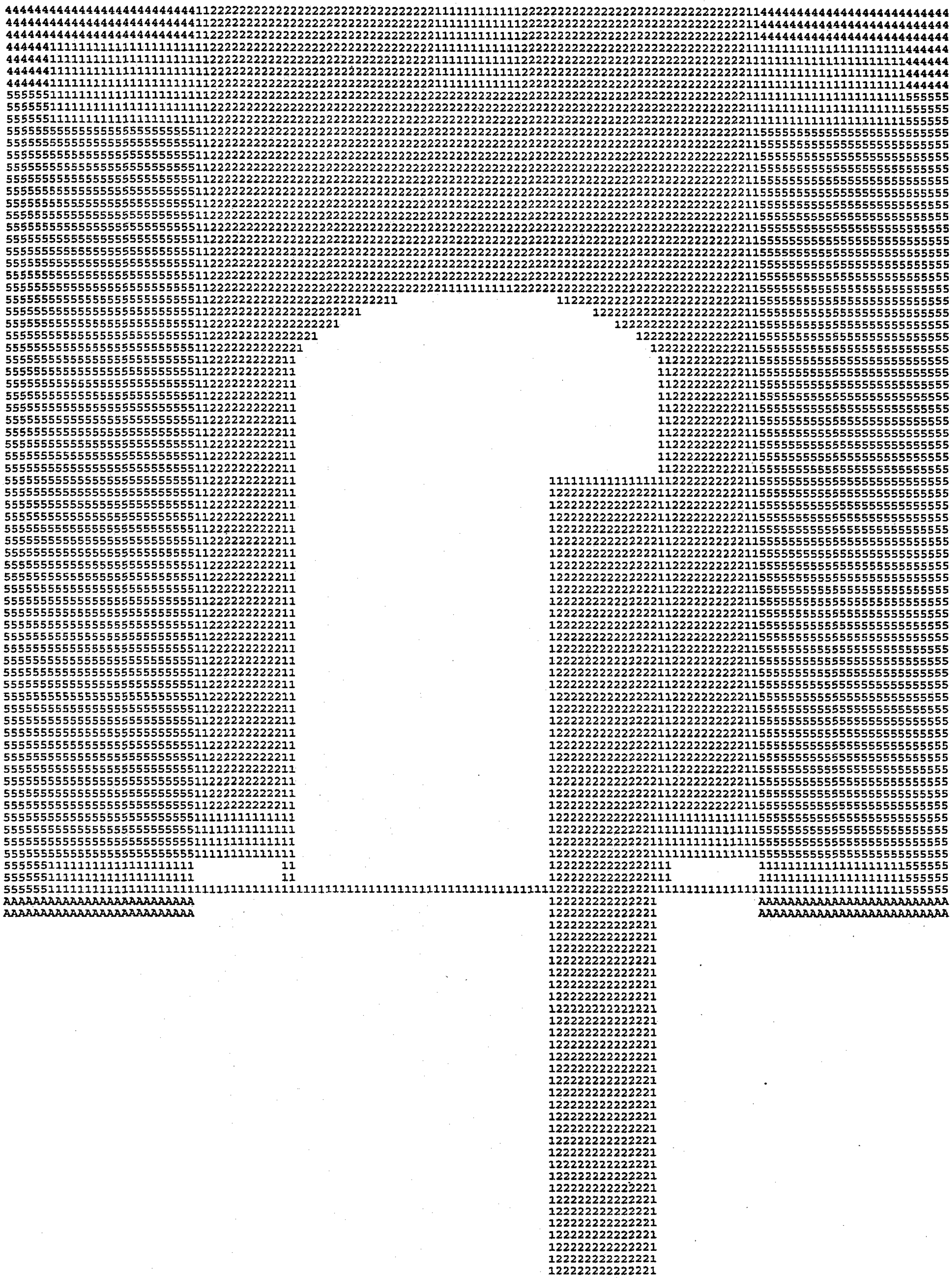

Figure B-2: Cross Section of Calciner Model, Page 3 of 3

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Figure B-3: Horizontal Section Through Powder Layer on Load Out Tray

