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ALARA Analysis for Shippingport Pressurized Water Reactor Core 2 Fuel Storage in the Canister Storage Building

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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Richland, Washington

Approved for public release; further dissemination unlimited

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ALARA Analysis for Shippingport Pressurized Water Reactor Core 2 Fuel Storage in the Canister Storage Building

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Abstract:
The addition of Shippingport Pressurized Water Reactor (PWR) Core 2 Blanket Fuel Assembly storage in the Canister Storage Building (CSB) will increase the total cumulative CSB personnel exposure from receipt and handling activities. The loaded Shippingport Spent Fuel Canisters (SSFCs) used for the Shippingport fuel have a higher external dose rate. Assuming an MCO handling rate of 170 per year (K East and K West concurrent operation), 24-hr CSB operation, and nominal SSFC loading, all work crew personnel will have a cumulative annual exposure of less than the1,000 mrem limit.

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ALARA ANALYSIS FOR
SHIPPINGPORT PRESSURIZED WATER REACTOR
CORE 2 FUEL STORAGE
IN THE
CANISTER STORAGE BUILDING

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ALARA	as low as reasonably achievable
CSB	Canister Storage Building
MCNP	Monte Carlo n-particle
MCO	multi-canister overpack
MHM	multi-canister overpack handling machine
PWR	pressurized water reactor
SSFC	Shippingport Spent Fuel Canister

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ALARA ANALYSIS FOR SHIPPINGPORT PRESSURIZED WATER REACTOR CORE 2 FUEL STORAGE IN THE CANISTER STORAGE BUILDING

SUMMARY

The addition of Shippingport Pressurized Water Reactor (PWR) Core 2 Blanket Fuel Assembly storage in the Canister Storage Building (CSB) will increase the total cumulative CSB personnel exposure from receipt and handling activities. The loaded Shippingport Spent Fuel Canisters (SSFCs) used for the Shippingport fuel have a higher external dose rate by a factor of approximately three, primarily the result of a substantially higher neutron exposure dose rate. Several crew member groups could exceed 1,000 mrem/year when the operations are analyzed for worst case maximum fuel loading and assuming a proposed handling rate of 200 multi-canister overpacks (MCOs) per year, plus all 18 SSFCs in one year. These groups are operators, health physics technicians, and inspection personnel. Nominal fuel loading of the additional SSFCs could result in the operators exceeding 1,000 mrem/year, assuming a proposed handling rate of 200 MCOs per year. More recent MCO handling rates are estimated to be fewer per year, which would decrease personnel annual exposures without decreasing the total exposure for the project. Assuming an MCO handling rate of 170 per year (K East and K West concurrent operation), 24-hr CSB operation, and nominal SSFC loading, all work crew personnel will have a cumulative annual exposure of less than 1,000 mrem. Additional external shielding of the SSFC is not an option due to size restrictions. Additional shielding for the CSB facility is not warranted due to the relatively short exposure time frames involved, and potential exposures could be mitigated with administrative controls.

1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this ALARA (as low as reasonably achievable) analysis is to determine the annual personnel exposure at the CSB due to handling and storing Shippingport PWR Core 2 fuel in 18 additional SSFCs. All handling activities are assumed to occur during a single year. The impact on the CSB cumulative annual personnel exposure is also assessed.

1.2 SCOPE

This analysis is limited to the estimation of facility personnel exposures during receipt, cap welding, and staging for the storage of 18 SSFCs. No other hazardous agents have been determined to be of concern during these operations. Off-normal/recovery operations or accident conditions are not within the scope of this analysis; however, a 10% increase in exposure was included to account for any abnormal operations.

1.3 BACKGROUND

There are currently 72 Shippingport PWR Core 2 blanket fuel assemblies in underwater storage racks in a converted cell in the 221-T Canyon. These assemblies are to be removed from the T-Plant for long-term dry storage in the CSB. The assemblies will be removed from the pool, allowed to drain and dry, and then loaded into an SSFC within a TN-WHC transport cask on a transport trailer in the T-Plant canyon railroad tunnel. When loaded, each SSFC will have its shield plug installed and will be backfilled with helium, vacuum checked, and leak tested prior to transport to the CSB. All CSB mechanical handling and operations will be the same as for the N Reactor fuel in MCOs from the Cold Vacuum Drying Facility.

Eighteen MCOs will be purchased and modified to contain four Shippingport PWR Core 2 blanket fuel assemblies. The basic MCO, without the center process tube, is adequate to adapt for the SSFC, except that the cavity height is about two inches short. Since the SSFC will not require the canister internal filters, the required cavity space can be readily obtained by their removal and by modifying the shield plug. An additional 2-in thick shield plate is also welded to the bottom of the shield plug.

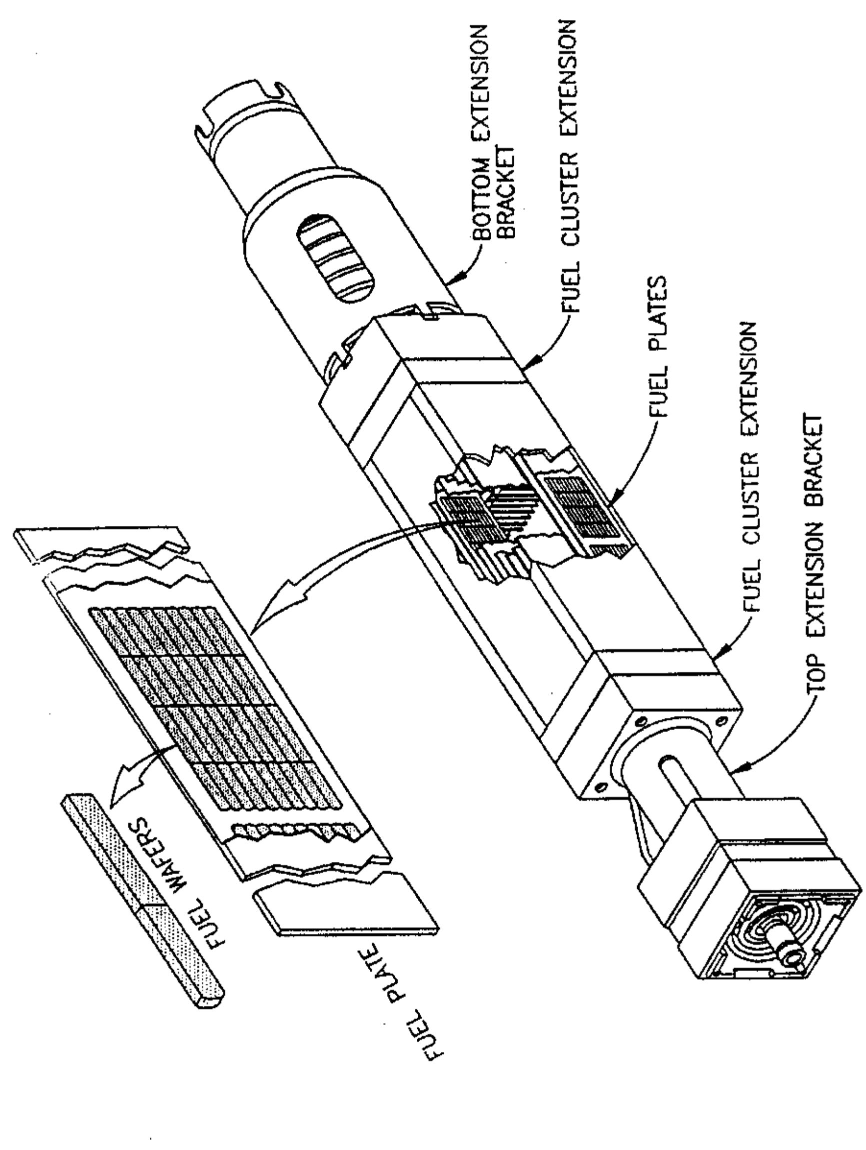
The Shippingport PWR Core 2 fuel was a developmental fuel in the U. S. Energy Research and Development Administration (now the U.S. Department of Energy) light water breeder reactor research program. Core 2 was the second of three cores irradiated in the Shippingport Atomic Power Station at Shippingport, Pennsylvania. The major purpose of the Shippingport project was to advance reactor technology and breeder reactor technology. The core was arranged into separate "seed" and "blanket" assemblies (present terminology would probably be "driver" and "target"). The seed assemblies were highly enriched uranium in uranium oxide mixed with zirconium oxide ceramic fuel (UO_2-ZrO_2), which provided the neutron source. The blanket assemblies were natural uranium oxide (UO_2) for breeding purposes. The blanket assemblies were arranged to be in close proximity to the seed assemblies. Seventy-two standard blanket assemblies were shipped to the Hanford Site during 1978 and 1979 and have since been stored underwater in the 221-T Canyon.

