Sta # 19 (15)
NOV 12 2001

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ENGINEERING DATA TRANSMITTAL

1. EDT 629267

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	SNF Construction Projects	N/A
5. Proj./Prog./Dept./Div.:	6. Design Authority/Design Agent/Cog. Engr.:	7. Purchase Order No.:
SNF Fuel Transfer System A.15	R. Hernandez/J. Zimmer/M. Langevin	N/A

8. Originator Remarks:

Applies.

11. Receiver Remarks:

11A. Design Baseline Document? ☒ Yes ☐ No

9. Equip./Component No.: N/A

10. System/Bldg./Facility: FTS 105KE&105KW Basins

12. Major Assm. Dwg. No.: N/A

13. Permit/Permit Application No.: N/A

14. Required Response Date:

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Desig-nator	(G) Reason for Trans-mittal	(H) Origi-nator Dispo-sition	(I) Receiv-er Dispo-sition
1	SNF-8788	N/A	0	FTS Final ALARA Design	E, S[N] Q, S[IH] R	1 2		

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D OR N/A (See WHC-CM-3-5, Sec. 12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
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18.	19.	20.	21. DOE APPROVAL (if required)
[signature] 11/7/01 Signature of EDT Originator — Date	Authorized Representative for Receiving Organization — Date	R. Hernandez 11/8/01 Design Authority/Cognizant Manager — Date	Ctrl No. N/A ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	L. R. Kueberth	Date 10/30/01
Project Title/Work Order		EDT No. 629267
SNF-8788 FTS Final ALARA Design Review Project A.15		

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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A-15 Proiect Files *	X3-85	X			
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SNF-8788
Revision 0
EDT 629267

Fuel Transfer System ALARA Design Review – Project A.15

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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SNF-8788
Revision 0
EDT 629267

Fuel Transfer System
ALARA Design Review - Project A.15

Project No: A.15 Document Type: DR Division: SNF

L. R. Kueberth
Fluor Hanford, Inc

Date Published
November 2001

Prepared for the U.S. Department of Energy
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U.S. Department of Energy under Contract DE-AC06-96RL13200

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P.O. Box 1000
Richland, Washington

Total Pages: 39

Fuel Transfer System ALARA Design Review, – Project A.15

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ATTACHMENTS

Key words: Fuel Transfer System, ALARA, SNF, K Basins, Radiation

Abstract: This document is the FTS **ALARA** Design Review, – Project **A.**15

Trademark Information

NucFil™ is a trademark of Nuclear Filter Technology.

ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
Annex	105 K East and 105 K West Basin Fuel Transfer System Annexes
CCTV	Closed Circuit TV
CSB	Canister Storage Building
CTO	Cask Transfer Overpack
CVD	Cold Vacuum Drying
DEP	Dummy Elevator Pit
DPM	Disintegrations Per Minute
EPDM	Ethylene-Propylene-Diene-Terpolymers
FAT	Factory Acceptance Test
FH	Fluor Hanford
FTS	Fuel Transfer System
GPM	Gallons Per Minute
HEPA	High Efficiency Particulate Air
HPT	Health Physics Technician
KE	105 K East Basin
KW	105 K West Basin
MREM	Milliroentgen Equivalent Man
REM	Roentgen Equivalent Man
RMA	Radioactive Materials Area
SNF	Spent Nuclear Fuel
STC	Shielded Transfer Cask
TCA	Transfer Cask Assembly

Fuel Transfer System ALARA Design Review, – Project A.15

1.0 INTRODUCTION

One mission of the Spent Nuclear Fuel (SNF) Project is to move the SNF from the K Basins in the Hanford 100K Area to an interim dry storage at the Canister Storage Building (CSB) in the Hanford 200 East Area. The Fuel Transfer System (FTS) is a subproject that will move the SNF from the 105K East (KE) Facility to the 105K West (KW) Facility. The SNF will be treated for shipment to the Cold Vacuum Drying (CVD) facility at the KW Basin.

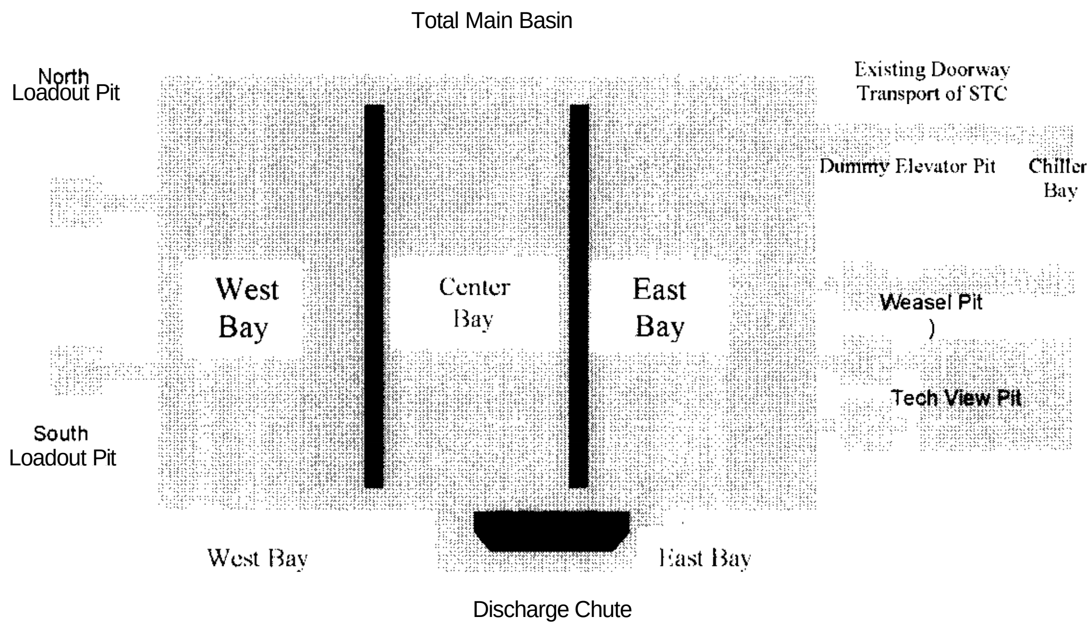
The SNF canisters will be loaded underwater into a Shielded Transfer Cask (STC) in the KE Basin. The fully loaded STC will be brought out of the water and placed into a Cask Transfer Overpack (CTO) by the STC Straddle Carrier. As the STC is removed from the water, it will be washed down with demineralized water by an manual rinse system. The CTO with the STC inside will be placed on a transport trailer and transferred to the KW Basin as an intra-facility transfer. The CTO will be unloaded from the shipping trailer at the KW Basin and the STC will be removed from the CTO. The STC will then be lowered into the KW Basin water and the fuel will be removed. The SNF will then be processed for shipment to the CVD. As soon as all of the fuel has been removed from the STC, the cask will be removed from the KW Basin water and placed into the CTO. The CTO will again be placed on the trailer for transport back to the KE Basin where the entire cycle will be repeated approximately 400 times.

This document records the As Low As Reasonably Achievable (ALARA) findings and design recommendations/requirements by the SNF Project noted during the Final Design Review of the STC, CTO, STC Transfer System, Annexes and Roadways for support of FTS.

This document is structured so that all statements that include the word “shall” represent design features that have been or will be implemented within the project scope. Statements that include the words “should” or “recommend’ represent ALARA design features to he evaluated for future implementation.

2.0 KE AND KW BASIN LAYOUT

KE and KW Basins are 12s-feet long by 67-feet wide, and are divided into three approximately equal bays. The dividing walls do not tie into the outer walls. and have a 96 cm (38-inch) wide gap on each end that provide pathways between the respective bays There are several pits located to the east and west ofthe main Basin. Each Basin is 20-feet, 9-inches deep. The KE water is approximately 17-feet deep. The KW water is approximately 16-feet deep Each Basin is covered with a grating that is suspended from the superstructure. There is a monorail system that may be used to support equipment in the Basin There are slots in the grating below the monorail system to accommodate underwater movement of fuel canisters and equipment. Figure 2.1 illustrates the Basin and pit configuration and their floor areas.



KE Basin Schematic and Overview

Figure 2.1

3.0 DESIGN CONSIDERATIONS

This section addresses design considerations relative to required shielding and area preparations for supporting the FTS project. It specifically addresses design considerations for the STC and the CTO, FTS, Annexes and roadways.

To incorporate ALARA issues in the design process, a multidiscipline and organizational design review team including ALARA and radcon personnel was assembled and participated in the formal design review process. Each team member applied their individual expertise and perspectives to the FTS design to identify design issues that were appropriately resolved to enhance the design. Integral to these issues were ALARA considerations related to the maintenance and operation of the FTS.

3.1 SHIELDING REQUIRED AND AREA PREPARATIONS FOR FTS SUPPORT

The KE and KW Area preparation for FTS shall include coating the floor areas in the new Annex Buildings. These floor coatings should be a hard, impenetrable, high gloss, easily decontaminated, chemically inert materials that are not slippery when wet.