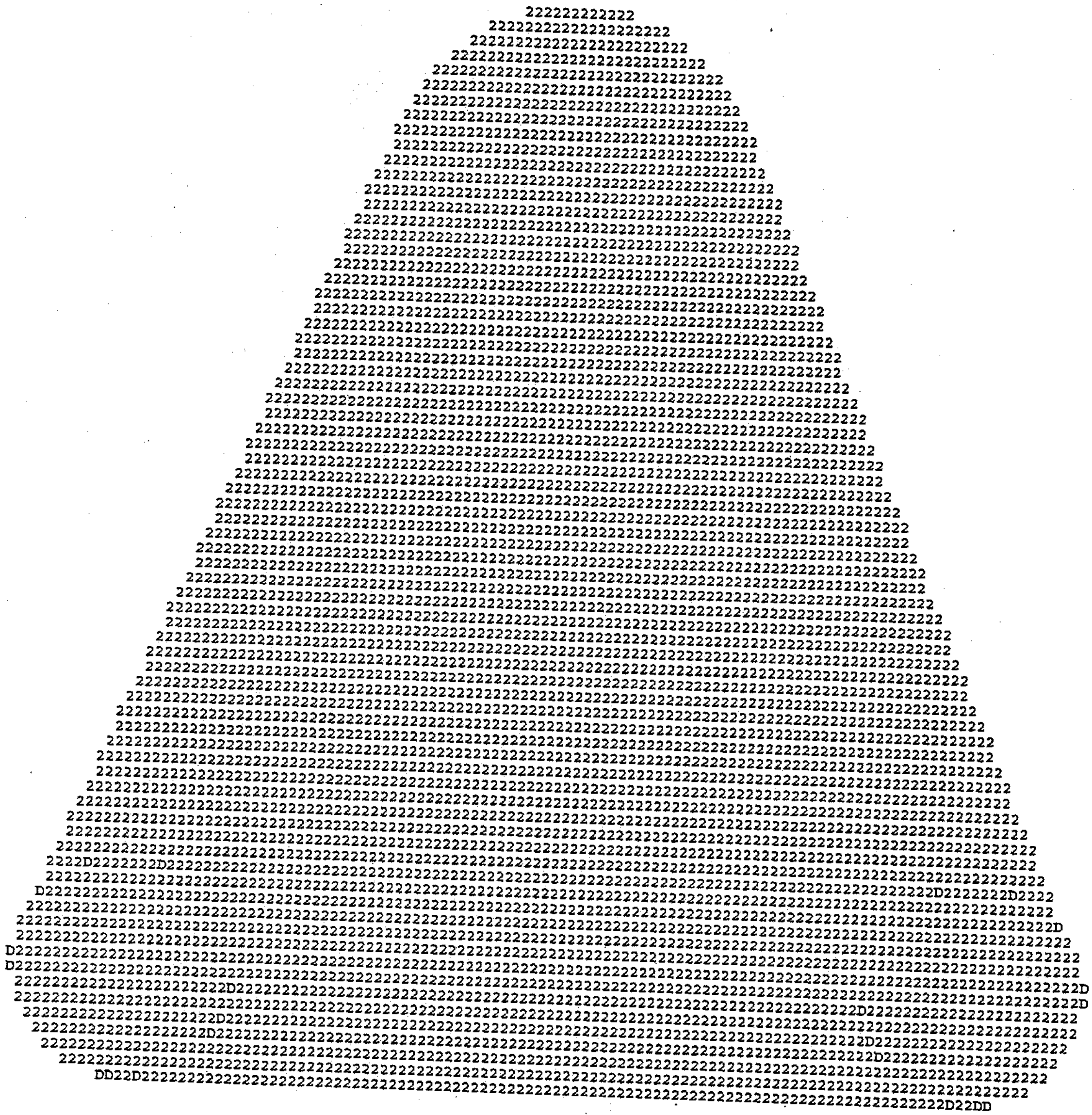

Figure B-4: Horizontal Section Through Powder Can Lids and Product Receiver

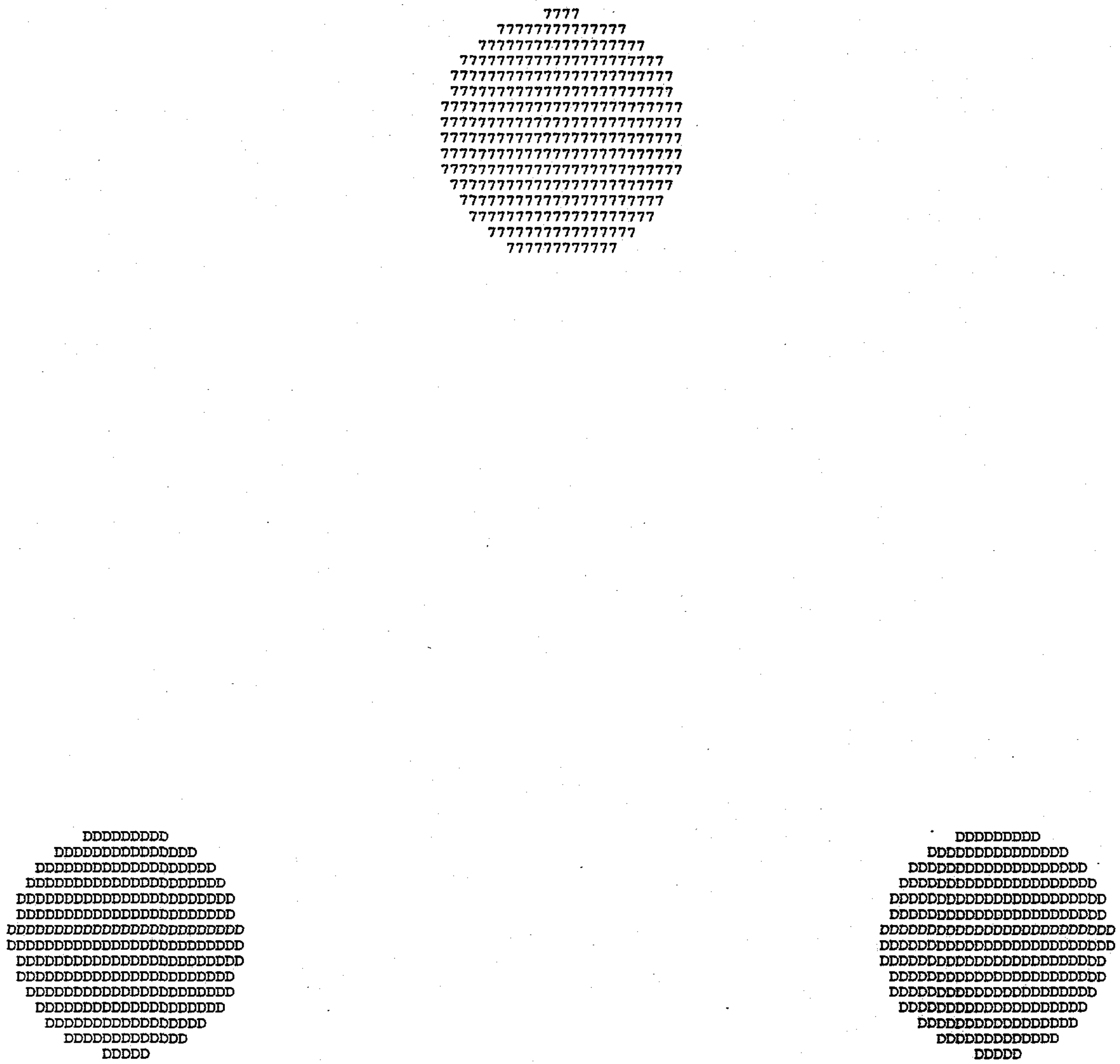

Figure B-5: Vertical Section Through Slip Lid Cans, Load Out Tray, and Sump

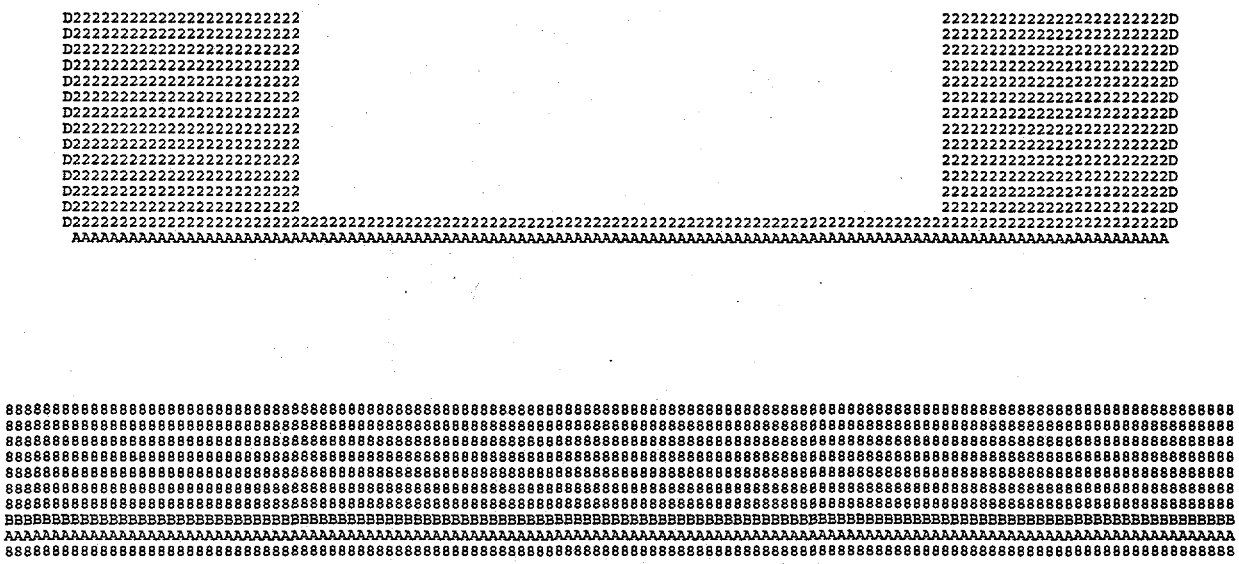

Figure B-6: Horizontal Section through Calciner, Feed Tank, Feed Bottle

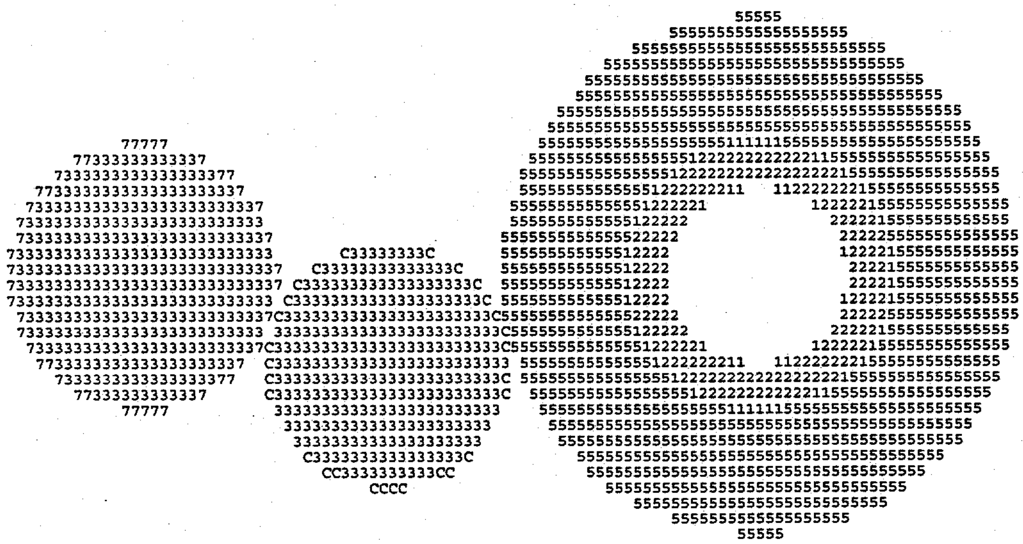

Figure B-7: Vertical Section through Glovebox on Scrubber and Calciner Centerlines

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Figure B-8: Vertical Section through Glovebox on Scrubber and Calciner Centerlines showing Mud Cone and Feed Cylinder from Contingency 2

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APPENDIX C: FISSION SOURCE STUDY

This appendix presents the results of a study on the effects of putting the initial fission source in different portions of the system. The purpose of the study was to determine whether starting the neutrons in the fissile material throughout the glovebox provided adequately realistic calculated results. As the following sections show, the study did not show any statistically significant variations resulting from putting the initial fission source in different parts of the system.

The study begins by making multiple calculations of the same physical model, starting the neutrons in a different location for each calculation. The k_{eff} of the entire system, as well as the fission rates (per 10,000 neutron histories) for each equipment piece, are examined for the different calculations. The examination consists of determining the t value for each starting location, and then looking for statistical outliers which would indicate a statistically significant variation in the examined quantity for a given starting distribution. The t values are calculated by dividing the deviation of a quantity from the mean by the standard deviation of the difference:

$$t_i = \frac{x_i - \overline{x}}{\sigma_{dif}}$$

$$= \frac{x_i - \overline{x}}{\sqrt{\sigma_i^2 + \sigma_p^2}}$$

where

x_i *is the* i^{th} *value of* x

$\overline{x}$ *is the mean for all* x

σ_i *is the standard deviation of* x_i

σ_p *is the population standard deviation*

σ_{dif} *is the standard deviation of the difference* $x_i - \overline{x}$.

The population standard deviation and mean are given by

$$\sigma_p = \sqrt{\frac{\sum_{i=1}^{n} ((x_i - \overline{x})^2 + \sigma_i^2)}{n - 1}}$$

where

σ_p *is the population standard deviation*

x_i *is the* i^{th} x

σ_i *is the standard deviation of* x_i

$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ *is the mean.*

For each neutron starting location, table C-1 presents the abbreviation used in the following sections and the name of the MONK6B run.

C.1 FLOOR MATERIAL

Table C-2 examines the results of different starting locations for the two regions of fissile material outside smaller equipment pieces. In all cases, the t values lie between ±2, with only two cases for each region outside ±1. Thus, there is no significant effect on the accumulations of changing the neutron starting locations.

C.2 FEED POLYBOTTLE