The 72 standard blanket assemblies are 142.3 in. long and have a 7.5-in. square cross-section (SNF-5809). The assemblies contain three basic linear sections that are bolted together: an extended fuel cluster in the middle, and top and bottom extension brackets. The fuel cluster is clad with Zircaloy-4. The bracket extensions are made of 304 stainless steel. Each assembly weighs approximately 1,180 lbs.

The fuel cluster consists of two identical oxide fuel plate subassemblies welded together to form a square structure, with two Zircaloy-43 cluster extensions welded to the ends of the subassemblies. Each subassembly consists of 30 compartmented fuel plates and two Zircaloy-4 end plates welded together to form parallel coolant channels. The fuel plate design includes many small ceramic fuel wafers surrounded by a Zircaloy-4 grid to provide adequate structural strength. The wafers have a pyrolytic carbon coating that prevented the zirconium from reacting chemically with the uranium oxide (WAPD-296). The upper and lower halves of the extended fuel cluster are mirror images.

The minor differences in the top and bottom extension brackets between blanket assemblies are due to the two-pass flow arrangement used to optimize heat transfer in the reactor core. The top extension brackets are identical, except for the location of the cooling water outlet passages. The bottom extensions brackets are basically the same, except for key slots to prevent inserting an assembly into the wrong cooling water pass location. A Shippingport PWR Core 2 blanket fuel assembly is shown in Figure 1-1.

Figure 1-1. Shippingport Pressurized Water Reactor Core 2 Blanket Fuel Assembly



2.0 METHODS

2.1 DOSE RATE CALCULATIONS FOR SHIPPINGPORT SPENT FUEL CANISTER OPERATIONS

HNF-SD-SNF-TI-062, *Shippingport Pressurized Water Reactor Core 2 Blanket Assemblies in Multi-Canister Overpack Shielding Calculations Using MCNP*, provides the dose rate calculations using the enhanced source term data from HNF-SD-SNF-TI-061, *Shippingport Pressurized Water Reactor Core 2 Blanket Assemblies Source Term Calculations Using ORIGEN2*. HNF-SD-SNF-TI-061 provides the latest source term information, which updated the previous source term to include the following:

- Extended decay time.
- Change axial distribution of fission and activation products from an average over the length of the fuel assemblies to distribution based on experimental measurements.
- Addition of a nominal fuel assembly.
- Correction of hafnium concentration in Zircaloy fuel cladding.

Radiation dose rates were calculated using Monte Carlo n-particle (MCNP) transport computer codes for two decay times (January 1, 2001, and January 1, 2004). The calculations included gamma and neutron sources. The calculations considered radiation from fuel activation and activation products in the extension brackets. Geometries considered were: (1) an SSFC in a TN-WHC cask with and without a cask lid installed, and (2) the SSFC in air without a cask. (This document refers to the SSFC as an MCO). As previously noted, the two casks are identical externally; however, there are internal differences to accommodate the different fuel type.

A nominal SSFC loading (three assemblies at ~13,800 megawatt thermal days per metric ton uranium [$MW_t d/MTU$] and one assembly at ~24,600 MW/MTM) will be established by operating procedures and TSR controls. This nominal loading is used for calculations in this analysis. Maximum loading (four assemblies at 24,600 MW/MTM) was also calculated and is included in Appendix A.

Table 2-1 through Table 2-4 summarize the MCNP radiation exposure data from HNF-SD-SNF-TI-062 using nominal fuel loading. Appendix A provides a similar summary using maximum fuel loading.

Table 2-1. Source: Irradiated Uranium and Cladding
Nominal Loading
Radial – Multi-Canister Overpack Inside Lidded Cask

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Gamma	46	24	11	5	1	0.4
Neutron	69	32	13	6	1	0.4
Total	115	56	24	11	2	1

Table 2-2. Source: Irradiated Uranium and Cladding
Nominal Loading
Top – Multi-Canister Overpack Inside Lidded Cask

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Gamma	0.08	0.08	0.03	0.03	0.02	0.01
Neutron	2.0	1.0	0.4	0.2	0.1	0.06
Total	2.08	1.08	0.43	0.23	0.12	0.07

Table 2-3. Source: Irradiated Uranium and Cladding
Nominal Loading
Top – Multi-Canister Overpack Inside Cask, No Lid

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Gamma	4.7	2.8	1.3	0.7	0.4	0.1
Neutron	3.0	2.0	0.6	0.3	0.1	0.02
Total	7.7	4.4	1.9	1.0	0.5	0.12

Table 2-4. Gamma Source: Irradiated Top Extension Bracket

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Nominal Loading-Lidded	2	0.8	0.3	0.1	0.02	0.02
Nominal Loading- No Lid	39	19	8	4	0.6	0.2

FDH-788, *SNF Canister Storage Building ALARA Analysis 09*, is the most recent ALARA analysis for the CSB. This report provides maximum personnel exposure estimates for the first and second year of CSB operations. Based on the analysis, there appears to be a high probability that none of the operating personnel will exceed 1,000 mrem/year due to MCO handling operations. Therefore, the design objective from Title 10, *Code of Federal Regulations*, Part 835 (10 CFR 835), "Occupational Radiation Protection," for personnel exposures has been achieved. This ALARA analysis does not factor in an increased background dose during the handling and operations resulting from adding 18 SSFCs to the building inventory, as the operating area is well shielded from the vault beneath and the Shippingport PWR Core 2 fuel is only approximately 5% of the CSB inventory.