The current general area dose rates over the KE DEP are 18 to 40 mredhour at waist level as shown in letter 01-SNF/WAD-057 dated 8/8/01 that is shown as Attachment A. The dose rates in the general area of the DEP are 15 mredhour. The shielding package described below should provide a new dose rate of 1.5 to *2* mredhour over the DEP and 0.5 to 1 mredhour in the general area of the DEP. The DEP is located towards the Northeast area of each Basin and will be used as the FTS STC load out area in both Basins. The Chiller Bay is an area immediately East and South of the DEP containing several radiation sources.

3.1.1 Radiation sources in KE that affect dose rates are:

- Recirculation Pump P-1C suction, pump impeller, and discharge piping
- Recirculation Pump P-1B discharge piping (dead leg riser, hot spot of 200 mrem/hour)
- 8-inch Recirculation piping overhead in the center of the Chiller Bay
- Old Heat Exchanger
- DEP and Basin Bathtub Ring

3 1 *2* Recirculation Pump P-IC

The Recirculation Pump P-IC is located approximately four feet from the work location at the DEP The piping and pump impeller currently produce dose rates of 60 to 100 mredhour on contact and contribute substantial dose to the DEP area Pump P-1C shall be removed from its current location and a new pump located in the empty pump base for Recirculation Pump P-1B The pump along with all suction and discharge piping shall be removed and replaced with new equipment at the Pump P-IB location Relocating this pump and replacing the piping to the P-1B location increases distance to the DEP work area to approximately 10 feet All radiation dose rates associated with the current P-1C as well as the P-1B piping would be eliminated, thereby reducing the DEP general area dose rates substantially. Although the new pump and piping will eliminate the source terms associated with P-IC, these radiation hot spots will return over the three year life of the project. Therefore, the new P-1B pump as well as the suction and discharge piping should be covered with a minimum of *0.5* inches of encapsulated Lead shielding to control the future dose build-up in these areas. According to the data shown in letter 01-SNF/WAD-057 dated 8/8/01, the replacement of Pump P-1C and its associated piping is expected to reduce the dose rate in the area of the DEP by 20 person rem. Therefore, if these modifications can be made at a cost less than $600,000 (20 person rem x $30,000/person rem), then these changes are required to maintain the project within the scope of the contract and ALARA.

3.1.3 Eight Inch Recirculation Pipe

The 8-inch recirculation pipe in the overhead located immediately north and west of the chiller is a radiation source that will contribute to FTS personnel exposure. It is recommended that this piping be shielded with *0.5* inch of encapsulated Lead to include the 90-degree, long radius elbow and 4 linear feet on both sides of the pipe elbow.

3.1.4 Old Heat Exchanger

The old heat exchanger is currently shielded with one layer of lead blankets over its entire length. The current dose rate is less than 100 mrem/hr. ***An*** additional layer of 0.5-inch thick lead plate equivalent blankets shall be installed directly over the existing lead blankets on the heat exchanger beginning at the north end and extending to a minimum of **8** linear feet south. This new lead blanket will reduce the dose to less that 26 mrem/hr. These lead blankets are available in 5-foot lengths.

3.1.5 DEP and Basin Bathtub Ring

The DEP walls include an area just at the Basin water level, known as the “Bathtub Ring”. The Bathtub Ring in the DEP is confirmed to be the primary source of radiation exposure to FTS KE workers loading SNF into the **STC.** Dose rates as high as 360 mrem/hour at two feet above the water exists in the southeast corner of the DEP at the Bathtub Ring. This hot spot is located adjacent to the southeast corner of the DEP lift platform. This hot spot shall be shielded with 0.5-inch of encapsulated lead that extends approximately 36 inches above the Bathtub Ring and 6-inches below the water level and extends **3** feet in each direction from the corner. This encapsulated lead shielding is in addition to the existing 1 inch of steel shielding that is part of the DEP lift platform. If it is physically impossible to install the additional, encapsulated lead shielding, then further analysis shall be required to arrive at a solution that meets the requirements of ALARA. Survey Report Number K010773 (Attachment B) conducted in the KE Basin on 10122101 confirmed that the dose to the KE personnel is coming from the Bathtub Ring and not the recirculation header that is located directly beneath the grating. It is recommended that 12 feet of the north facing Bathtub Ring located in the northeast corner of the KE Basin be shielded with a minimum of 0.5 inches of encapsulated lead that extends 12 inches above the water and 6 inches below the water. In addition, the east Bathtub Ring should also be shielded with a minimum of 0.5 inches of encapsulated lead that extends at least 12 inches above the water and 6 inches below the surface of the water. The 0.5 inches of lead shielding will reduce the existing source by a factor of 3.87. Thus, if the contact dose rate is 60 mrem/hr, it will be reduced to 16 mrem/hr.

In the event that the dose to personnel installing the Bathtub Ring shielding exceeds the benefit derived by the personnel who are working on the FTS, then an alternative recommendation is to install an additional, 0.5 inch of lead equivalent blankets on top of the existing lead blankets that are currently on top of the grating. An engineered feature that reduces the tripping hazard of these blankets should also be provided.

Currently included in the design of the STC lift platform is a I-inch thick steel plate. This steel is to extend from the top of the Basin wall (height of 21-feet), to the 16-foot level. This steel plate represents approximately 1.59 half-value layers to the existing source term. This shielding does not represent an adequate reduction in dose to the personnel. Therefore, the exposed grating east of the DEP shall be covered with 0.5-inches of lead blankets. This will reduce the dose by another 1.95 half-value layers. In addition, the operations personnel will load **fuel** from a mobile DEP Work Platform that has a 1-inch steel base that provides another 1.59 half-value layers. The total of all of this shielding will reduce the dose rate to the workers by more than a factor of 35. In addition, due to irregularities in the DEP wall, a radiation streaming space is expected to exist between the wall and the DEP lift platform 1 inch **steel** shielding. An additional 0.5 inch of encapsulated lead shielding should be horizontally placed over the streaming space.

The most effective shielding is a coated lead sheet that is available commercially. The coating is a durable, ductile material that encapsulates the sheet of lead inside and minimizes the chance of contaminating the lead. Lead encapsulated with stainless steel is a secondary option, but due to the welding of thin **steel** material, the possibility of water leaking into the panel and contaminating the lead sheet makes this an impractical method of shielding. The coated lead panels and piping shields are priced approximately the same as the equivalent of lead blankets and they install quickly reducing dose to workers during installation

3.2 STC AND CTO

Many ALARA factors were considered to provide a design that adequately addresses radiation exposure concerns.

3.2.1 Additional STC ALARA features are as follows:

STC

- Remote lid lock
- Voids in shielding
- HEPA Filter
- Gasket type and physical location
- Lid opening devices
- Decontamination surfaces of STC (outside)
- Drain and fill system for the STC
- Fuel lift design

3.2.2 Remote Lid Lock

An STC remote lid-locking feature is included in the design. The STC shall be locked and unlocked underwater at the maximum depth of the FTS lift station located in the DEP. The remote locking/unlocking shall be accomplished by the use of an extension tool. ***An*** additional, extension tool will be used to attach the electric winch cable hook to the STC lid. Extension tools that are used for underwater work in the Basin are required to have holes drilled into them in such a manner as to allow water to fill inside the shaft of the tool. Requiring that water fill the extension tool ensures that "streaming" dose rates from the fuel that is underwater does not expose personnel to unplanned dose rates. Tools should be manufactured from the lightest possible materials to assist the personnel handling each task. Tools should also consist of an adjustable handling method to support the personnel whether he/she is shorter or taller than the average person because an inappropriate tool will result in more time and more dose to the personnel.

3.2.3 Voids in Shielding

The shielding provides the SNF with 7 inches of steel in a 4π geometry. The 4π shielding geometry will be confirmed at the factory acceptance test (FAT) by the use of a gamma scan. The gamma scan consists of placing a high energy, high activity radioactive source, such as 100 millicuries of ^{60}Co in the center of the STC with the lid closed and locked. A spherical dose measurement at a fixed radius is then taken to identify any radiation streaming that may be coming from any questionable areas such as the penetrations and the High Efficiency Particulate Air (HEPA) filter.

3.2.4 HEPA Filter

The HEPA filter design shall not compromise the 7 inches of steel shielding in a 4π geometry. In addition, the HEPA filter shall be fabricated with a sintered metal that will not lose its filter capacity while stored underwater. This will assist in reducing potential contamination in the Basins. Finally, the HEPA filter is mounted to the lid with four bolts and also has quick disconnect fittings for easy replacement. The filter isolation valve should be open during normal operation except to test the watertight integrity ofthe STC.

3.2.5 Gasket Material

The gasket material shall be Ethylene-Propylene-Diene-Terpolymers (EPDM) or Neoprene. It is understood that these are closed cell materials that will not swell even after extended periods underwater. Therefore, the gasket material and its physical location will not compromise the 7 inches of steel shielding in a 4π geometry.