Table C-3 examines the effect on the calculated fission rate in the feed polybottle of starting the neutrons in different locations. All of the t values are within ±2. Only two t values are outside ±1. Therefore, the examination does not show any significant effect on the calculated response in the feed polybottle of different neutron starting locations.

C.3 THE FEED TANK

Table C-3 examines the effect on the calculated fission rate in the feed tank of starting the neutrons in different locations. All of the t values are within ±2. Only two t values are outside ±1. Therefore, the examination does not show any significant effect on the calculated response in the feed tank of different neutron starting locations.

Table C-1: Neutron Starting Location Abbreviations		
Abbreviation	**Neutron Starting Location***	**Run #**
St	Throughout the Glove Box	DeNO3St
sc	Calciner	DeNO3sc
sf	Feed Tank	DeNO3sf
sb	Feed Polybottle	DeNO3sb
ss	Scrubber	DeNO3ss
sw	First Waste Tank	DeNO3sw
sW	Second Waste Tank	DeNO3sW
sr	Product Receiver	DeNO3sr
sl	Loadout Can	DeNO3sl
sn	Nitrate on Intermediate Floor	DeNO3sn
sm	"Mud" on the Bottom Floor	DeNO3sm
sp	Pump	DeNO3sp

*The neutrons are started in the fissile material throughout the region

Table C-2: Material on the Glovebox Floors				
Start	Effect on Intermediate Floor		Effect on Bottom Floor	
	Fissions	t	Fissions	t
St	206±5	-1.152	797±14	0.377
sc	213±5	-0.524	791±14	0.158
sf	213±5	-0.524	821±14	1.253
sb	225±5	0.554	777±14	-0.353
ss	215±6	-0.330	793±15	0.227
sw	228±6	0.789	787±14	0.012
sW	224±6	0.445	776±14	-0.389
sr	209±6	-0.846	798±15	0.406
sl	215±5	-0.344	801±13	0.533
sn	232±6	1.133	746±14	-1.484
sm	226±5	0.644	778±14	-0.316
sp	220±5	0.105	775±13	-0.434
Ave.	218.833		786.667	
StD.	9.948		23.562	

Table C-3: The Feed Polybottle and Feed Tank				
Start	Effect on the Feed Polybottle		Effect on the Feed Tank	
	Fissions	t	Fissions	t
St	33±5	-0.567	39±6	-0.565
sc	45±5	0.321	60±7	0.796
sf	35±5	-0.419	35±5	-0.849
sb	61±8	1.365	76±9	1.712
ss	36±5	-0.345	48±8	0.026
sw	28±4	-0.961	38±5	-0.647
sW	30±4	-0.809	45±5	-0.174
sr	35±7	-0.394	30±4	-1.212
sl	39±5	-0.123	52±7	0.283
sn	50±7	0.649	49±7	0.091
sm	36±4	-0.354	51±7	0.219
sp	60±8	1.298	48±6	0.027
Ave.	40.667		47.583	
StD	12.561		13.944	

C.4 THE FEED PUMP

Table C-4 examines the effect on the calculated fission rate in the feed pump of starting the neutrons in different locations. The t values are all within ±1. Therefore, the examination does not show any significant effect on the calculated response in the feed pump of different neutron starting locations.

C.5 THE VERTICAL DENITRATION CALCINER

Table C-4 examines the effect on the calculated fission rate in the vertical calciner of starting the neutrons in different locations. All of the t values are within ±2. All but four of the t values are within ±1. Therefore, the examination does not show any significant effect on the calculated response in the vertical calciner of different neutron starting locations.

C.6 THE OFF GAS SCRUBBER

Table C-5 examines the effect on the calculated fission rate in the scrubber of starting the neutrons in different locations. All of the t values are within ±2. Only two t values are outside ±1. Therefore, the examination does not show any significant effect on the calculated response in the scrubber of different neutron starting locations.