The primary method employed to estimate personnel exposure for each task is that of assigning a dose rate and time interval during which specified personnel are exposed to that dose rate. The sum of these products for all of the time intervals, dose rates, and personnel categories provides the cumulative dose received by all personnel to complete a task. The variables in this process include selecting the best estimates for task times and the dose rates present. Since dose rates are influenced by distance from the source and intervening shielding, the average dose rate is not easily determined. The MCNP simulation provides estimated dose rates at prescribed distances. Detailed time-motion studies of the tasks involved within the CSB are not available; however, an estimated step-by-step flow chart was provided in ALARA Analysis 09 (FDH-788) and is included as Appendix B. These estimated times were further refined by use of a program called Crystal Ball from Decisioneering, Incorporated, Denver, Colorado. This program accounts for the fact that personnel only spend a fraction of the task time in the greatest dose rate region. The remainder of the task time is spent in a lower dose rate region. Using these refined task times provides a more realistic estimate of personnel exposure.

The analysis for SSFC operations followed the same logic path as the MCO exposure analysis, substituting MCNP dose rate numbers for the Shippingport fuel. It should be noted that this analysis is conservatively high, as all steps used for the MCO were calculated for the SSFC. This results in additional steps not applicable for the SSFC being assessed, which also drives the total personnel exposure estimate higher. Nominal fuel loading in the SSFC will result in only one quadrant of the cask exhibiting the highest radiation levels. This allows workers a relatively low dose area to approach and work on the cask. Since only about 10% of the fuel is maximum burnup, and an administrative control will be used to insert the "nominal load" in accordance with the loading plan, it is defensible to assume nominal loading for realistic personnel exposure calculation. The personnel exposures calculated using the anticipated nominal fuel loading is provided in Table 2-5.

Table 2-5. One Year - Nominal Shippingport Spent Fuel Canister Exposure

Crew member	Annual cumulative exposure (person-mrem)	Number in crew	Average annual personnel exposure (mrem/yr)	Meet design objective of <1,000 mrem/yr
Operators	2,808	12	234	Yes
Health Physics Technicians	1,008	8	126	Yes
Inspection Personnel	1,887	8	236	Yes
Weld Personnel	584	8	73	Yes
Drivers	72	4	18	Yes
Total Crew	6,359	40	159	Yes

3.0 RESULTS, OPTIONS, AND CONSIDERATIONS

CSB personnel exposures from either MCO or SSFC receiving and handling operations will *not* exceed 1,000 mrem/year for any work crew member. Combining the two operations during a single year will not result in work crew members exceeding 1,000 mrem/year based on several assumptions. Several factors impact the cumulative exposure at the CSB, including the number of MCO receiving operations in a year, facility staffing level, installed facility shielding, and fuel loading of the SSFCs. Assuming an MCO handling rate of 170/year and nominal SSFC loading, and staffing levels as listed in Table 2-5, all work crew personnel will have an annual exposure of less than 1,000 mrem.

The following discussion explores several options or considerations that could reduce radiation exposure in the CSB.

3.1 SHIELDING SHIPPINGPORT SPENT FUEL CANISTER

Additional shielding for the SSFC was considered, but the design of the SSFC does not lend itself to additional external shielding. There is minimal room inside the SSFC that could be used to incorporate additional internal shielding. The amount of shielding that could be included would not substantially reduce the exposure, especially since the majority is from neutrons. Additional shielding attached outside the shipping cask would also have marginal effect on operations at the CSB, as the majority of the exposure is received after the SSFC is removed from the transport cask.

3.2 SHIELDING IN THE CANISTER STORAGE BUILDING

Additional shielding (temporary or permanent) at two operating stations, the receiving crane and the MCO handling machine (MHM), was considered. However, only marginal exposure savings can be gained at the receiving crane operation station. The total time this operator is exposed to the highest radiation field (approximately 27 mrem/hr) is approximately one hour per container. Since the majority of the exposure is from neutrons, the thickness needed for any substantial decrease in dose rate, coupled with the relatively short duration, does not justify the cost of installation. The addition of a full 10-in. thickness of shielding would only result in an exposure reduction of approximately 54 mrem for the entire campaign.

The MHM operator will be exposed approximately three times as long in the radiation field as the receiving crane operator. The majority of the exposure from an SSFC to the MHM operator will be from gamma radiation. The unshielded dose rate two meters from the top of the SSFC is 424 mrem/hr and 228 mrem/hr at six meters. The MHM operator is provided shielding by the existing MHM design and is approximately three meters above the SSFC. The MHM operator would be exposed to only approximately 1.3 mrem/hr. The design basis of the MHM operator for MCO radiation exposure was 0.5 mrem/hr. The time frame coupled with the increase in dose rates resulted in consideration of additional shielding to minimize MHM operator exposure. If an additional 2 in. of steel shielding were installed, this could reduce radiation exposure by approximately 30%. However, the total radiation exposure savings would be insignificant. In addition, the MHM design might not accommodate this additional loading. The cost for these insignificant savings is therefore not justified.

No additional shielding is recommended for the walls of the CSB. There may be short duration time frames where exposures in routinely occupied spaces outside of the Receiving Area exceed posted limits (i.e., the fan room and the counting station). Administrative controls and temporary posting can deal with these occurrences in order to control exposures.

3.3 NUMBER OF OPERATIONS PER YEAR

One of the basic assumptions for the analysis was that the number of MCO cask operations estimated was fixed at 170 per year. The increase in radiation exposure from the SSFCs could be offset by a reduced number of MCO operations. Current discussions are considering variations of the MCO receiving operation period due to MCO fuel loading constraints at the K Basins. This could reduce the cumulative MCO personnel exposure by the percentage of MCO reduction during the year the SSFCs were handled. An additional decrease in MCO operations coupled with nominal SSFC fuel loading would achieve an additional reduction below the 1,000 mrem/year limit for all categories of involved workers.

4.0 REFERENCES

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*.

FHD-788, 1998, *SNF Canister Storage Building ALARA Analysis 09*, Fluor Daniel Hanford, Incorporated, Richland, Washington.

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HNF-SD-SNF-TI-062, 1999, *Shippingport Pressurized Water Reactor Core 2 Blanket Assemblies in Multi-Canister Overpack Shielding Calculations Using MCNP*, Rev. 1, Fluor Daniel Northwest, Incorporated, Richland, Washington.

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APPENDIX A

SHIPPINGPORT SPENT FUEL CANISTER EVALUATIONS FOR MAXIMUM FUEL LOADING

This Appendix provides a summary of the Monte Carlo n-particle (MCNP) radiation exposure data from HNF-SD-SNF-TI-062, *Shippingport Pressurized Water Reactor Core 2 Blanket Assemblies in Multi-Canister Overpack Shielding Calculations Using MCNP*, for Shippingport Spent Fuel Canisters (SSFCs) with maximum fuel loading. The same methodology was used as in the body of this analysis. This Appendix provides a comparison between maximum and nominal fuel loading in an SSFC and the resultant cumulative work crew exposure. The table numbers correlate to table numbers in the body of the text.