3.2.6 Lid Opening Design

The STC shall be unlocked and the lid opened when the cask reaches its maximum underwater depth. When the STC if fully loaded with SNF, the cask lid shall be closed and locked before being lifted from its maximum underwater depth. These functions (opening, closing, locking and unlocking) of the lid shall be under Administrative Control. However, the consequences of the STC arriving at the water surface with the lid still open are too significant to leave to Administrative Control. The STC is locked and unlocked underwater by the personnel's use of an extension tool. The STC lid is opened and closed through the use of an electric winch cable. The electric winch cable will prevent the lid from inadvertently closing during fuel loading. If the STC should start to lift before the lid is closed and locked, due to an Administrative Control failure, it is recommended that an engineered feature be provided to close the lid before the STC comes to within approximately four feet of the surface of the water. In the event that a debris build-up would prevent the lid from closing securely, personnel shall perform an underwater cleaning of the lid and mating surface. Due to the presence of a pressure relief device, the locking and unlocking cycles will be under Administrative Control. The wire rope that is used to lift the STC lid wicks contamination and will become another personnel exposure source if it is wound out of the water Therefore, it is recommended that the wire rope be coated with a flexible, chemically inert material that will keep the contaminated water off of the wire rope.

3.2.7 STC Decontamination Surfaces

The STC is fabricated with solid stainless steel. The outside of the STC has a 125 rms finish that should facilitate decontamination. However, if the dry contamination levels on the exterior of the STC exceeds 50,000 dpm/100 cm^2 of beta/gamma emitters and/or 500 dpm/100 cm^2 of alpha emitters, then airborne contamination is likely to occur. It is recommended that Administrative Controls require that the STC be maintained wet when the cask is outside of the sealed CTO. As the STC is removed from the sealed CTO in the KW Basin, it is recommended that the STC be coated with a demineralized water mist. The DEP manual demineralized water spray wash should maintain the exterior of the STC reasonably clean. It is not expected that the inside of the STC will require decontamination. The inside of the STC can be cleaned while it is underwater.

To assist in decontaminating the STC surface, a critical feature of the ALARA program at KE is the flushing of the DEP with a sufficient flow of deionized water. This water originates in the Basins, passes through the sand filters, the ion exchange modules, and then is flushed into the east side of the DEP. The purpose of this water is to continually cleanse the DEP. Therefore, it is recommended that this system operate continuously over the life of the project. Any shut down of this system could allow contamination to return to the DEP. There are four ion exchange modules that are run in pairs. Each ion exchange module is capable of producing 160 gpm of deionized water. Thus, there is no reason why this system cannot continue to flush the DEP for the life of the project. The KW DEP is also flushed with a sufficient supply of deionized water.

3.2.8 Drain and Fill System

The STC is always filled with Basin water and fuel or only Basin water when the lid is unlocked and opened at the bottom of the DEP. The drain is a tube that reaches from the top of the STC to the bottom that can be used to drain the STC if that becomes necessary. Access to the drain tube is via a manual valve and quick disconnect fitting on the top of the STC. The drain tube makes three ninety-degree turns as it progresses through the shielding.

As stated above, the STC provides the SNF with 7 inches of steel shielding in a 4π geometry

3.2.9 Fuel Lift Design

During the SNF loading, a mechanical stop shall be provided to assure that the top of the fuel canisters never exceed a distance of 11 feet from the bottom of the 100 **K** Basins. This will ensure that the fuel canisters always maintain a minimum of 4 feet of water between the SNF and the operations personnel even if the water level should drop to 15 feet.

3.2.10 Additional ALARA factors considered with the unshielded CTO are as follows:

CTO

- Gasket Material
- HEPA filters – position and physical make up
- Lid Closure Design
- CTO Lift Platform
- Operator Control Station
- Exterior Coating Requirements

3.2.11 Gasket Material

The CTO gasket is approximately 2-inch wide EPDM, 40 Durometer Rubber that is mounted on the 2-inch flange lip located on the top and bottom of the CTO. There is also a EPDM gasket mounted on the valve cover plate on the side of the CTO. The ability of these gaskets to continue to seal even if they get wet makes them no ALARA concern.

3.2.12 HEPA Filters

There are ten NucFil 016 Drum Vent wire mesh HEPA filters located throughout the CTO lid. These filters have extensive use throughout the nuclear industry and therefore do not represent an ALARA concern.

3.2.13 CTO Lid Closure Design

It should be noted that the fuel loaded STC is estimated to be the primary source of exposure within the Basins. Up to when the CTO lid is installed, all of the STC movement has been by remote handled equipment. The CTO is fabricated with stainless steel but does not provide any additional shielding. There are guide bars at each inside corner to align the lid and base of the CTO. Even though the CTO lid is lifted by a crane, the personnel will be required to physically guide the lid onto the bottom then connect the eight quick release toggle clamps. This operation is estimated to take approximately 0.5 hours while standing in a 40 mrem/hr gamma field. Thus, two personnel performing this task will receive 20 mrem each or a total of 40 person-mrems as a potential upper bound. Because this operation is repeated over 400 times, this will result in a total operation dose of 16 person-rem. The personnel will then be required to disconnect the single point rigging that lifted the CTO lid in place. The CTO lid rigging will remain in place as the TCA is shipped to the KW Basin.

The final task for the personnel is to attach the four-point rigging that will lift the CTO with the STC inside of it.

It is recommended that before fuel is loaded into the STC, operational tests will be conducted in the Basin. The result of these no source tests will determine the optimal use of time, distance/remote tools and shielding. Remote tools or platforms that are not part of the current project should be fabricated if it is determined that they will reduce personnel dose.

3.2.14 CTO Lift Platform

Personnel will raise and lower the CTO lift platform to transfer the STC into and out of the CTO. This is remotely done at the shielded operator control panel. Therefore, the dose to the operator is minimized. As an alternative to shielding the operator station, the straddle carrier rails can be shielded as shown below.

3.2.15 Operator Control Station

The STC Straddle Carrier rails are approximately 3 feet above the floor and because the highest dose associated with the STC is located on the bottom, there shall he a shielded operator station or shielding from the rails to the floor. This shielded station will be open to the west but will provide 2 inches of steel shielding to the north, east, and south. The shielded station will mate with the floor on the bottom and provide *0.5* inch of lead glass equivalent on the three sides from approximately 3.5 feet to 6 feet on the top. The measurement dimensions for the lead glass are taken as distance from the floor. As an option, *0.5* inch of encapsulated lead equivalent shielding blankets could be hung under the west side of the STC Straddle Carrier rails to the floor for the entire length of the rails.

3.2.16 Exterior Coating Requirements

The stainless steel body of the CTO shall be coated to facilitate decontamination and reduce thermal heating during transfer of the CTO to the KW Basin. This coating shall be a hard, impenetrable, high gloss, easily decontaminated, chemically inert material.

3.2.17 Further Design Concerns

It is recommended that the STC drain valve be placed in the closed position when the cask reaches the top of the DEP. The reason to close the drain valve is to keep contaminated Basin water from entering the CTO. The CTO will be surveyed and decontaminated after the STC is removed in the KW Basin. Decontaminating the interior of the CTO will result in a potential dose to the Operational Personnel and may require the use of protective masks. Therefore, it is recommended that some of the water be drained from the STC before the cask is moved from the DEP. For example, one inch of water removed from the STC equals 7.7 gallons of Basin water. With that much liquid removed, it is unlikely that any Basin water will be spilled into the CTO. The water could be removed by the use of a peristaltic pump. The volume of water removed may be determined by measuring the run time of the pump. The exact amount of water to be removed should be determined during the operational tests using demineralized water.

An inflatable bladder that would hold 7.7 gallons of Basin water plus any gases generated by the fuel will also keep Basin water out of the CTO. This design feature was examined and discarded due to the difficulty in disposing of the bladders.

One requirement in the Statement of Work is to coat the exterior of the CTO. The CTO will be manufactured using stainless steel. Coating stainless steel is a problem due to the corrosive reaction with most coatings. The selection of coating materials, as well as the application method, is important when coating stainless steel materials. These coatings shall be a hard, impenetrable, high gloss, easily decontaminated, chemically inert material. These "high gloss" coatings will limit heat build-up of the CTO during transport when exposed to the ultraviolet rays of the sun. Information, such as, Material Safety Data Sheets, and Product Data Sheets for these coatings, shall be provided by the manufacturer.

All gasket materials should be submitted to Fluor Hanford along with the MSDS and Product Data Sheets in the event that the STC or CTO gaskets **require** splicing.

The Separation Rack may be required to be lifted from the empty STC for underwater cleaning of the STC at some time during operations. The separation rack shall include a means to lift it in and out of the STC. Water could fill one or all of the tubing sections due to leaks into the tubing. All underwater tubing will become a sludge trap if it is not sealed. Therefore, all underwater tubing shall be sealed or replaced with "I" beam or angle iron construction that does not include sludge traps.

3.3 FTS TRANSFER CASK SYSTEM

The most effective plan for the transfer of SNF is to control contamination buildup and handle the STC wet to reduce the potential for airborne radioactivity. The work plan should consist of packaging the STC into the CTO while it is still wet with demineralized water. After each STC transfer, the Health Physics Technician (HPT) will verify contamination levels of the pathway and personnel will decontaminate the transfer path after the STC is loaded into the CTO.