C.7 THE WASTE SCRUB SOLUTION CATCH TANKS

Table C-5 examines the effect on the calculated fission rate in the catch tanks of starting the neutrons in different locations. All of the t values are within ±2. Only two t values are outside ±2. Therefore, the examination does not show any significant effect on the calculated response in the feed tank of different neutron starting locations.

C.8 THE PRODUCT RECEIVER

Table C-6 examines the effect on the calculated fission rate in the product receiver of starting the neutrons in different locations. All of the t values are within ±2. Only one t value is outside ±1. Therefore, the examination does not show any significant effect on the calculated response in the product receiver of different neutron starting locations.

C.9 THE LOAD OUT CONTAINER

Table C-6 examines the effect on the calculated fission rate in the load out container of starting the neutrons in different locations. All of the t values are within ±2. Only one t value is outside ±1. Therefore, the examination does not show any significant effect ont he calculated response in the load out container of different neutron starting locations.

Table C-4: The Feed Pump and Calciner				
Start	Effect on the Pump		Effect on the Calciner	
	Fissions	t	Fissions	t
St	4±1	0.406	88±12	-1.109
sc	2±1	-0.812	145±18	0.058
sf	2±1	-0.812	95±13	-0.961
sb	4±1	0.406	156±17	0.277
ss	4±1	0.406	110±15	-0.647
sw	3±1	-0.203	136±16	-0.122
sW	4±1	0.406	169±19	0.528
sr	3±1	-0.203	125±15	-0.345
sl	3±1	-0.203	91±11	-1.053
sn	4±1	0.406	231±24	1.678
sm	4±1	0.406	195±19	1.039
sp	3±1	-0.203	164±17	0.436
Ave.	3.333		142.083	
StD	1.303		47.255	

Table C-5: The Scrubber and Scrub Solution Catch Tanks				
Start	Effect on the Scrubber		Effect on the Catch Tanks	
	Fissions	t	Fissions	t
St	57±5	-0.176	1429±23	0.975
sc	49±5	-0.703	1356±27	-0.131
sf	45±5	-0.967	1409±25	0.664
sb	70±7	0.648	1303±27	-0.918
ss	52±8	-0.467	1398±28	0.490
sw	75±8	0.935	1366±26	0.017
sW	55±8	-0.284	1389±27	0.359
sr	41±4	-1.255	1428±25	0.949
sl	60±8	0.020	1407±24	0.637
sn	75±9	0.907	1271±32	-1.350
sm	59±6	-0.043	1285±27	-1.186
sp	78±8	1.118	1337±27	-0.413
Ave.	59.667		1364.833	
StD	14.320		61.688	

Table C-6: The Load Out Container				
Start	Effect on the Receiver		Effect on the Container	
	Fissions	t	Fissions	t
St	4±1	-1.098	5±1	0.266
sc	6±1	-0.248	4±1	-0.266
sf	9±2	0.827	5±1	0.266
sb	5±1	-0.673	5±1	0.266
ss	7±2	0.143	4±1	-0.266
sw	6±1	-0.248	2±1	-1.328
sW	5±1	-0.673	4±1	-0.266
sr	6±1	-0.248	6±1	0.797
sl	8±1	0.602	5±1	0.266
sn	9±2	0.827	4±1	-0.266
sm	8±1	0.602	4±1	-0.266
sp	6±1	-0.248	6±2	0.586
Ave.	6.583		4.500	
StD	2.130		1.595	

C.10 THE ENTIRE SYSTEM

Table C-7 examines the effect on the calculated k_{eff} of the entire system of starting the neutrons in different locations. All of the t values are within ±2. Only one t value is outside ±1. Therefore, the examination does not show any significant effect on the calculated response of the entire system of different neutron starting locations. Accordingly, it is appropriate to use a fission source distributed over all the fissile material in the system.

Table C-7: The Entire System		
Start	Effect on the k_{eff}	
	k_{eff}	t
St	0.7695±0.0037	-0.556
sc	0.7783±0.0039	0.529
sf	0.7724±0.0038	-0.195
sb	0.7714±0.0038	-0.318
ss	0.7664±0.0041	-0.918
sw	0.7711±0.0039	-0.353
sW	0.7894±0.0041	1.867
sr	0.7739±0.0040	-0.010
sl	0.7753±0.0037	0.163
sn	0.7735±0.0042	-0.058
sm	0.7695±0.0038	-0.553
sp	0.7771±0.0037	0.386
Ave.	0.7740	
StD	0.0072	

APPENDIX D: VARIABLE DENSITY WATER SPRAY

The addition of water into the void space of a configuration has several effects: increased moderation, increased absorption, increased reflection, and increased isolation. Because two of these effects tend to increase and two tend to decrease reactivity, it is not immediately obvious what concentration of water will yield the highest k_{eff} by flooding. Accordingly, several computer simulations were run varying the concentration of water in the void space of the glove box from 0.001% to 80%. The results indicate that the highest k_{eff} for the vertical denitration system occurs when the glovebox is completely filled with water and all the air is displaced.

D.1 THE PLUTONIUM SYSTEM

A total of 23 simulations were run using the plutonium model. The spacing of water concentrations used in the simulations was basically two per decade, with some extra concentrations. Because of an expectation that the differentiation option of MONK6B would be useful in more quickly characterizing the curve, some concentrations were run more than once, with different parameters for the differentiation option. The differential coefficients reported by MONK6B were not helpful, and therefore are neither reported nor used in the discussion.

Table D-1 presents the calculated values of k_{eff} for the 23 plutonium model runs, together with the percent concentrations of water in the void space. Table D-2 presents the average values of k_{eff} and the calculational uncertainties for the concentrations examined. Figure D-1 presents the data from table D-2 graphically. As can be seen, the calculated k_{eff} increases with increasing water concentration. The appropriate flooding double contingency condition therefore fills the glovebox completely with water, and not merely a water spray.