Table A-1. Source: Irradiated Uranium and Cladding
Maximum Loading
Radial – Multi-Canister Overpack Inside Lidded Cask

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Gamma	78	41	18	9	2	1
Neutron	204	94	39	18	3	1
Total	282	135	57	27	5	2

Table A-2. Source: Irradiated Uranium and Cladding
Maximum Loading
Top – Multi-Canister Overpack Inside Lidded Cask

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Gamma	0.1	0.1	0.06	0.04	0.03	0.01
Neutron	7	3	1	0.6	0.3	0.2
Total	7.1	3.1	1.06	0.64	0.33	0.21

Table A-3. Source: Irradiated Uranium and Cladding
Maximum Loading
Top – Multi-Canister Overpack Inside Cask, No Lid

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Gamma	7.5	4.4	2.1	1.3	0.2	0.1
Neutron	8	4	2	0.9	0.3	0.2
Total	15.5	8.4	4.1	2.2	0.5	0.3

Table A-4. Gamma Source: Irradiated Top Extension Bracket

(mrem/hr)	Shipping cask contact	0.3 m	1.0 m	2.0 m	6.0 m	10.0 m
Max. Loading – Lidded	3	1	0.4	0.2	0.03	0.02
Max. Loading-No Lid	56	27	11	5	0.9	0.3

Table A-5. One Year – Maximum Shippingport Spent Fuel Canister Exposure

Crew member	Annual cumulative exposure (person-mrem)	Number in crew	Average annual personnel exposure (mrem/yr)	Meet design objective of <1,000 mrem/yr
Operators	7,020	12	585	Yes
Health Physics Technicians	2,520	8	315	Yes
Inspection Personnel	4,716	8	590	Yes
Weld Personnel	1,458	8	183	Yes
Drivers	180	4	45	Yes
Total Crew	15,894	40	398	Yes

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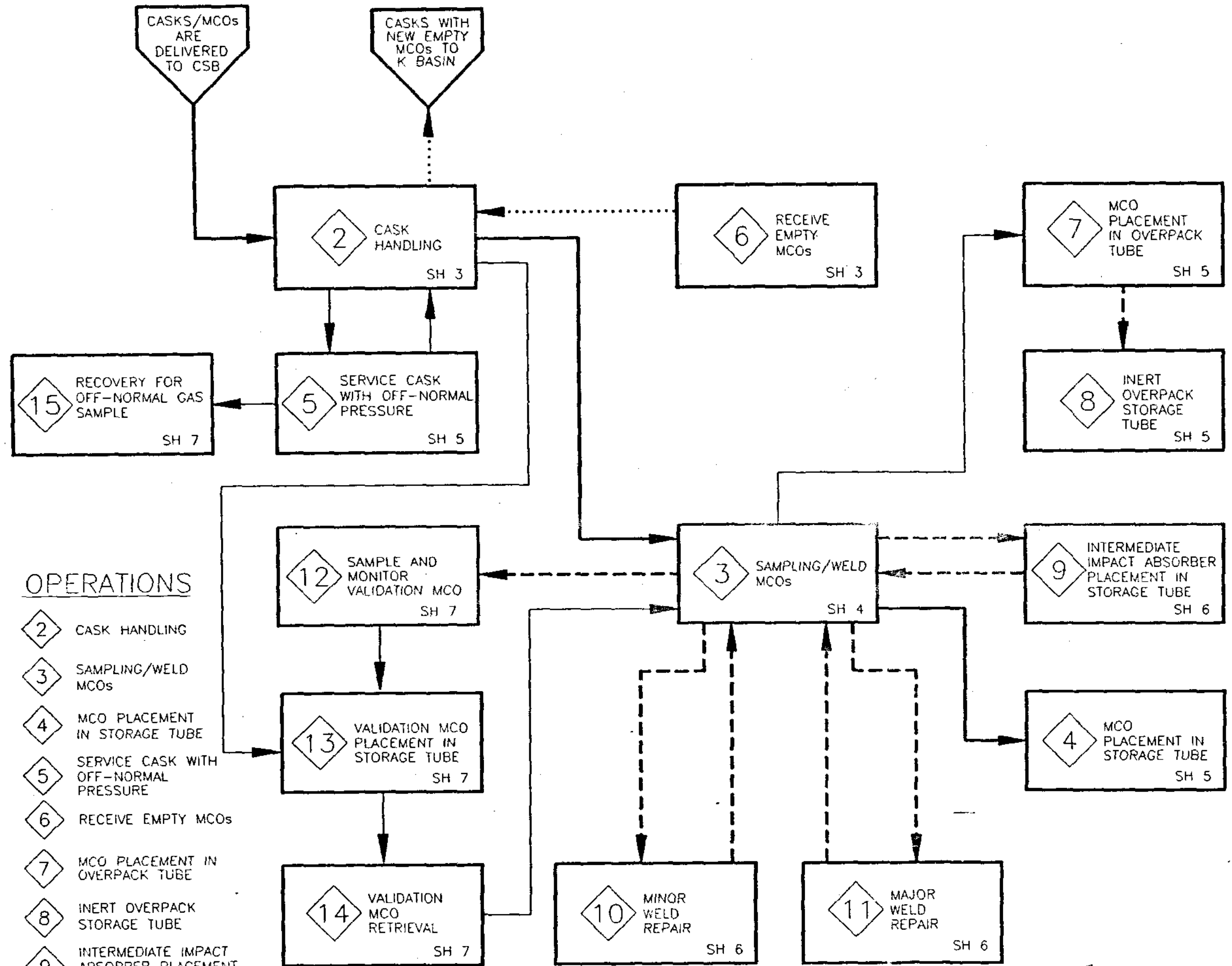
APPENDIX B

OPERATIONAL SEQUENCE BLOCK FLOW DIAGRAMS

These seven operational sequence block flow diagrams are included to capture the process step timing and sequence used in this ALARA analysis. They were developed by CSB personnel through time/motion studies and are updated as process refinements are obtained.



OPERATIONS

- (2) CASK HANDLING
- (3) SAMPLING/WELD MCOs
- (4) MCO PLACEMENT IN STORAGE TUBE
- (5) SERVICE CASK WITH OFF-NORMAL PRESSURE
- (6) RECEIVE EMPTY MCOs
- (7) MCO PLACEMENT IN OVERPACK TUBE
- (8) INERT OVERPACK STORAGE TUBE
- (9) INTERMEDIATE IMPACT ABSORBER PLACEMENT IN STORAGE TUBE
- (10) MINOR WELD REPAIR
- (11) MAJOR WELD REPAIR
- (12) SAMPLE AND MONITOR VALIDATION MCO
- (13) VALIDATION MCO PLACEMENT IN STORAGE TUBE
- (14) VALIDATION MCO RETRIEVAL
- (15) RECOVERY FOR OFF-NORMAL GAS SAMPLE FROM CASK

LEGEND

DR = DRIVER
OP = OPERATOR
HP = HEALTH PHYSICIST
UT = ULTRASONIC INSPECTION
PT = DYE PENETRANT INSPECTION
IP = INSPECTOR
TW = TECHNICIAN, WELDING