3.3.1 Additional ALARA factors considered with the TCA:

- STC Lift Platform
- STC Lift Platform Rinse Station and water supply
- STC Work Platform, Handrails, and Fall Restraint
- Instrumentation and Control System
- Closed Circuit TV (CCTV) Camera and Monitoring System
- FTS Annex

3.3.2 STC Lift Platform

The STC Lift Platform is located inside the DEP and will be used to lower the STC into the Basin water to allow loading of SNF underwater and will lift the loaded STC from the Basin water. Several systems interface with the STC Lift Platform while the STC is lowered, loaded, and raised from each Basin. Each system is addressed in separate sections of this document. The STC Lift Platform will utilize jackscrews to raise and lower the lift platform. The bearings needed to operate the jackscrews shall be manufactured with impregnated bronze. The service life of these jackscrew assemblies and the maintenance involved with replacements (if required) has been evaluated and the most efficient materials available have been selected. Radiation exposure and outage time appears to be substantial if replacement of the jackscrew assemblies **is** required. In fact, maintenance on the jackscrew assemblies is the most dose intensive feature of the FTS. Therefore, it is recommended that the jackscrew assemblies he warranted by the manufacture for the life of the project. There is redundancy built into the STC Lift Platform. There are four jackscrews used to lift the platform. However, the platform is capable of lifting the fully loaded STC with only two jackscrews so long as they are diagonally opposed to each other. It is further recommended that the jackscrew assemblies be modularized with efficient disconnects so that maintenance can be performed ALARA.

3.3.3 STC Lift Platform Rinse Station and Water Supply

The rinse station is positioned immediately above the Basin water level inside the DEP surrounding the STC Lift Platform. The rinse station is designed to place demineralized water on the top, sides, and bottom of the STC as it is raised to the above grade position and as the STC is lowered into the Basin water. The rinse station should clean the exterior of the STC sufficiently to remove the majority of Basin water contamination.

An adequate supply of fresh, demineralized water is included in the design of the water rinse station. The water is provided by an external system that demineralizes a raw water source. A system shall be provided to pressurize the rinse station so that the station provides sheeting of the rinse water. If at any time, rinse water is not available, operations should stop and the STC should be placed at the bottom of the DEP Lift Platform travel until such time that the rinse water becomes available again.

3.3.4 STC Work Platform

As stated above, the STC Work Platform provides the personnel with 1 inch of steel shielding. The stiff-backed fuel retrieval tool can be operated from the work platform. In addition, the STC Work Platform **is** provided with permanent guardrails. It is recommended that personnel be provided with some type of fall restraint in addition to the guardrails.

3.3.5 Instrumentation and Control System

It is recommended that there should be no failure mode that will strand the STC out of the water. The STC Transfer System provides a back-up methodology for returning the STC to a minimum of four feet below the water in the DEP in the event of a **loss** of facility power. In addition, in the event of a loss of facility power, and if the STC is already installed in the CTO with the CTO lid closed, the system shall be capable of installing the transfer cask assembly (TCA) onto the transfer trailer for shipment to KW Basin. The safety class Instrumentation and Control System shall be designed to be “fail safe”, with manual override capabilities to allow the system to be placed in a safe configuration.

3.3.6 The Closed Circuit TV (CCTV) Camera and Monitoring System

The underwater CCTV system should consist of multiple cameras. These cameras are provided with integral flood and spot lights in addition to underwater pan, tilt and zoom controls. This equipment is mounted on mobile camera booms with splash plates that hold the excess wire. These cameras are used to assist operating personnel with loading the STC with fuel. Reducing the fuel loading time will minimize exposure time. In addition, the cameras can be used during off-normal operations and this use also reduces exposure time. The output of these cameras is sent to a control panel that contains camera control units that operate the pan, tilt and zoom functions, selector switches that allows any camera to be viewed on any monitor, video monitors to allow the personnel to "see" underwater and the ability to connect to a video cassette recorder which will record any underwater operations that are required.

3.3.7 FTS Annex

The Annexes are necessary at each Basin to allow for adequate space to load the STC into the CTO and the Transfer Cask Assembly (TCA) onto the trailer for transport to and from each Basin.

The existing roadway will be improved as necessary for TCA transfer to travel from KE to KW Basin and return. The roadway allows for adequate turn around space at each facility to limit the maneuverability required during transfers.

Construction of the Annex will require the removal of a portion of the existing contaminated concrete slab, asphalt and potentially contaminated soil from the north side of the KE and KW facility buildings at door 149. Also included is the demolition of a monorail, monorail supports, and an existing chain link fence to facilitate installation of the new FTS Annex. The work area is not posted as a radiation area although there are low dose rates on the southern boundary near to the 105 KE Basin wall. Currently part of the work area at KW is posted as a Radioactive Materials Area (RMA) in which waste packages are temporarily stored.

The contaminated condition of the soil under the KE concrete is not known. Initially the soil will be placed into large bags for temporary storage while final characterization samples are analyzed. Workers will be required to be qualified as radiation workers and have baseline whole body counts for working in the Contamination Area to be set up at KE. Dust is likely to occur while breaking up the concrete, therefore, misting shall be required to control the dust. HPTs will be required to take grab air samples downwind and within 6 feet of the concrete cutting work area during saw cutting through contaminated areas. Asbestos controls will also be necessary in removing transite walls and may complicate the contamination controls and radiation exposure potential Workers should have a portable anti-contamination change trailer available to them at the boundary to the KE work site. This will be needed to stock extra rubber boots and gloves as well as to stay within the site requirements for not allowing co-mingling of personnel in anti-contamination clothing and street clothing.

HPTs will monitor for contamination in KW periodically throughout the work progress including cutting the monorail supports. Detectable contamination will require posting changes and work practice changes to controls similar to those established for the KE worksite.

4.0 OPERATIONS

During operations the STC is lowered underwater to be loaded with 10 canisters containing SNF. The fully loaded STC will be raised from the Basin water and moved towards the CTO Lift Platform and placed inside the CTO. During the transfer of the STC, operations should operate the STC Straddle Carrier remotely using the shielded control panel. Every effort should be taken to maximize worker distance from the STC at each stage of the work. Remote lifting devices should be considered and included in the design of the TCA. As stated above, every effort should be taken to keep Basin water from contaminating the interior of the CTO. When the interior of the CTO is decontaminated, it should only contain residual surface water. Note that maintenance is covered in the individual equipment paragraphs.

5.0 RADIATION

There are two areas of concern regarding radiation exposure. The fully loaded STC will be the main source of radiation exposure during operations. At no time should it be necessary for workers to approach the fully loaded STC. Worker distance should be maximized at all times. The STC shall consist of 7-inch thick steel that shields the SNF in a 4π geometry.

If water leakage is permitted, the leakage could result in "fuel fragments" escaping from the STC and/or the CTO. Fuel fragments are extremely small in size and are high radiation sources that are often not visible to the naked eye. The STC design incorporates two features to prevent the production of fuel fragments. The first is the HEPA filter on the lid of the STC and the second is the screen on the drain line of the STC. In addition, as stated above, it is recommended that some of the Basin water be removed from the STC. After each STC transfer, the HPT should perform an open window dose rate survey of the traveled path prior to performing decontamination of the traveled path if necessary. An open window ion chamber dose rate instrument will detect beta radiation. Beta radiation is emitted from these particles and can often be detected from a distance of three feet (waist level). Fuel fragments can also be detected during a large area smear survey. After the traveled path is decontaminated, the area will be surveyed with large area wipes for loose surface contamination. When evaluating the large area smear with a Geiger Mueller (frisker), the HPT can determine if the resultant contamination is evenly distributed throughout the smear sample or if high readings are coming from isolated sections of the smear sample. Upon detection of fuel fragments/hot particles, the HPT should provide instruction for the proper handling and disposal.

6.0 CONTAMINATION CONTROL

Radiation Protection would prefer to control the transfer of SNF as controlled wet contamination work and decontaminate the affected area immediately after each STC transfer, rather than allowing the STC to dry and become a potential airborne concern. Design efforts of the transfer system address issues that shall allow the STC to drip contaminated water onto a drip pan that slopes toward the DEP. The drip pan should be flushed with demineralized water and decontaminated immediately after the Transfer Cask Assembly is loaded onto the trailer and transferred out of the Basin.

Coating the Annex STC travel path with a floor coating that is hard, impenetrable, high gloss, easily decontaminated, chemically inert material that is not slippery when wet will help control the spread of contamination by making the clean **up** after each STC transfer easy and quick. It was suggested that a wet mop, bucket and wringer he used to clean the coated floor after each STC transfer to maintain the area free of contamination and prevent contamination build up in the work area. Operations and Radiation Protection groups prefer to use a squeegee for decontamination purposes. A stainless steel drip pan attached directly under the straddle carrier rail shall be provided so contamination can be flushed and pushed back into the Basin using a squeegee. The stainless steel drip pan shall he attached to the straddle carrier rail system and is designed to catch contaminated water while the STC is being transferred to and from the DEP. The drip pan is sloped slightly toward the DEP so that potentially contaminated water can he captured and pushed back into the DEP by **use** of a squeegee.