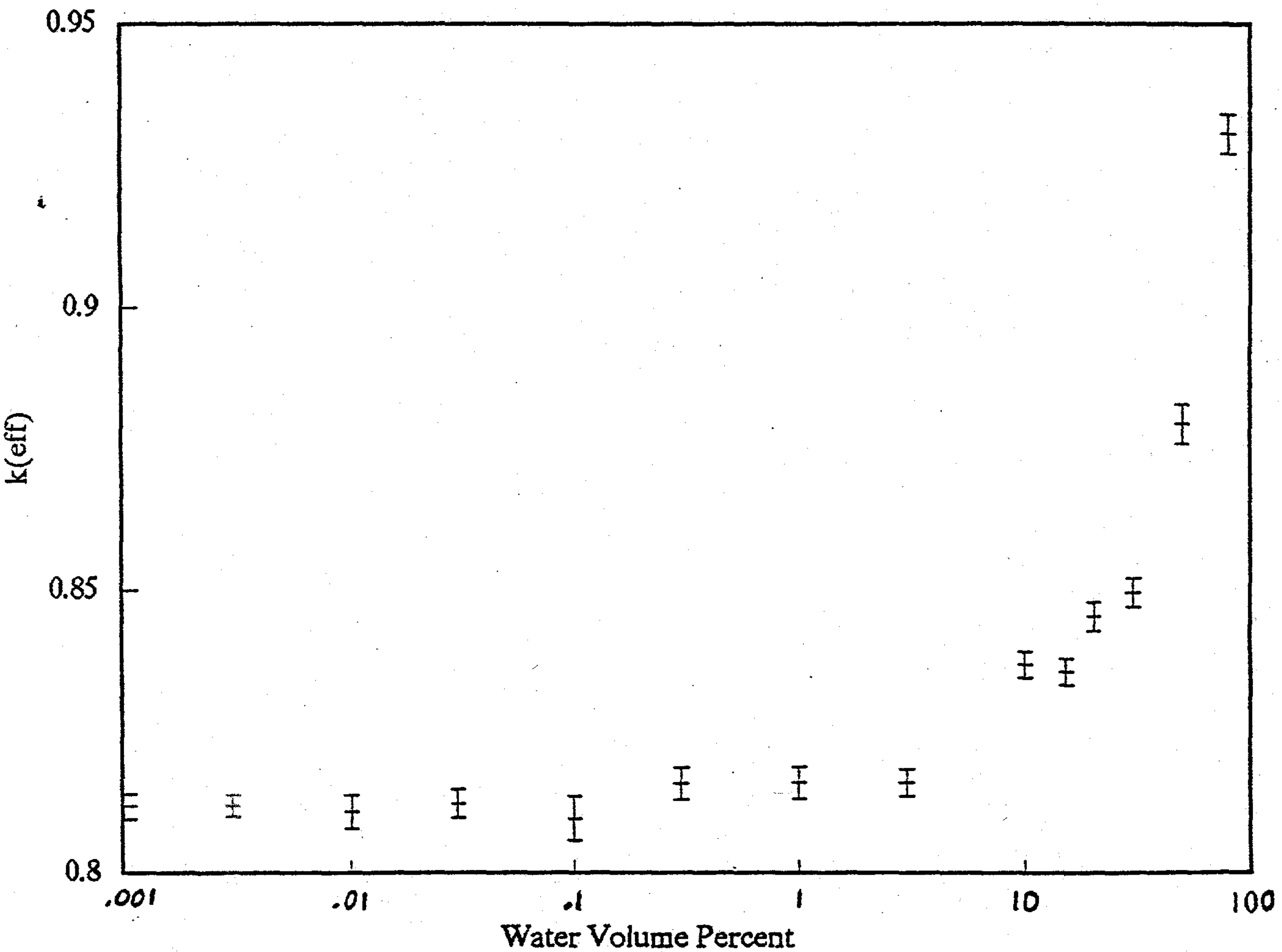
Table D-1: Water Spray Simulations for the Plutonium Model

Run Number	Percent Water in Spray	k_{eff}	StD*
sp80	80	.9307	.0035
sp50	50	.8795	.0035
DeNO3PSp30	30	.8478	.0036
sp30	30	.8513	.0025
sp20	20	.8453	.0025
sp15	15	.8355	.0024
DeNO2PSp10	10	.8365	.0034
sp10	10	.8372	.0037
DeNO3PSp3	3	.8168	.0037
sp3	3	.8151	.0028
DeNO3PSp1	1	.8178	.0035
sp1	1	.8142	.0035
DeNO3PSph	.3	.8173	.0036
sph	.3	.8141	.0037
DeNO3PSpd	.1	.8054	.0034
spd	.1	.8139	.0036
sps	.03	.8123	.0025
DeNO3PSpc	.01	.8085	.0035
spc	.01	.8132	.0035
spp	.003	.8131	.0025
sppt	.003	.8109	.0024
spm.1	.001	.8138	.0026
spm.2	.001	.8099	.0026

*StD is the standard deviation reported by the MONK6B program.

Table D-2: Effect of Water Concentration in Spray for the Plutonium Model		
Percent Water in Spray	k_{eff}	StD
80	.9307	.0035
50	.8795	.0035
30	.8496	.0025
20	.8453	.0025
15	.8355	.0024
10	.8369	.0024
3	.8160	.0024
1	.8160	.0028
.3	.8157	.0028
.1	.8097	.0039
.03	.8123	.0025
.01	.8109	.0030
.003	.8120	.0019
.001	.8119	.0023

Figure D-1: Effect of Water Concentration in Spray on k_{eff} for the Plutonium Model- Semilog Plot



D.2 THE URANIUM SYSTEM

A total of eighteen simulation were run using the uranium model. The spacing of water concentrations used in the simulations was basically two per decade, with some extra concentrations. Because of an expectation that the differentiation option of MONK6B would be useful in more quickly characterizing the curve, some concentrations were run more than once, with different parameters for the differentiation option. The differential coefficients reported by MONK6B were not helpful, and therefore are neither reported nor used in the discussion.

Table D-3 presents the calculated values of k_{eff} for the eighteen uranium model runs, together with the percent concentrations of water in the void space. Table D-4 presents the average values of k_{eff} and the calculational uncertainties for the concentrations examined. Figure D-2 presents the data from table D-4 graphically. As can be seen, the calculated k_{eff} increases with increasing water concentration in the void space. The appropriate flooding double contingency condition therefore fills the glovebox completely with water, and not merely a water spray.

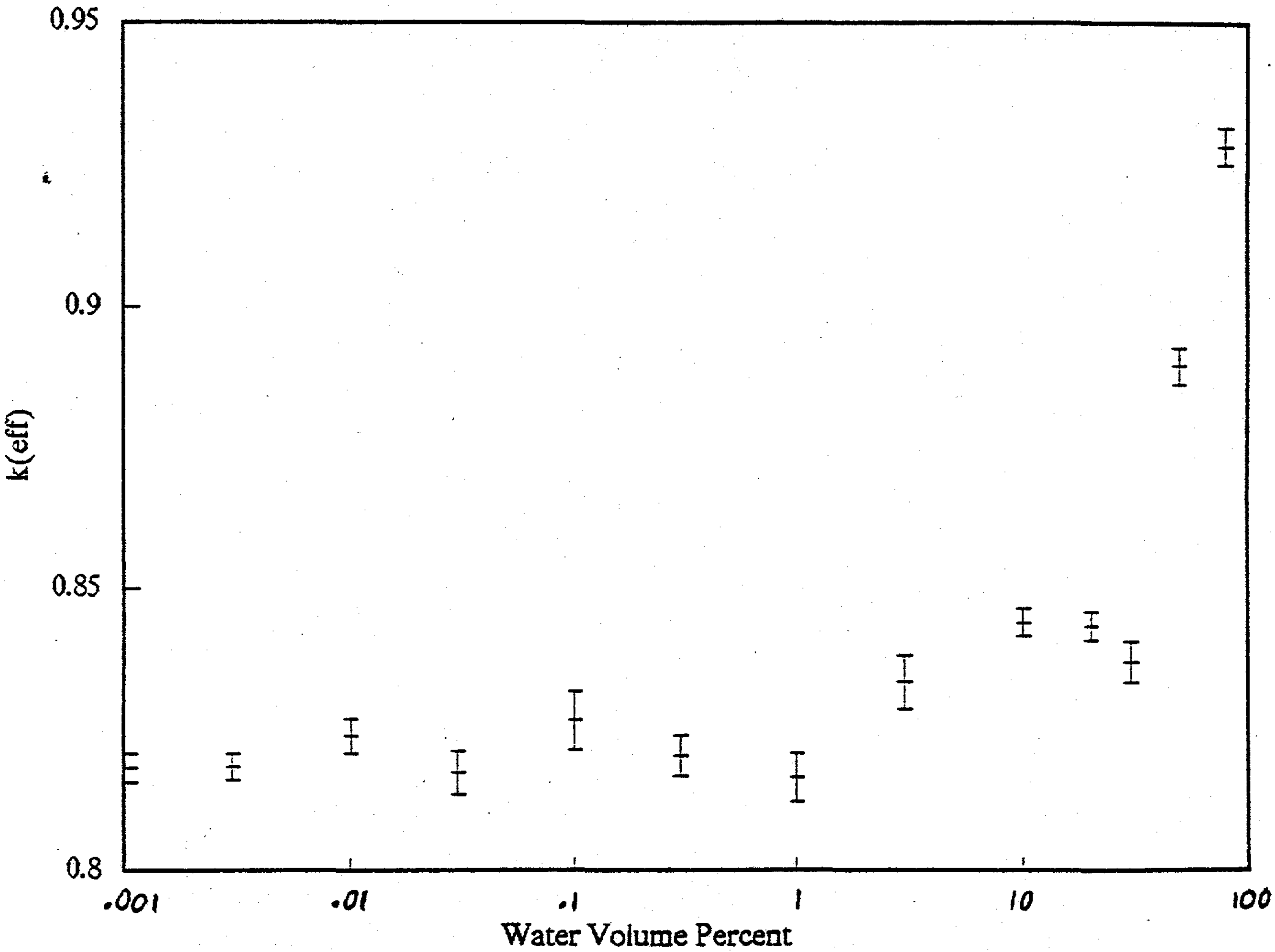
Table D-3: Water Spray Simulations for the Uranium Model