——— TYPICAL MCO PATH
——— ALTERNATE MCO PATH
– – – NON-MCO HANDLING OPERATION
······· NON-SNF HANDLING OPERATION

NOTES

1. THIS FLOW DIAGRAM DEPICTS THE CSB ACTIVITIES ASSOCIATED WITH MCO OPERATIONS. THE SEQUENCE OF OPERATIONS SHOWN REPRESENTS ORGANIZATION OF THE ACTIVITIES INVOLVED SO AS TO MAXIMIZE SAFETY AND EFFICIENCY. HOWEVER IN SOME INSTANCES STRICT ADHERENCE TO THE SEQUENCE MAY NOT BE MANDATORY. SOME ACTIVITIES MAY BE PERFORMED IN PARALLEL IF SUFFICIENT STAFFING IS AVAILABLE. THE DIAGRAM IS INTENDED TO PRESENT A BOUNDING CASE FOR THE TIME REQUIRED TO COMPLETE VARIOUS MCO PROCESSES AT THE CSB. THE TIME LISTED FOR EACH BLOCK INCLUDES THE TIME REQUIRED TO ACCOMPLISH THAT ACTIVITY, AND ANY SUB-STEPS WHICH MAY NOT BE ITEMIZED. THESE PROCESSES AND CORRESPONDING OPERATING PROCEDURES WILL NOT BE FULLY OPTIMIZED UNTIL THE FACILITY IS OPERATIONAL.
2. HP WILL BE IN THE AREA AND WILL PROVIDE COVERAGE ON AN AS NEEDED BASIS.
3. SUPERVISOR WILL SPEND 1 TO 2 HOURS PER SHIFT ON OPERATING DECK DURING TRANSFER OPERATIONS.
4. PROCEED AFTER MHM HAS CLEARED THE RAIL FROGS.
5. THE PREFERRED STORAGE LOCATION FOR INTERMEDIATE IMPACT ABSORBERS IS THE FOUR SOUTHERNMOST OF THE SIX OVERPACK TUBES. MHM ACCESS TO THE TWO NORTHERNMOST OVERPACK TUBES REQUIRES AN ADDITIONAL ROTATION OF THE RAIL FROGS.
6. INTERMEDIATE IMPACT ABSORBERS WILL BE INSTALLED PRIOR TO PLACING THE 2nd MCO IN A STORAGE TUBE.
7. WHEN ACCESSING THE FIRST 7 ROWS OF STORAGE TUBES AT THE NORTH END OF VAULT 1, MHM WHEEL TRAVEL REQUIRES THAT THE RAIL FROG MUST BE ORIENTED FOR MHM ACCESS.
8. ONCE THE CASK IS VENTED THE SHIPPING WINDOW FOR MCO HANDLING IS SATISFIED AND IS NO LONGER A FACTOR FOR OPERATIONS (234 HOUR LIMIT FROM THE TIME THE CASK IS SEALED AT CVDF).
9. WHEN ACCESSING THE 2 NORTHERNMOST OVERPACK TUBES, MHM WHEEL TRAVEL REQUIRES THAT THE RAIL FROG MUST BE ORIENTED FOR MHM ACCESS.
10. VALIDATION MCOs RECEIVED FROM CVD WILL BE PLACED IN STORAGE TUBES PRIOR TO SCHEDULED MONITORING ACTIVITIES.
11. THE FIRST 6 MCOs RECEIVED WILL BE VALIDATION MCOs. OPERATIONS 12, 13 AND 14 ARE FOR VALIDATION MCOs ONLY.
12. THE CASK CAN BE VENTED BY CONNECTING TO THE SERVICE STATION VENT SYSTEM. AS AN ALTERNATIVE, THE VENT AND PURGE CART MAY BE USED TO PROVIDE THIS CAPABILITY.
13. IF GAS SAMPLE FROM CASK IS CONTAMINATED, DO NOT PROCEED WITH CASK VENTING. FOLLOW APPROPRIATE RECOVERY PLAN.
14. IF CASK PRESSURE IS ELEVATED, SAMPLING AND ANALYSIS OF GAS CONTENTS IS REQUIRED.
15. THE CASK PRESSURE CHECK MAY BE PERFORMED ON THE TRANSPORTER WHILE IN THE TRUCK VESTIBULE, HOWEVER THIS IS CURRENTLY NOT IN THE BASELINE.
16. "MHM STAGING AREA" REFERS TO ANY SELECTED LOCATION THAT IS CONVENIENT FOR PARKING THE MHM WHEN IT IS NOT IN USE. THIS MAY BE A DESIGNATED PARKING FACILITY OR ANY OTHER LOCATION IN THE OPERATING AREA WHERE THE MHM DOES NOT OBSTRUCT OTHER OPERATIONS.
17. VALIDATION MCOs WILL BE RETRIEVED FROM THE STORAGE TUBE 8 TIMES FOR SCHEDULED SAMPLING AND MONITORING.
18. IN ORDER TO PROCEED TO THE NEXT STEP, THE CASK SURVEY RESULTS MUST BE ACCEPTABLE. DECON OPERATIONS ARE NOT INCLUDED IN THE TIME LINE.

J SEALED MCO STRATEGY

B123400A WHC-SD-...
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TWV-SW-370252

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GOVERNMENT SERVICES OPERATING CO

OPERATIONAL SEQUENCE BLOCK FLOW DIAGRAM OVERVIEW

SNF - CANISTER STORAGE BUILDING
W - 379 | 80460210 | CSB
FG RITCH | 3-24-98 | NONE | 212H
NONE | NOT RECD | H-2-123400 | 1 | 7 | J

REFERENCE DRAWINGS
NEXT USED ON

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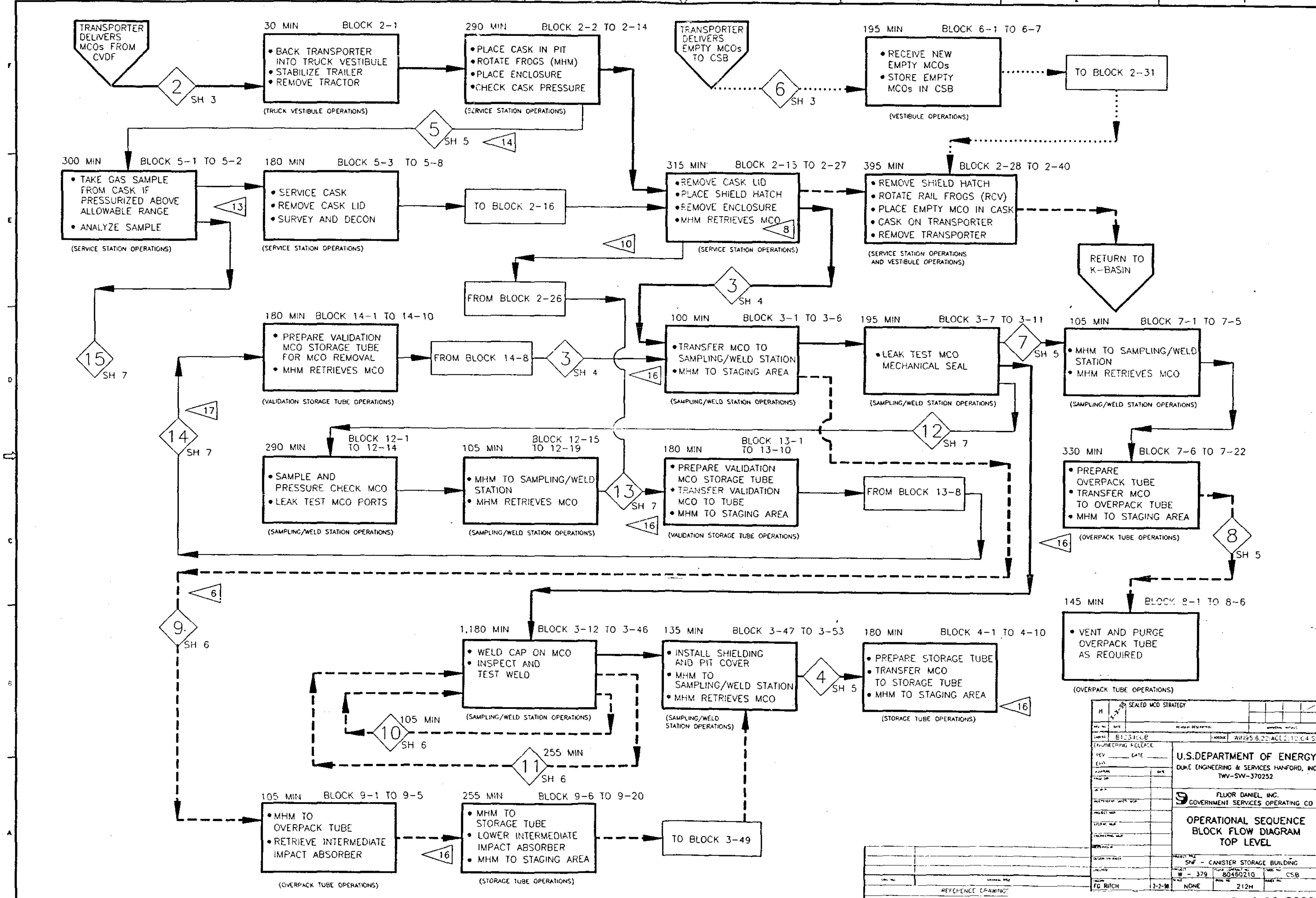