7.0 AIRBORNE RADIOACTIVITY

The STC includes a HEPA filtered system as part of the design for water and hydrogen venting during normal operation. The current design includes a filter assembly on the top of the lid. The assembly includes a cover plate over the filters, four (4) in line HEPA filters, and tubing (with a relief valve) extending from the inside of the STC through the lid to the filter assembly.

The HEPA filter assembly requires a test he performed to determine proper efficiency prior to acceptance. Acceptance of the filters and assembly for use shall be based on the ability to properly filter the vented STC.

The STC should remain wet during the movement to and from the DEP to minimize the possibility of airborne radioactivity. Any drying of the STC should he discouraged. Previously, cask decontamination was routine but handling materials wet and immediate decontamination of the work area after the materials are packaged and transferred has proven to be most efficient in reducing radiation doses (internally and externally).

The loading time of the STC should be evaluated to determine if the traversed area from the CTO lift platform to the DEP should be decontaminated during the time that the TCA is loaded onto the trailer to prevent potentially contaminated drip pan water from evaporating and becoming airborne. Assuming 10 canisters are pre-staged near the DEP, it should take operations approximately 60 minutes to load and lift each STC in the KE Basin. HPTs providing coverage will determine if decontamination of the pathway is warranted. Decontamination after the STC is transferred from the DEP should be required after each TCA is removed from the Annex to be transferred to the opposite facility

Attachment A
Letter 01-SNF/WAD-057
ALARA Recommendations for Dose Reduction in the KE Chiller Bay
Dated 8-08-01

Attachment A begins on next page.

INTEROFFICE CORRESPONDENCE

01-SNF/WAD-057

To:	T.J. Ruane	X3-61	Date: August 8, 2001
	J. E. Crocker	H5-24	
From:	W.A. Decker	X3-68	Telephone: 372-2881
cc:	ALARA Committee		
	C.J. Slotemaker (w/o att.)	X3-68	
	LB/File	X3-68	

Subject. ALARA RECOMMENDATIONS FOR DOSE REDUCTION IN THE KE CHILLER BAY

Attached is a report that discusses the various radiation sources in the KE Chiller Bay. The report recommends actions that will reduce the dose rate to personnel operating the Fuel Transfer System (FTS). It is estimated that 20 Person-rem can be saved during the FTS operational lifetime and additional dose can be saved during construction and operations leading up to operation ofthe FTS. The recommendations are as follows:

1. Design shielding into the FTS Dummy Elevator Pit structure. The designers should be required to calculate and show the reduction in dose rates as a result of their design. This will be an important part ofthe ALARA design documentation required by 10 CFR 835.

2. Install additional temporary shielding on the PI-C pump piping and the old heat exchanger as soon as possible to begin saving dose immediately. Begin a decision process to change the piping or move the PI-C pump. The decision process should proceed independent of the temporary shielding.

3. Study the placement of shielding on the bathtub ring of the east Basin for the most practical engineering solution. Then a cost benefit analysis should proceed to assist in making a decision.

If you have any questions please call me

Attachments (1) Attachment 1

ALARA Report on Opportunities for Dose Reduction in the 105KE Chiller Bay

(2) Introduction

The Fuel Transfer System (FTS) (Project A.15) will use the Dummy Elevator Pit (DEP) to load a cask for moving fuel canisters from the KE Basin to the KW Basin. A significant amount of construction work will take place in or near to the DEPs in both Basins. The DEP is located in the northeast corner of the Chiller bay in both Basins. The Chiller Bay and DEP area in the KW Basin has a low radiation background, less than 0.5 mrem/hour and is not a significant **ALARA** concern for either construction or operations. The Chiller Bay and DEP area in the KE Basin has radiation background that will contribute significantly to the dose required to construct and operate the FTS.

(3) Purpose

This report will examine and quantify the radiation background levels, identify specific sources of the background, and identify opportunities for reducing dose. A priority will also be recommended for dose rate reduction efforts.

(4) Description of Radiation Sources

There are six radiation sources that affect background dose rates in the KE Chiller Bay and Dummy Elevator Pit (DEP) area that will cause exposure for Fuel Transfer System construction and operations. Those sources are: 1) walls of the DEP, 2) piping to and from Recirculation Pump P1-C, 3) eight inch Recirculation water piping overhead in the center of the chiller bay, 4) old heat exchanger, 5) walls of the main Basin, and 6) Basin water.

1. Walls of the Dummy Elevator Pit

   The walls of the DEP have been coated with a layer of epoxy since 1996. They were not cleaned prior to being coated. The coating extends from below the water line to about two feet above the waterline. Smears on the coating range from 1000 dpm/100cm^2 to 15000 dpm/100cm^2.

   A teletector GM type dose rate instrument was used to obtain readings from the Basin walls. The instrument was suspended about 6-12 inches from the wall and moved slowly away from the corners. Readings were taken at approximately one foot vertical increments up to the top of the pit. The highest reading observed was 350 mrem/hour in the south east corner about 1 foot above the water line. As the detector was moved away from the corner the dose rate decreased significantly. Facility personnel were questioned about what could have caused a higher dose rate in the corner. Several personnel said that a drip leg from the old heat exchanger used to terminate above the water line in that corner and it was possible that it splashed the wall.

Dose rates at the top of the pit wall over the water in the SE corner are between 100 and 120 mrem/hour gamma. The other perimeter readings around the pit over the water are 30 to 40 mrem/hour at the floor level and 18 to 28 mredhour at the waist level.

The concrete walk way around the DEP had readings at the waist level that ranged from 6 to 23 mredhour. The highest reading came at the extreme east end of the pit where exposure from both walls within the pit can contribute to the dose. The next highest reading was on the south side ofthe pit between the pit and the PI-C pump. The dose taken while standing at the edge of the pit is primarily from the wall on the opposite side ofthe pit except on the southwest side where the PI-C pump is the major source of exposure.

2. Piping to and from Recirculation Pump PI-C

The suction side (Basin side) ofthe PI-C pump is shielded with a lead blanket. Despite this shielding it is possible to obtain a reading of 100 mrem/hour on the underside of the pipe and 70 mredhour through the shielding. The suction piping closer to the pump is not shielded, and reads from 20 to 40 mredhour.

On the discharge side of this pump the pipe readings are from 20 to 40 mredhour. This piping is the primary source of exposure for workers on the south side of the DEP.

3. Eight inch recirculation water piping overhead in the center of the chiller bay

This piping is located about ten feet above the floor and is the supply for the current Basin chiller. It is reduced from an eight to a three inch diameter pipe over the old heat exchanger. Contact readings along eight inch pipe range from 10 to 40 mrem/hour occasionally rising to as high as 70 mrem/hour at elbows. In the center of the Chiller Bay this is the primary source of background radiation.

This piping was hydrolased in 1996 and the dose rates dropped appreciably from levels in the 90 mrem/hour range.

4. Old heat exchanger

The old Basin water heat exchanger is located along the east side of the chiller bay. It is about 23 feet long and weighs about *6.5* tons. It is covered down to the floor with lead blankets that reduce the radiation dose rate to **less** than 100 mrem/hour and therefore is under the posting requirements for a High Radiation Area. Dose rates near the north end on contact with the lead blankets range from 20 to 30 mrem/hour. The heat exchanger is approximately 15 feet from the DEP and a grid survey shows that the dose rate decreases and then increases between the DEP and the heat exchanger. The heat exchanger is a background source for the DEP area but not as significant as the P1-C pump piping or the Recirculation water piping.

5. Walls of the main basin

The walls of the main basin immediately west of the DEP provide a background dose rate of from 6 to 10 mrem/hour The exposure is from the "bathtub" ring Some shielding is provided from 1/2" lead sheets encased in **18** mil thickness Pacifitex plastic. The shielding is not as effective as it could be because it is laid on the grating several feet above the bathtub ring This area will be the main traffic route for personnel into the FTS work area and will be a high source of incidental dose

6 Basin water

The basin water has been shown to contribute about a 2 mredhour background dose to workers when they are over the grating. Very little can be done to lower this dose rate outside of cleaning the water. Over time as fuel and sludge are removed from the basin, thus removing the primary source of dissolved cesium in the water, the water will provide less of a background dose as it is cleaned by the ion exchangers.

(5) Discussion of Dose Reduction Opportunities for Chiller Bay Radiation Sources

1.0 Walls ofthe Dummy Elevator Pit

The bathtub ring within the DEP will provide significant dose to FTS workers if it is not shielded or removed. **A** rough estimate is that 50 person-rem per year will be received by workers due to the bathtub ring without remediation. Removal has been considered before during the dose reduction efforts in 1996. It was determined at that time that scabbling a layer of concrete would be the best method for reducing the dose rate from the bathtub ring; however, scabbling would be radiologically and technically difficult and could potentially damage the structural integrity ofthe wall. The name "bathtub " ring is not accurate for the way the wall is contaminated because the contamination is embedded and may even be chemically combined with the concrete. It is this fact that makes scabbling difficult because it is estimated that as much as a half inch of concrete would have to be removed to be effective.