Run Number	Percent Water in Spray	k_{eff}	StD
su80	80	.9283	.0033
su50	50	.8892	.0033
su30	30	.8368	.0037
su20	20	.8432	.0025
DeNO3USp10	10	.8428	.0036
su10	10	.8450	.0026
DeNO3USp3	3	.8391	.0035
su3	3	.8276	.0036
DeNO3USp1	1	.8113	.0034
su1	1	.8215	.0025
suh	.3	.8203	.0036
DeNO3USpd	.1	.8331	.0037
sud	.1	.8199	.0024
sus	.03	.8172	.0038
DeNO3USpc	.01	.8268	.0035
suc	.01	.8207	.0026
sup	.003	.8183	.0024
sum	.001	.8181	.0025

Table D-4: Effect of Water Concentration in Spray for the Uranium Model

Percent Water in Spray	k_{eff}	StD
80	.9283	.0033
50	.8892	.0033
30	.8368	.0037
20	.8432	.0025
10	.8439	.0024
3	.8334	.0048
1	.8164	.0042
.3	.8203	.0036
.1	.8265	.0052
.03	.8172	.0038
.01	.8238	.0031
.003	.8183	.0024
.001	.8181	.0025

Figure D-2: Effect of Water Concentration in Spray on k_{eff} for the Uranium Model - Semilog Plot



APPENDIX E: WATER AFFINITY OF CALCINER SECTION INSULATION

Westinghouse Hanford Company **Internal Memo**

From: Plutonium Process Support Laboratories 15F00-95-048
Phone: 373-2296 T5-12
Date: May 3, 1995
Subject: VERTICAL CALCINER INSULATION WATER ABSORPTION RESULTS

To: L. T. Nirider T5-50

cc: Y. M. Chien	T4-20	A. L. Ramble	H4-64
J. F. Durnil	T5-55	P. M. Rickords	T4-20
F. D. Fisher	T5-12	L. H. Rodgers	T5-54
J. L. Geiger	H4-64	C. S. Sutter	T5-12
M. W. Gibson	T5-55	Process Aids (PFP)	
C. M. Kronvall	T5-53	File RE 3.5.4.3	
W. S. Lewis	T5-55	LB	
S. B. Merrick	T4-20		

The Plutonium Process Support Laboratories (PPSL) obtained and tested a sample of the direct denitration vertical calciner's insulation for water absorption. The testing was done at the request of the Plutonium Finishing Plant (PFP) Criticality Safety Representative (CSR). The CSR was concerned that, if exposed to a water source, the insulation might absorb and retain enough water to lead to a criticality inside the calciner.

The insulation sample was labeled type KVS174/400, which is very similar to the insulation material purchased for the calciner. The sample was obtained from the insulation manufacturer (Rath Performance Fibers, Wilmington, DE), who stated that the insulation was about 90 percent void space and would absorb water rapidly. The manufacturer describes the insulation as "high alumina fibers" held together by a colloidal silica/alumina filler and sintered to form glossy faces. The alumina fibers are on the order of microns in length, causing the large amount of void space. Samples left in a room atmosphere should have a Loss On Ignition of ½-2 weight percent due to moisture absorption from the air.

The sample obtained was a block 3¾ inches square by 1½ inches thick. Three smaller samples were cut from this block. Samples A and B were 1½-inch cubes and Sample C was ¾ by 1½ by 1½ inches. Dry weights of these samples were 21.53 gm, 21.86 gm, and 12.66 gm, respectively, for an average density of 0.39 gm/cc. This measured average density is very close to the manufacturer's stated density of 400 kg/m^3 (0.40 gm/cc). The cutting action of making the smaller samples in the PPSL probably caused the difference in density. Note that this density and the humidity absorption information (above) yield a normal room temperature water content of 0.002-0.008 gm water per cc of insulation.

Sample C was tested first by dipping it about ¼ inch into water for one second. The weight increased from 12.66 gm to 24.28 gm during that time. Sample C was then dipped about halfway into water and held there for about 2 seconds. There was a definite cooling feeling from the absorbed water at

L. T. Nirider 15F00-95-048
Page 2
May 3, 1995

the top of the sample by the time the sample was removed. Sample C now weighed 36.4 gm, even after some water was clearly removed by wiping with a paper towel before reweighing it. Sample C was then set under water and allowed to soak for about one minute. Even though some loose insulation powder was left behind in the water and some water was absorbed by a paper towel, the sample now weighed 36.9 gm. After an additional 6-minute soak, the sample weighed 37.0 gm, indicating that 1 minute was about enough time to reach saturation. There was no visible change to the insulation's appearance during these tests.

Sample B was tested next by placing it gently onto the water surface in a beaker to see how long it would take to sink from a dry state. It sank almost immediately. Bubbles were visibly forced out from the upper surface for about 45 seconds; the sample was then removed. The sample weight had increased from 21.9 gm to 62.6 gm. Sample B was reimmersed and reweighed as 62.5 gm, indicating that about a minute was also adequate for a 1½-inch-thick block to saturate with water.

Sample B was set on a paper towel and allowed to dry in room air for 5 days. For the first 24 hours, there was a distinct damp area on the paper towel extending about 2 inches from the edge of the sample, helping to dry the sample. The damp area began shrinking visibly after about 28 hours and extended only about ¼ inch from the sample's edges after 32 hours. Sample weights and corresponding fractions of saturation moisture remaining in Sample B are listed below as functions of time.

Elapsed Time (hr)	Sample Weight (gm)	Moisture Remaining (%)
0.00	62.5	100.0
0.17	61.9	98.5
0.42	61.5	97.5
0.67	61.1	96.6
1.00	60.7	95.6
1.50	60.0	93.8
2.08	59.2	91.9
2.50	58.6	90.4
3.08	57.8	88.4
3.52	57.2	86.9
4.00	56.5	85.2
5.00	55.1	81.8
6.50	53.3	77.3
8.00	51.3	72.4
23.00	35.7	34.0
25.12	33.0	27.3
27.00	30.8	21.9
29.00	28.6	16.5
32.00	26.1	10.3
120.0	21.8	Dry

L. T. Nirider
Page 3
May 3, 1995

15F00-95-048

This insulation would dry faster at higher temperatures; however, the purpose of the insulation is to limit heat flow and minimize the amount of insulation at high temperatures. With plutonium constantly contained within the calciner body, any potential criticality would also occur before the insulation could dry at any temperature.