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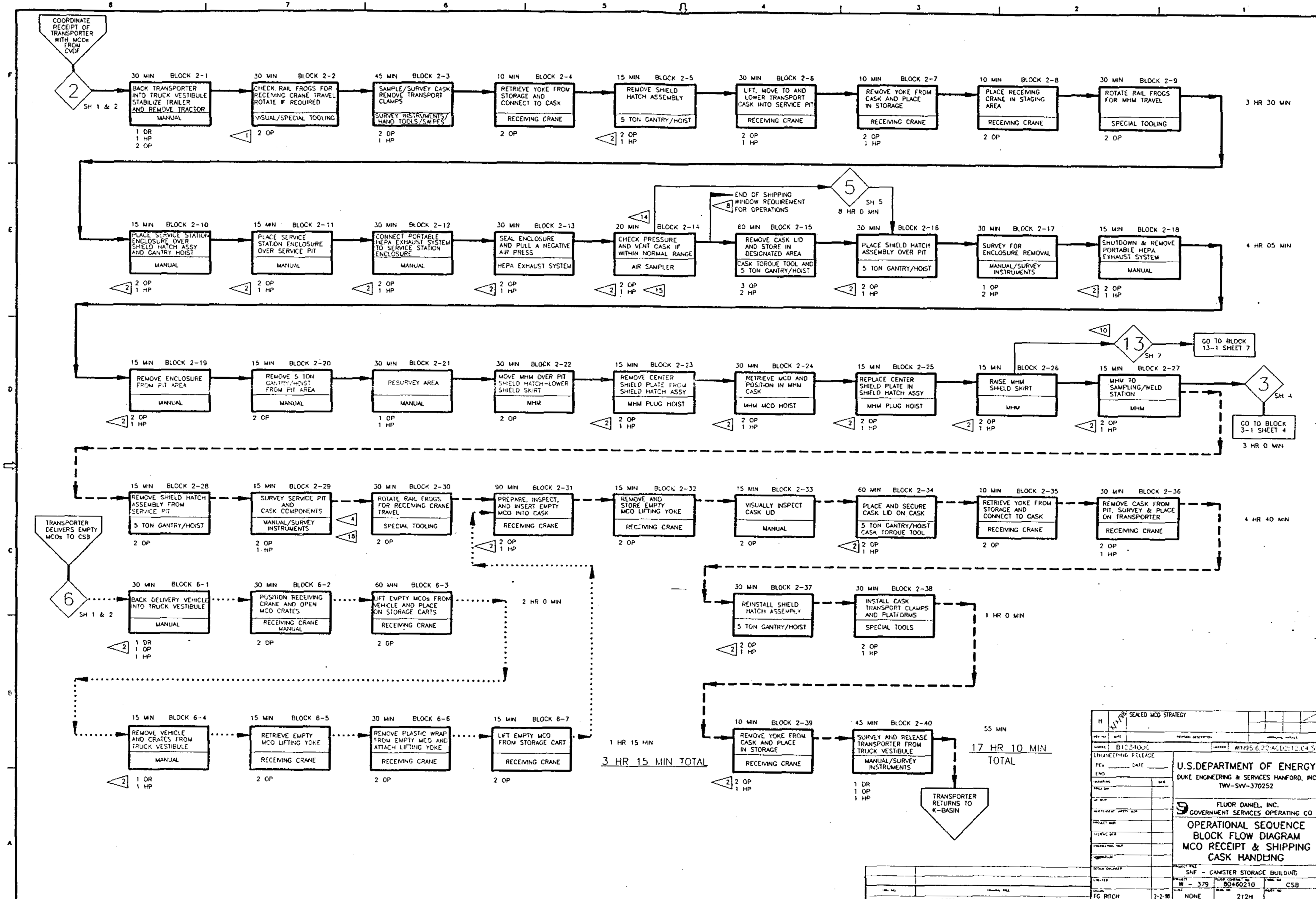

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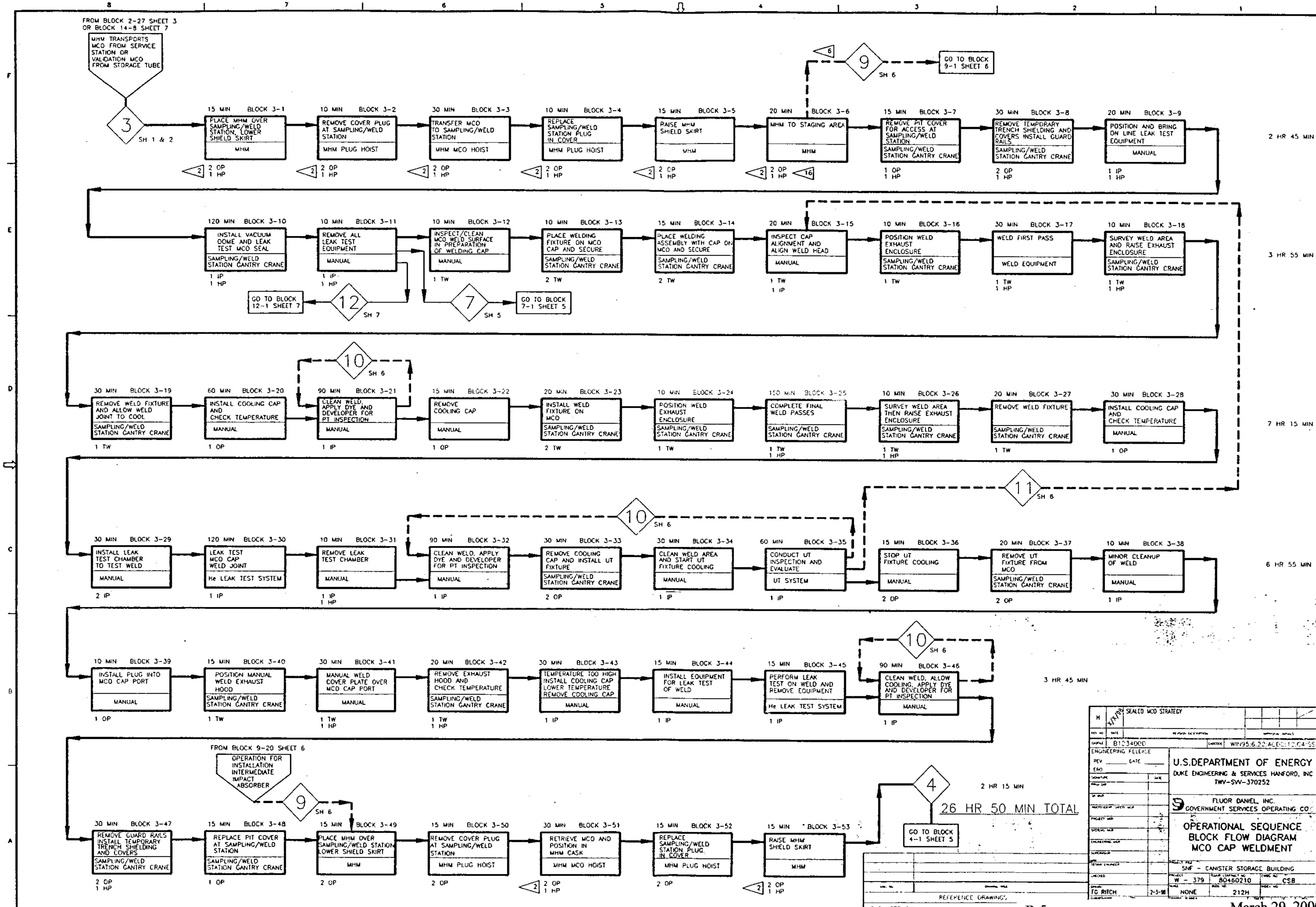