The most effective method for shielding a source is to get the shielding as close as possible to the source. In this case that would mean laying shielding against the DEP walls. The contaminated concrete extends below the water line so the shielding should extend a few inches into the water. After a few inches the water would provide adequate shielding.

Shielding is being incorporated into the design of the FTS lifting structure to be placed into the DEP.

2.0 Piping to and from Recirculation Pump PI-C

A rough estimate ofthe dose that will be taken by FTS personnel each year from PI-C pump piping is 20 person-rem. Several options are available for reducing the dose rate from this piping. The first is to place more temporary shielding on it. The suction side of the pump has one lead blanket on it already. Several feet of piping up to the pump have no shielding at all. A structural analysis could be performed and the pipe more thoroughly shielded. It is close to the floor and easily shielded even if the structural analysis shows the pipe will not carry the weight. Supports could be fabricated and installed around the piping to support the shielding.

The discharge side of the pump is more difficult to shield. There is a valve that must remain operable and the piping travels up vertically to a level about ten feet above the floor and turns south to join the discharge header for the other Recirculation pumps, one of which has been removed. It is doubtful that a structural analysis will allow hanging adequate shielding on this pipe.

Another option is to change out the discharge piping. The piping is connected by flanges. New sections of pipes could be fabricated, the old pipes removed, and new ones installed.

A third option is to move the pump and remove the piping. In addition to lowering worker dose, the extra room would be useful to operating the FTS. A new pump (or possibly the old pump) could be installed on the empty pump pad. This would be a high-risk radiological job in that it would involve several person-rem of dose to accomplish and involve handling the highly contaminated piping. However, the exposure benefits may be worthwhile and similar work has already been performed successfully.

3.0 Eight inch Recirculation water piping overhead in the center of the chiller bay

This piping presents a difficult problem. It is located high in the ceiling area. It was hydrolased in 1996 and the dose rate was significantly lowered, but it is still a large background radiation source for anyone in the center of the chiller bay or on the east and south sides of the chiller bay. To shield this piping would probably require separate supports for the shielding. The benefit to the workers at the DEP would be minor.

Another option is to control access administratively or by good practice. In this method a boundary would be erected that would not prevent access, but would remind personnel that they are entering an area of higher dose rates. Given the difficulty of reducing the dose rate and the low benefit for the DEP area, the administrative/good practice option is probably the most viable for this radiation source.

4.0 Old heat exchanger

Of the radiation sources affecting the DEP area, the old heat exchanger is the furthest away and has the smallest effect on the DEP area. At one time a plan was nearly complete for its removal, but was rejected by the SNF ALARA Committee and never fixed and brought back for approval. Given the cost and difficulty of moving the heat exchanger, that option is probably not reasonable since it has little effect on the dose at the DEP. More shielding should be placed on the north end to further reduce the dose.

5.0 Walls of the main basin

The walls of the main basin will cause exposure to all personnel as they travel to the FTS work area from the Basin entrance and it will present a significant amount of exposure to FTS workers as they retrieve fuel for loading the FTS cask. A rough estimate of the ingress/egress dose to FTS workers is about 2 person-rem per year. A rough dose estimate for fuel retrieval workers is about 13 person-rem per year from the basin walls.

Administratively, personnel can be instructed and warned to travel across the center of the grating to avoid the walls and therefore the "bathtub" ring, but they must cross the wall to reach the DEP area. Although temporary shielding is already in place resting on the grating directly over the bathtub ring, it is too far from the radiation source to be as effective as it could be. In addition, it presents a constant tripping hazard to personnel. Workers have learned to avoid the tripping hazard, but increased operations and construction work will aggravate the tripping hazard situation.

A potential solution is to engineer a way to shield the bathtub ring better at least in the area of the FTS. Find a way to place shielding directly on the bath tub ring and remove it from the grating for the east end of the pool, or at least from where the PI-C pump suction line enters the basin over to the northeast corner.

6.0 Basin water

The only way to reduce the dose from the basin water is to remove the dissolved cesium from the water and to avoid working over the water. The dose rate should decrease as FTS and the Sludge removal proceed because the water will be cleaned by the Sludge Water System.

(6) Priorities and Recommendations

The most important reduction in dose will be from designing shielding into the FTS Dummy Elevator Pit structure The designers should be required to calculate and show the reduction in dose rates as a result of their design. This will be an important part of the ALARA design documentation required by 10 CFR **835.**

Additional temporary shielding should be placed on the PI-C piping and the old heat exchanger as soon as possible to begin saving dose immediately. A decision process to change the piping or move the pump can proceed regardless of the temporary shielding. **A** significant reduction in the dose rate due to temporary shielding may assist the decision-making relative to the more complex measures.

Placing shielding on the bathtub ring of the east basin wall should be studied for the most practical engineering solution and then a cost benefit analysis should proceed to assist in making a decision.

Reducing the dose rates around the DEP *to* 2 mrem/hour which is effectively the dose rate from the water could save up to 20 person-rem during operations and a potentially a significant amount of dose during construction.

(7) Attachments

The following attachments were used to develop this report. Although they are not individually referenced in the text they are provided for assistance to the reader.

1) Meeting Minutes, Subject: Reduction of radiation dose rates in the KE chiller hay area for FTS operations, dated July 10, 2001
2) Radiological Survey Report No. 226642, dated March 12, 1996.
3) Radiological Survey Report No. K010446, dated June 4, 2001
4) Radiological Survey Report No. K010458, dated June 13, 2001
5) Radiological Survey Report No. K010470, dated June 14, 2001
6) Isometric drawing of the KE Chiller Bay Area, date unknown.

Attachment 1 to Letter

SNFP ALARA Support Team
MEETING MINUTES

Subject: Reduction of radiation dose rates in the KE chiller bay area for FTS operations

Location: 105KE Pre-job briefing room Date: 7/10/2001

ALARA
Chairman: W.A. Decker Presenter: W.A. Decker

Attendees: W.A. Decker, L.A. Rodgers, J. D. Reeve (JR), *S.* Godfrey, Craig Knapp, R W. Radliff, J.W. Brooks, D.E. Funk, Jeff Jens, Danny Yun, Tom Ruane
Minutes:

1) **Safety Topic -** Bill Decker discussed student drivers and the need to communicate with them.
2) **Purpose -** Bill said the purpose of the meeting was to review recent radiological survey data and reach a consensus on what radiation sources to emphasize for remediation. He said the result would be a letter to Tom Ruane and Jim Crocker recommending which sources to remediate prior to starting construction on the FTS project.
3) **Overview of dose rates -** Bill handed out recent survey maps of dose rates from the chiller bay area. Included was a survey of the inside walls of the Dummy Elevator Pit (DEP).

   Bill said that one corner of the DEP has radiation dose rates that are considerably higher than the other areas of the bathtub ring. One of the readings is 400 mrem/hour near the water line. Bill checked with the engineer who led the "clean and coat" effort, Rich Creed. Rich said they did not clean the ring in the DEP, but did apply the epoxy coating. Bill said that others had told him that one corner of the DEP probably reads higher than the rest because at one time there was a drip line from the old heat exchanger that dripped contaminated water in that area. Bill said the dose rate at the ankle level over the water in the DEP is in excess of 100mrem/hour.

   This has already been pointed out to the FTS design team. Jeff Jens said that the design team will include shielding in its design for the DEP that will help to reduce the dose rate. Bill said a one inch steel skirt would reduce the dose rate by about 50%. Add to this the steel to be used in the lift table and a significant reduction will be achieved.

Bill said the next significant source was the piping associated with the recirculation pump located directly south of the DEP. Dose rates on this piping on the basin side (suction) were in excess of 100 mrem/hour on contact. Some temporary shielding is already in place, but more is needed. On the discharge side there is no shielding and the dose rates on contact are up to 70 mrem/hour. Dose rates on the pump are relatively tow compared to the piping. This piping contributes roughly half of the background dose rate in the walk way space between it and the DEP which is a total of about 14 mrem/hour. The rest of the dose rate in this area comes from the DEP and the basin bathtub ring. This equipment is within a few feet of the DEP.

The next significant source is the eight inch Recirculation piping located about ten feet overhead in the center of the chiller bay. This piping is currently in use as the path for basin water to and from the basin water heat exchanger. **At** a point over the middle of the old heat exchanger, it is flanged and converts to three inch pipes that connect to the HX. The old portion of the piping was hyrdolased several years and the dose rate was significantly decreased; however, it is a large line source that still has contact readings as high as 25 mrem/hour near its closest approach to the DEP.