The insulation designed for the calcining section of the calciner is a hollow right circular cylinder with an inside diameter of 20.0 cm, an outside diameter of 39.7 cm, and a height of 20.3 cm. The bulk volume of this insulation is 18.8 L. These dimensions and the test data do not include the insulation that will be field fit to the gas filtering section of the calciner.

The dried samples are available for inspection or further testing in Room 202, if desired, and will be kept until the Criticality Safety Evaluation Report for the calciner is completed. The test data are recorded in laboratory notebook ARH-N-260. Please call Jim Compton at 373-2296 if you have any questions about these tests and results.

James A Compton

J. A. Compton, Sr. Engineer
Plutonium Process Support Laboratories

jac

APPENDIX F: QUALITY ASSURANCE RECORD TRANSMITTALS

Calculations performed in support of a criticality safety evaluation report are quality assurance records, which must be maintained until the system is no longer in service. The disposition of a calculation to the record holding area is documented via a completed quality assurance record transmittal, which also provides the necessary information to retrieve the record, if needed. The quality assurance record transmittal copies in this section cover the computer calculations supporting this criticality safety evaluation report.

Transmittal No.: RHA-95-225
Page 1 of 5

QUALITY ASSURANCE RECORD TRANSMITTAL

To:
[ ] Central Files Vault, 3706 Building/300 Area
[ ] QA Vault, 4702 Building/400 Area
[X] Records Holding Area, 712 Building
[ ] Engineering Files, 3rd Floor Federal Building
[ ] Other (explain)

2. Westinghouse Hanford/Consequence Analysis — Retiring Company/Department
A. L. Ramble/J. L. Geiger — Manager/Custodian
4/20/95 — Date

8M400 — Organization Code
RCHN — Area
450HILLS — Bldg.
109A — Room
H4-64 — MSIN
372-3632 — Phone No.

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WHC-SD-SQA-CSA-20392. Standard Configuration. The second title line of this printout is: DeNO3as PFP Denitration, Standard Config....	1	U	N/A	3/14/95	3/24/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WHC-SD-SQA-CSA-20392. Contingency 1 is a second feed pollybottle next to the feed tank and calciner. The second title line of this printout is: DeNO3a1 PFP Denitration, Ct1: Feed Overbatch	1	U	N/A	3/15/95	3/15/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 2 is a feed solution spill. In this case, the feed is still falling. The second title line of this printout is: DeNO3a2 PFP Denitration, Ct 2: Falling Feed..	1	U	N/A	3/15/95	3/15/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

Transmittal No.: RHA-95-225
Page 2 of 5

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 2 is a feed solution spill. In this case, the feed and calcine have mixed and settled. The second title line of this printout is: DeNO3A2 PFP Denitration, Ct2: Cone of Mud...	1	U	N/A	3/16/95	3/16/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 2 is a feed solution spill. In this case, the feed has diluted the calcine, which has settled into a cone. The second title line of this printout is: DeNO3AT PFP Denitration, Ct2: Fluffy Mud Con	1	U	N/A	3/16/95	3/16/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 3 is a product overbatch. The second title line of this printout is: DeNO3a3 PFP Denitration, Ct3: Loadout Overba	1	U	N/A	3/16/95	3/16/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 4 is a floor double batch. The second title line of this printout is: DeNO3a4 PFP Denitration, Ct4: Floor Overbatc	1	U	N/A	3/16/95	3/16/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 5 is a calciner flood. This case has wet insulation. The second title line of this printout is: DeNO3a5 PFP Denitration, Ct5: Calcnr Flood w	1	U	N/A	3/16/95	3/16/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-225
Page 3 of 5

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 5 is a calciner flood. This case has dry insulation. The second title line of this printout is: DeNO3A5 PFP Denitration. Ct5: Calcnr Flood d	1	U	N/A	3/16/ 95	3/16/ 95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 6 is a glovebox flood. The second title line of this printout is: DeNO3a6 PFP Denitration. Ct6: Glovebox Flood	1	U	N/A	3/21/ 95	3/24/ 95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 6 is a glovebox. In this case, the criticality drain works and the glovebox is filled with a 10% water mist. The second title line of this printout is: DeNO3A6 PFP Denitration. Ct6: Glovebox Spray	1	U	N/A	3/22/ 95	3/22/ 95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 7 is an overbatch of solids in the scrubber. The second title line of this printout is: DeNO3a7 PFP Denitration. Ct7: Scrub Overbatc	1	U	N/A	3/15/ 95	3/15/ 95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

11. The signature below certifies that the records submitted by this transmittal have been reviewed, are complete, and are in conformance with applicable procedures; and the "Transmittal and Record Acceptance Criteria" checklist on the last page of this form has been completed.

95 Apr 26

Cognizant Individual

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-225
Page 4 of 5

12. Transfer Approval IRM Records Management Specialist	Data Entry Info.	Received/Verified by RHA or Central Files
Bonnie Sullivan 4-20-95	S-8 [ ] S-10 [ ] S-9 [ ] S-11 [ ]	[illegible] Cooper 5/2/95

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-224
Page 1 of 5

QUALITY ASSURANCE RECORD TRANSMITTAL

To: [ ] Central Files Vault, 3706 Building/300 Area
[ ] QA Vault, 4702 Building/400 Area
[X] Records Holding Area, 712 Building
[ ] Engineering Files, 3rd Floor Federal Building
[ ] Other (explain)

2. Westinghouse Hanford/Consequence Analysis — Retiring Company/Department
A. L. Ramble/J. L. Geiger — Manager/Custodian
4/20/95 — Date

8M400 — Organization Code
RCHN — Area
450HILLS — Bldg.
109A — Room
H4-64 — MSIN
372-3632 — Phone No.

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WHC-SD-SQA-CSA-20392. Standard Configuration for the Uranium model. The second title line of this printout is: DeNO3us PFP Denitration, Uranium Standard C.	1	U	N/A	3/16/95	3/16/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WHC-SD-SQA-CSA-20392. Contingency 1 is a second feed pollybottle next to the feed tank and calciner. The second title line of this printout is: DeNO3u1 PFP Denitration, Ct1: U Feed Overbat	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 2 is a feed solution spill. In this case, the feed is still falling. The second title line of this printout is: DeNO3u2 PFP Denitration, Ct 2: Falling U Feed	1	U	N/A	3/21/95	3/24/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-224
Page 2 of 5

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
1500006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 2 is a feed solution spill. In this case, the feed and calcine have mixed and settled. The second title line of this printout is: DeNO3U2 PFP Denitration, Ct2: Cone of U Mud.	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 2 is a feed solution spill. In this case, the feed has diluted the calcine, which has settled into a cone. The second title line of this printout is: DeNO3UF PFP Denitration, Ct2: Fluffy U Mud..	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 3 is a product overbatch. The second title line of this printout is: DeNO3u3 PFP Denitration, Ct3: U Product Over	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 4 is a floor double batch. The second title line of this printout is: DeNO3u4 PFP Denitration, Ct4: Floor U Double	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 5 is a calciner flood. This case has wet insulation. The second title line of this printout is:. DeNO3u5 PFP Denitration, Ct5: U Calc. Floodw	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: KHA-95-444

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 5 is a calciner flood. This case has dry insulation. The second title line of this printout is: DeNO3U5 PFP Denitration, Ct5: U Calc. Floodd	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 6 is a glovebox flood. The second title line of this printout is: DeNO3u6 PFP Denitration, Ct6: U Glovebox Flo	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 6 is a glovebox. In this case, the criticality drain works and the glovebox is filled with a 10% water mist. The second title line of this printout is: DeNO3U6 PFP Denitration, Ct6: U Box Spray...	1	U	N/A	3/22/95	3/22/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. Contingency 7 is an overbatch of solids in the scrubber. The second title line of this printout is: DeNO3u7 PFP Denitration, Ct7: U Scrub Overba	1	U	N/A	3/17/95	3/17/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

11. The signature below certifies that the records submitted by this transmittal have been reviewed, are complete, and are in conformance with applicable procedures; and the "Transmittal and Record Acceptance Criteria" checklist on the last page of this form has been completed.