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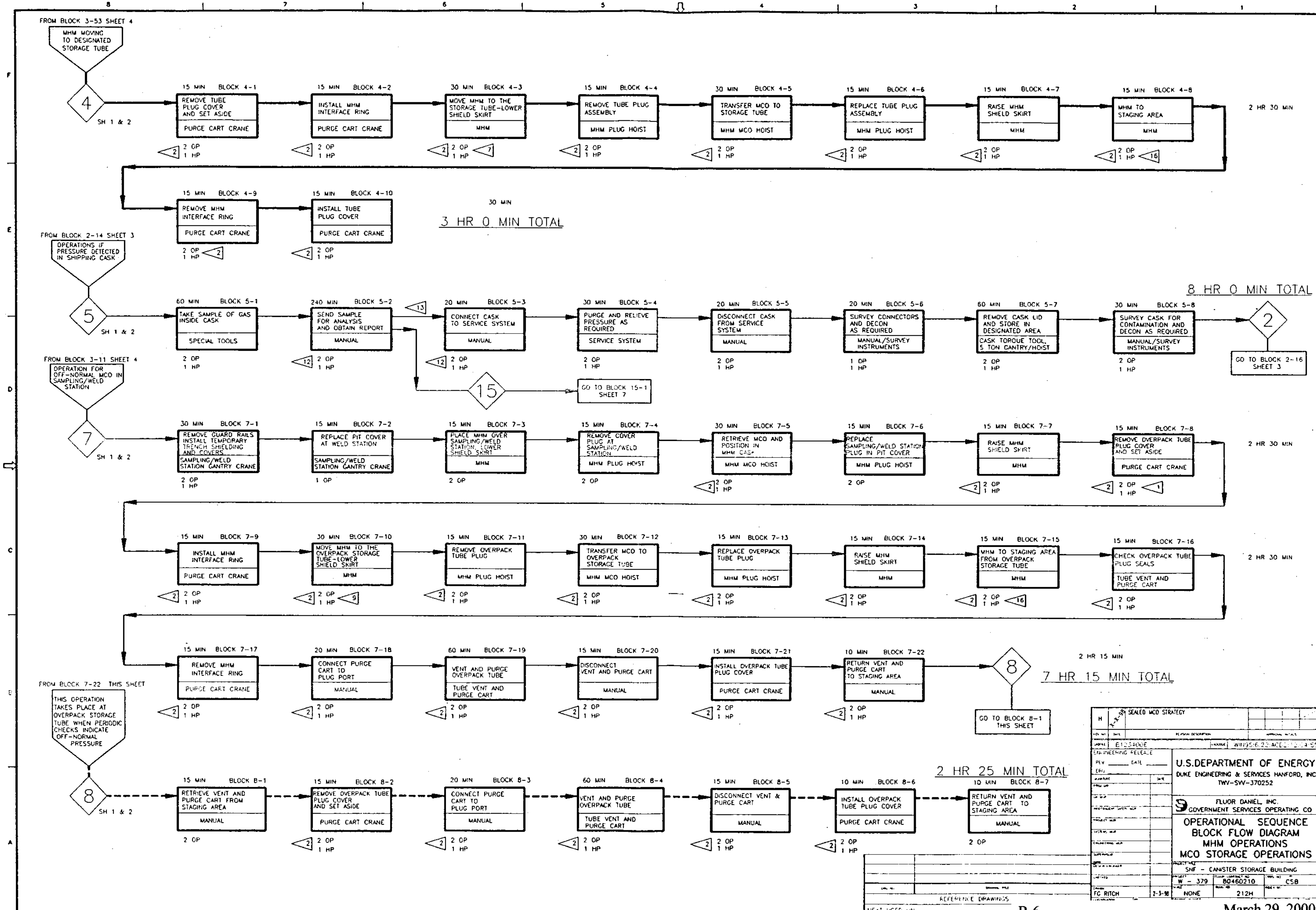