The old heat exchanger (HX) is the final source. Currently it is covered with temporary shielding to keep the area from being a high radiation area. JR said that most of the dose rate comes from the bottom of the HX. The HX is located about 15 feet east of the DEP. Furthest away of all the sources. The most recent surveys indicate that the dose rate declines and then increases again as one approaches the HX from the DEP.

4) **FTS and Sludge Conceptual Designs**

Conceptual designs were discussed. The sludge and water design has minimal impact in the DEP with the exception of bringing (constructing) in a demineralized flush water source for the pit. During FTS construction a water supply from the Sludge and Water system (SWS) will be brought in to the DEP and sludge suction equipment will be made available for cleaning out the FTS cask while it is underwater in the pit.

The conceptual design for the FTS has personnel spending time around the DEP but primarily on the North side away from the sources. Spending some time on the south side will be unavoidable particularly because that is the side from which personnel will enter the FTS work area coming from the KE basin main ingress/egress point.

5) **Potential Ways to Reduce Dose Rates**

I. Heat Exchanger - Discussion concerning the heat exchanger centered on providing more shielding. Bill Decker said there was a work package that was very close to being implemented from several years ago. The HX would be taken out door 149 across the east end of the DEP. Tom Ruane said the work package was disapproved by the **ALARA** Committee. The HX is far enough away from the DEP that it can be avoided. If necessary a boundary can be put up to keep personnel away from it and more shielding can be added to the north end.

ii. Recirculating Water Piping - This piping is in the overhead area between the **HX** and the DEP. It has already been hyrdolased. Temporary shielding will be difficult because it is located in the overhead and it is old. Replacement is an option but the age of the pipe and the fact that it has been hyrdolased mean the pipe walls are thin and may not support much shielding. In addition Leonard Rodgers said replacement piping may be difficult to design because the thinning walls will make welding difficult.

iii. Recirculating Pump Piping - This pump is located immediately south of the DEP. The discharge piping from this pump is flanged and presents the possibility of replacement piping. Replacing this piping would lower a very significant dose rate source for operations around the DEP.

The intake side of the pump would be more difficult to deal with because the piping section is very long and goes into the basin. Replacement could be done but would involve cutting the pipe and welding on a flange so that a spool piece can be used. It may be easier to shield this pipe and use the floor and grating to support the shielding. In fact there is already some temporary shielding on this pipe but it needs to be increased significantly to reduce its contribution to the background dose rate on the south side of the DEP.

iv. Bath-tub ring-

1. DEP - The bath tub ring in the DEP presents a significant problem for shielding. To clean the ring is probably not feasible because it would entail scabbling or hydrolasing the concrete to a significant depth. Earlier studies of the bath tub ring indicate that it is not really a bath tub ring. Radionuclides have "soaked" into the concrete where ever basin water is in contact with the concrete to a significant depth. Attempts have been made to surface clean the concrete but have had limited success. Including a shielding skirt from the water line up to about 2 feet above the water line would be effective. Discussions with the Design Authority for FTS indicate that this will be designed into the structures necessary for using the pit for FTS. The biggest concern here will be getting enough shielding to make a significant decrease in the dose rate. Part of the preliminary design has a removable work platform over the pit which will be in a high radiation area given the current dose rates.
2. Basin - The basin bath tub ring does not have as high a dose rate as the DEP, but it is still elevated and personnel will spend significant time just passing over it on the way to the

work area. There is currently some shielding on the grating that helps to reduce the dose rate. It was already "cleaned" once several years ago, but raising the water level was more effective in reducing dose than the cleaning.

Bill concluded the meeting. He said he would write a letter to Jim Crocker, Tom Ruane and include the Cognizant engineer and his manager which recommends that the pump piping dose rate be remediated and that further study be done on the old recirc piping in the over head. The HX is too far away from the work area to provide much relief. Bill said that adding some shielding to that already on the HX would help.

Attachment B
SNF Project Radiological Survey Report
Survey Report No. K010773
Dated 10-22-01

Attachment B begins on next page.

SNF PROJECT RADIOLOGICAL SURVEY REPORT

Page 1 of 5

Date (MM/DD/YY)	Time (Start/Stop)	Survey Report No.
10 - 22 - 01	1315 / 1630	KC10773

RWP	Area/Bldg./Room/Location	Facility Code
K - 203	100K / 105KE / Basin	K

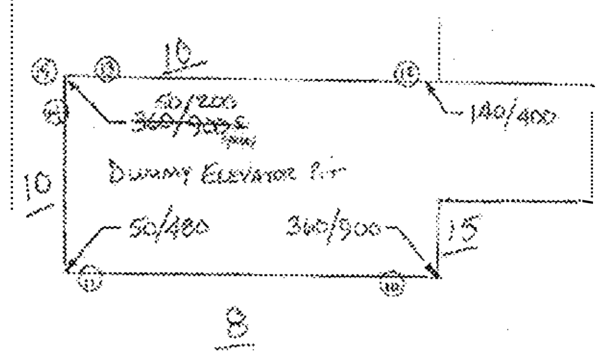
Description
Pre-Survey Shielding Evaluation (Dose Rate Survey) Below Grating

Purpose of Survey		Incident	
☐ Job Coverage		☐ Skin Contamination	
☐ Material Release		☐ Clothing Contamination	
☐ Routine No.	N/A	☐ CAM	
■ Work Package No.	1K-01-1783	☐ ARM	
☐ HRA/VHRA		☐ PSO	
☐ RM Transfer/Shipment		☐ Spill	
☐ RSR No.	N/A	☐ Exposure	
☐ OPR No.	N/A	☐ Other	N/A

Check appropriate box(es) above

Map/Sketch

North



#/# : Extended Dose Rate in mR/h,
2 ft Above Water Line / At Water Line

Chiller Bay Area

AIR SAMPLE MEASUREMENTS (µCi/ml)

	BZ	GA	Initial	Decay	Sample No.
α1	N/A	N/A	N/A	N/A	N/A
βγ1	↓	↓	↓	↓	↓
α2					
βγ2					

All dose rates are in mrem/hr, unless otherwise noted.

Instrument	WS Shielded Ext.	GM	PAM	RO-3B	N/A
Probe		Probe	Probe	N/A	
Serial No.	0002	0368	0576	0195	
		0646	0135	N/A	
Efficiency	N/A	10%	14%	N/A	↓

LEGEND

- (#) Smear
- [#] Large Area Wipe
- \# Deep Dose Rate (Ext)
- △ Air Sample
- Contact Reading
- Neutron
- --- Radiological Area Boundary

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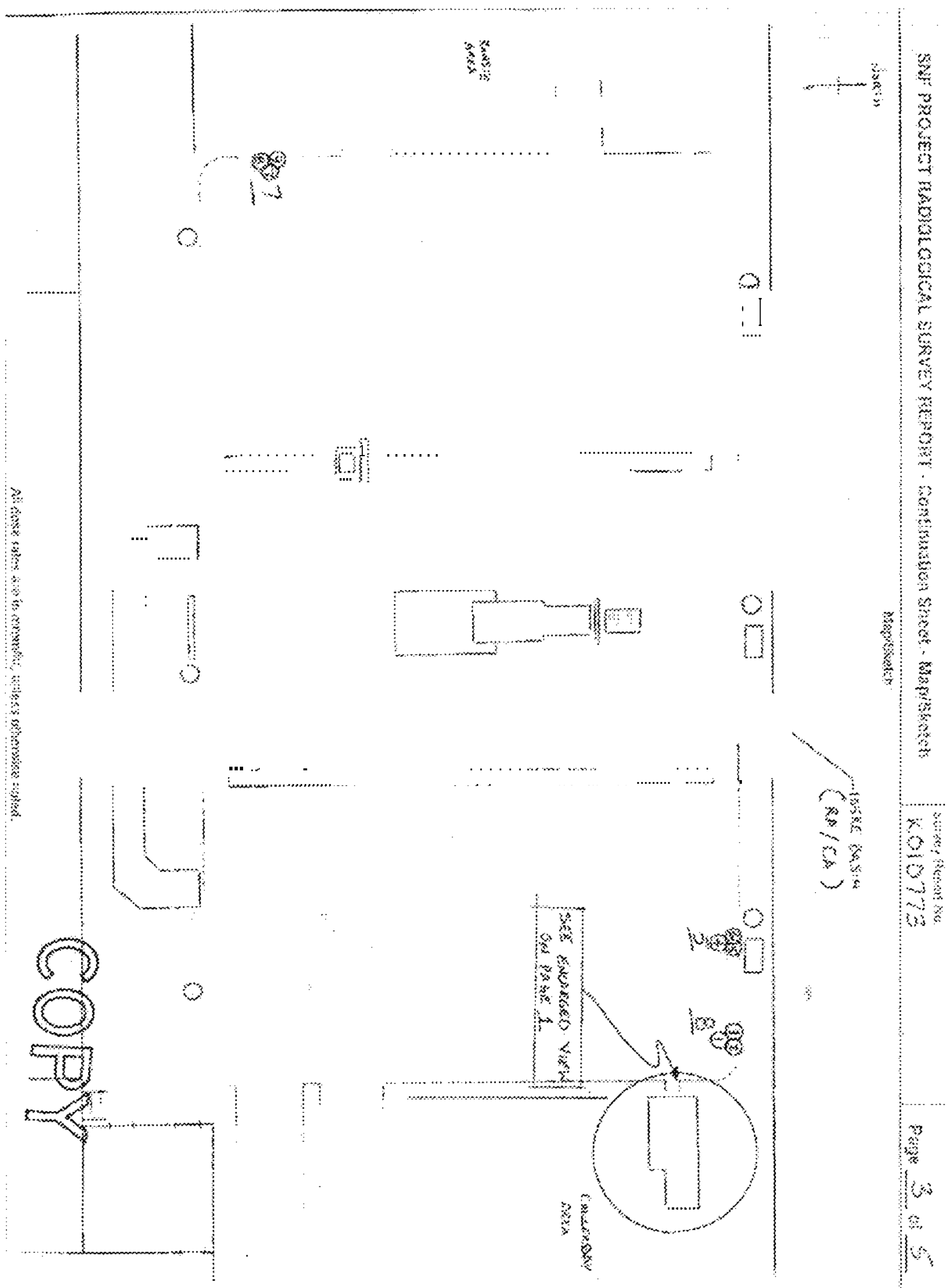
SNF PROJECT RADIOLOGICAL SURVEY REPORT