95 Apr 20

Cognizant Individual

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-234
Page 4 of 5

12. Transfer Approval IRM Records Management Specialist	Data Entry Info.	Received/Verified by RHA or Central Files
Bonnie Sullivan 4-20-95	S-8 [ ] S-10 [ ] S-9 [ ] S-11 [ ]	Gayle Cooper 5-2-95

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-226
Page 1 of 5

QUALITY ASSURANCE RECORD TRANSMITTAL

To: [ ] Central Files Vault, 3706 Building/300 Area
[ ] QA Vault, 4702 Building/400 Area
[X] Records Holding Area, 712 Building
[ ] Engineering Files, 3rd Floor Federal Building
[ ] Other (explain)

2. Westinghouse Hanford/Criticality and Radiological Analyses
Retiring Company/Department

A. L. Ramble/J. L. Geiger
Manager/Custodian

3/29/95
Date

8M400
Organization Code

Area	Bldg.	Room	MSIN	Phone No.
RCHN	450HILLS	109A	H4-64	372-3632

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392. This run analyzes the assumed standard configuration of the denitrating system. The second title line of this printout is: DeNO3St PFP Denitration - Standard Config...	1	U	N/A	2/7/95	2/7/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sc PFP Denitration Std. Cnfg. Start Clcn	1	U	N/A	2/7/95	2/7/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sf PFP Denitration Std. Start Feed Tank	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sb PFP Denitration Std. Start Polybottl	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-226
Page 2 of 5

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
1300006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3ss PFP Denitration Std. Start Scrubber.	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sw PFP Denitration Std. Start Waste Tk1	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sW PFP Denitration Std. Start Waste Tk2	1	U	N/A	2/7/95	2/7/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sr PFP Denitration Std. Start Prod. Rec	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sl PFP Denitration Std. Start Loadout..	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: RHA-95-226

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sn PFP Denitration Std. Start Nitrate..	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sm PFP Denitartion Std. Start in Mud...	1	U	N/A	2/8/95	2/8/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation calculation printout supporting WHC-SD-SQA-CSA-20392 neutron starting study. The second title line of this printout is: DeNO3sp PFP Denitration Std. Start in Pump..	1	U	N/A	2/9/95	2/9/95	DRS-14.6a TBD92 RL-93-619 Retain until the system evaluated by WHC-SD-SQA-CSA-20392 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: RHR-95-226
Page 4 of 5

11. The signature below certifies that the records submitted by this transmittal have been reviewed, are complete, and are in conformance with applicable procedures; and the "Transmittal and Record Acceptance Criteria" checklist on the last page of this form has been completed.

Cognizant Individual

12. Transfer Approval IRM Records Management Specialist	Data Entry Info.	Received/Verified by RHA or Central Files
Corinne Ransdell 3-29-95	S-8 [ ] S-10 [ ] S-9 [ ] S-11 [ ]	Gayle Cowper 5-2-95

A-6000-354 (02/92) GEF089

Transmittal No. DACZ-95-0221
Page 1 of 4

QUALITY ASSURANCE RECORD TRANSMITTAL

To: [ ] Central Files Vault, 3706 Building/300 Area
[ ] QA Vault, 4702 Building/400 Area
[X] Records Holding Area, 712 Building
[ ] Engineering Files, 3rd Floor Federal Building
[ ] Other (explain)

2. Westinghouse Hanford Company / Consequence Analysis
Retiring Company/Department

A. L. Ramble / J. L. Geiger
Manager/Custodian

5/17/95
Date

8M400
Organization Code

RCHN	450 Hills	109A	H4-64	372-3632
Area	Bldg.	Room	MSIN	Phone No.

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
130006								
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392. CSER 95-005. Study of varying density of water spray in glovebox. Plutonium as fissile material. k(eff) only calculated. The second title line of this printout is: DeNO3PP PFP Denitrating Calciner Spray Study	6	U	N/A	4/24/95	5/4/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392. CSER 95-005. Study of varying density of water spray in glovebox. Uranium as fissile material. k(eff) only calculated. The second title line of this printout is: DeNO3UP PFP Denitrating Calciner Spray Study	4	U	N/A	4/24/95	5/4/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: DACZ-95-0221
Page 2 of 4

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (L, N, PC)
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392, CSER 95-005. Study of varying density of water spray in glovebox. Plutonium as fissile material. k(eff) and derivative calculated. The second title line of this printout is: DeNO3PS PFP Denitrating Calciner Spray Study	12	U	N/A	4/26/95	5/4/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392, CSER 95-005. Study of varying density of water spray in glovebox. Uranium as fissile material. k(eff) and derivative calculated. The second title line of this printout is: DeNO3US PFP Denitrating Calciner Spray Study	10	U	N/A	4/27/95	5/4/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392, CSER 95-005. Filling the Calciner Section with Mud, Point Calculations. The second title line of this printout is: DeNO3FCp PFP Denitrating Calciner, Filling	3	U	N/A	5/10/95	5/11/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392, CSER 95-005. Mud filling the Calciner Section, Derivative Calculations. The second title line of this printout is: DeNO3FCd PFP Denitrating Calciner, Filling	7	U	N/A	5/6/95	5/11/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392, CSER 95-005. Mud filling the Filter Section, Derivative Calculations. The second title line of this printout is: DeNO3FFd PFP Denitrating Calciner, Filling	8	U	N/A	5/9/95	5/11/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L

A-6000-354 (02/92) GEF089

Transmittal No.: DACZ-95-0221
Page 3 of 4

3. Box No.	4. Description of Record	5. Total No. of Pages	6. Classification (U, C, S)	7. Cubic Ft.	8. Inclusive Dates From	8. Inclusive Dates To	9. Disposal Authority/ Retention Years	10. QA Classification (I, N, PC)
	MICROFICHE: Criticality Computer Code MONK6B calculation printout in support of WCH-SD-SQA-CSA-20392, CSER 95-005. Mud filling Filter Section from Top, Calciner Section Empty. The second title line of this printout is: DeNO3FFe PFP Denitrating Calciner, Fill Top	7	U	N/A	5/10/95	5/11/95	DRS-14.6A TBD92 RL-93-619 / Retain until the system evaluated by WHC-SD-SQA-CSA-20932 is removed from service.	L

11. The signature below certifies that the records submitted by this transmittal have been reviewed, are complete, and are in conformance with applicable procedures; and the "Transmittal and Record Acceptance Criteria" checklist on the last page of this form has been completed.

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Cognizant Individual

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A-6000-354 (02/92) GEF089