Survey Report No. K010773 — Page 2 of 5

No.	Description	DOSE RATE MEASUREMENTS (Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)) Dist. Note[1] C/F	WO mR/hr	WO mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	CONTAMINATION MEASUREMENTS Bkg cpm βγ	Bkg cpm α	Gross Direct cpm/PA βγ	Gross Direct cpm/PA α	Removable dpm/100 cm² βγ	Removable dpm/100 cm² α	Total dpm/100 cm² βγ	Total dpm/100 cm² α
1	Extender Inner Sleeving	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100	0.8	N/A	N/A	<1000	<20	N/A	N/A
2	Grating									100	0.8			2500	35		
3	Grating									100	0.8			<1000	<20		
4	Extender Inner Sleeving									100	0.8			<1000	<20		
5	Grating									100	0.8			<1000	<20		
6	Grating									100	0.8			<1000	<20		
7	Extender Inner Sleeving									100	0.8			<1000	<20		
8	Grating									100	0.8			<1000	<20		
9	Grating									100	0.8			1500	<20		
10	Hand Rail									100	0.8			<1000	<20		
11	Hand Rail									100	0.8			<1000	<20		
12	Hand Rail									100	0.8			<1000	<20		
13	Hand Rail									100	0.8			<1000	<20		
14	Hand Rail									100	0.8			<1000	<20		
15	Extender Inner Sleeving									100	0.8			<1000	<20		

Comments:
Pre Job Briefing held at 1305 hrs. Below Grating Dose Rate Survey was performed IAW ALARA Mgr's Directions and Dose Rates Taken were Documented on Data Table (Page 5). Below Grating Dose Rates were Obtained with W.R. Telescoping Extender which was sleeved with multiple layers of [illegible] Sleeving; [illegible] Survey [illegible] the outer layer of Sleeving was wiped down + Removed/Discarded and then work area surveyed prior to moving to next location. No anomalies noted.
All Surveys were performed on 10-22-01, Documentation was finished on 10-23-01.

RCT Name (Print)	Date	Payroll	Signature	Reviewer Name (Print)	Date	Payroll	Signature
[illegible]	10-23-01	57131	(signature)	Sheila Godfrey	10/24/01	72324	(signature)


SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Map/Sketch
K010773
Page 3 of 5
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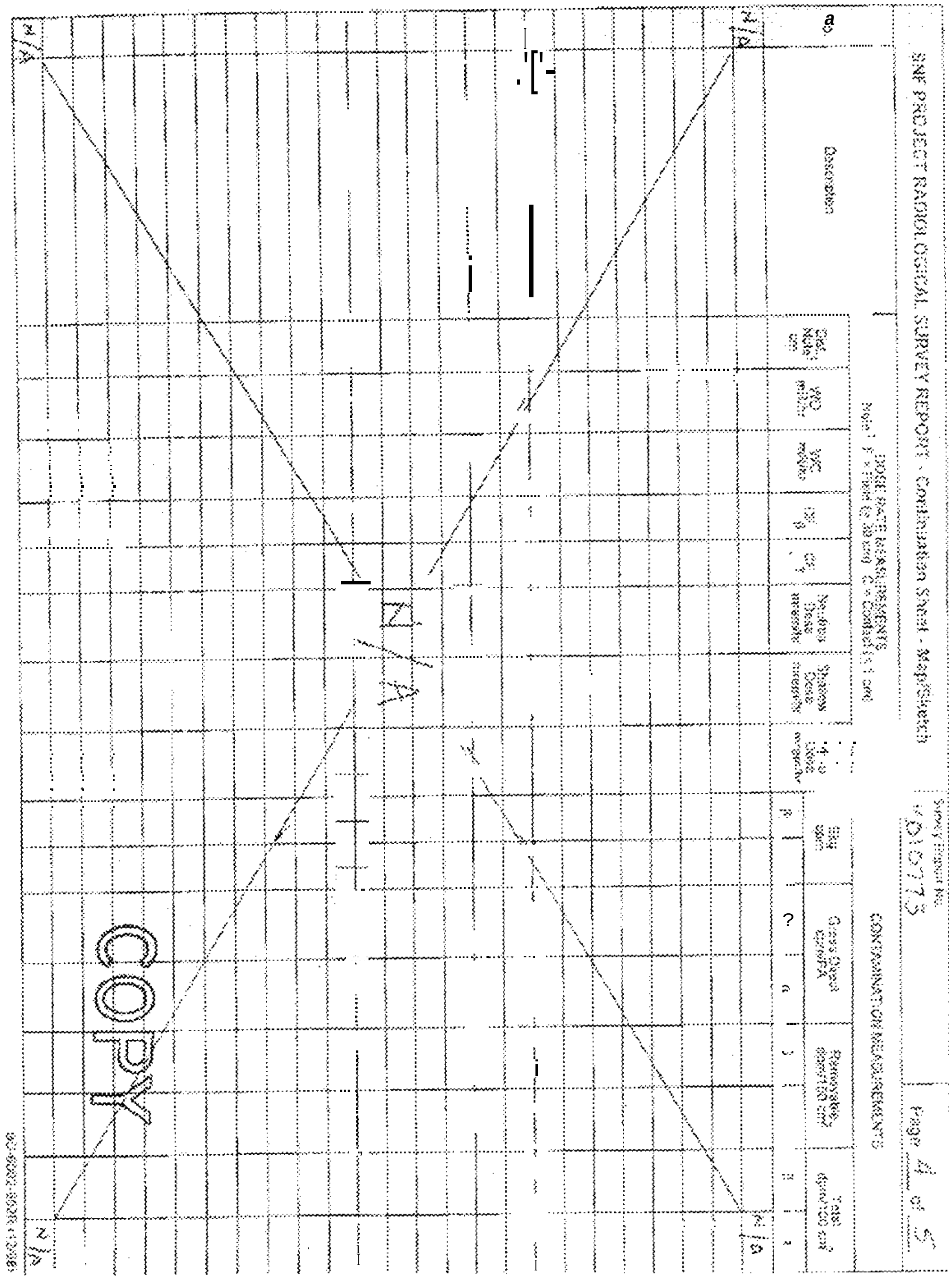

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Map/Sketch

Survey Report No. ✓D10773

Page 4 of 5

Description	DOSE RATE MEASUREMENTS Note¹ F = Field (@ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS			
	Dist. Note¹ cm	WO mR/hr	WC mR/hr	CF β	CF γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	[illegible] Dose mrem/hr	Bkg cpm	Gross Direct cpm/PA	Removable dpm/100 cm²	Total dpm/100 cm²
N/A												N/A
					N/A							
N/A												N/A

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Data Sheet for 1K-0 I-1783 RADIOLOGICAL SURVEY REPORT #K010773 PAGE 5 of 5

Recirculation Header Pipe Readings: (ALL READINGS IN mR/h)

Location	Contact Top of recirc. header	Grating level over header	Contact bottom of header	6" below header	12" below bottom of header	Check that Smear is taken
Row 1	0	N/A	36	34	30	N/A
Row 3	2	N/A	40	38	36	N/A

Basin Wall readings

Location	Contact wall 24" above water	Contact wall 12" above water	Contact wall 6" above water	Contact wall at water level	Contact wall 6" below water	Contact wall 12" below water	Contact wall 24" below water	Check that Smear is taken
Row 1	42	44	50	68	280	900	1800	N/A
Row 3	N/A	72	84	140	N/A	N/A	N/A	N/A
Cubicle area 6706-6713	20	32	40	56	160	700	2000	N/A
Cubicle area 6732-6739	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

In addition to the above readings try to determine if there is a definite line above the water in contact with the wall where there is a sharp decrease in dose rate. Record contamination survey results on a radiological survey report and attach a copy of this completed data sheet.

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