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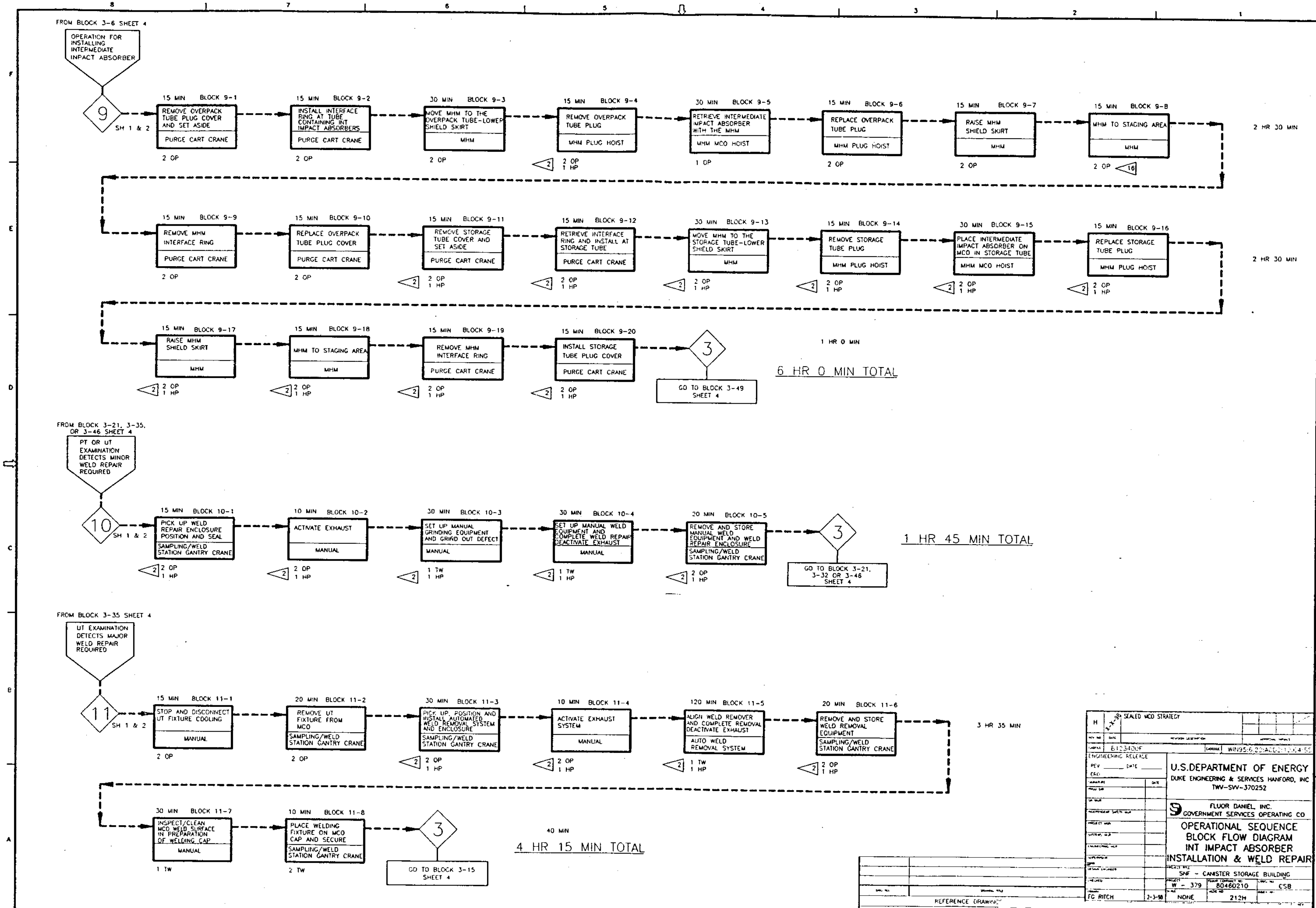

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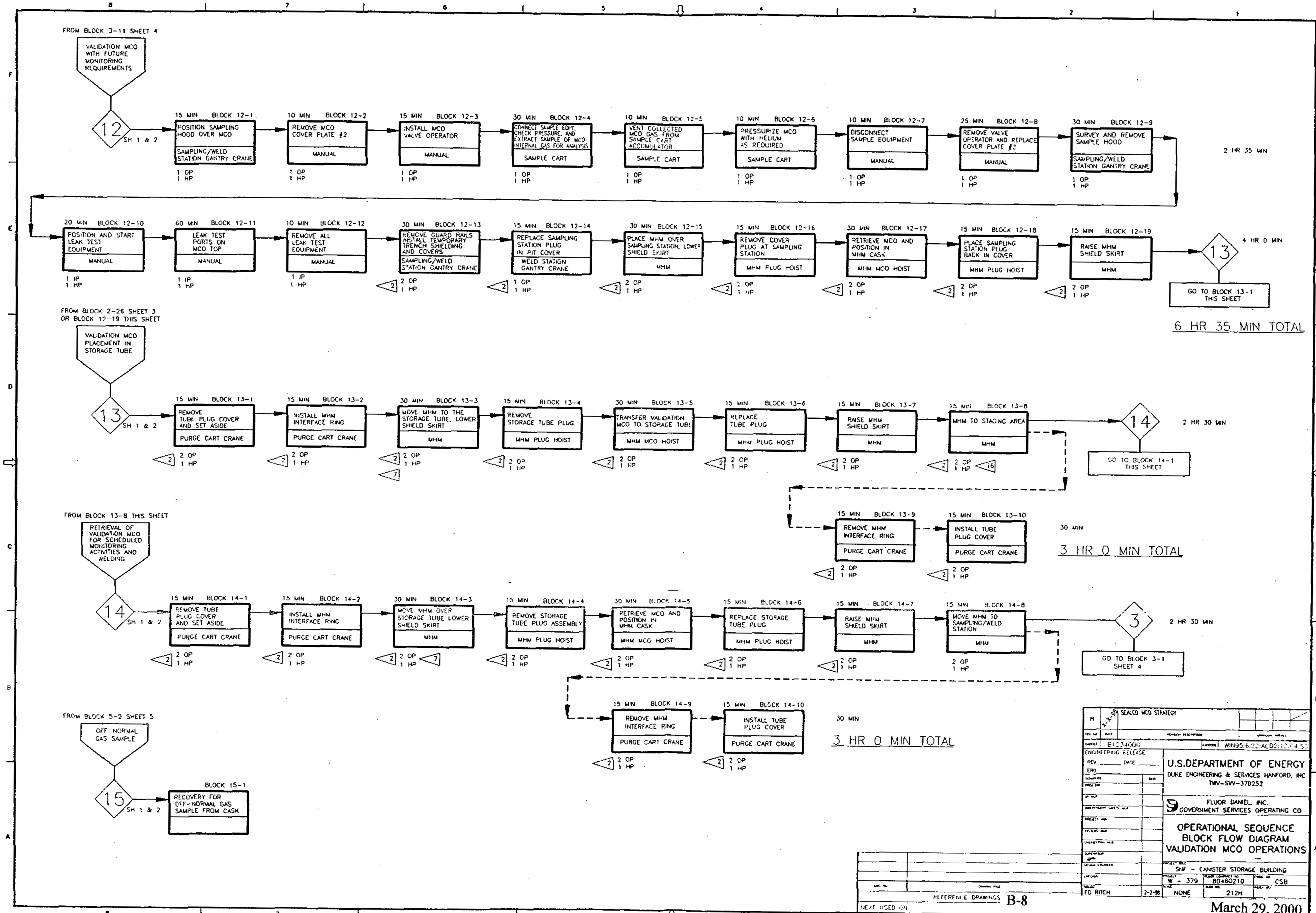

FROM BLOCK 3-11 SHEET 4
VALIDATION MCO WITH FUTURE MONITORING REQUIREMENTS
12
SH 1 & 2
15 MIN BLOCK 12-1
POSITION SAMPLING HOOD OVER MCO
SAMPLING/WELD STATION GANTRY CRANE
1 OP 1 HP
10 MIN BLOCK 12-2
REMOVE MCO COVER PLATE #2
MANUAL
1 OP 1 HP
15 MIN BLOCK 12-3
INSTALL MCO VALVE OPERATOR
MANUAL
1 OP 1 HP
30 MIN BLOCK 12-4
CONNECT SAMPLE EQPT, CHECK PRESSURE, AND EXTRACT SAMPLE OF MCO INTERNAL GAS FOR ANALYSIS
SAMPLE CART
1 OP 1 HP
10 MIN BLOCK 12-5
VENT COLLECTED MCO GAS FROM SAMPLE CART ACCUMULATOR
SAMPLE CART
1 OP 1 HP
10 MIN BLOCK 12-6
PRESSURIZE MCO WITH HELIUM AS REQUIRED
SAMPLE CART
1 OP 1 HP
10 MIN BLOCK 12-7
DISCONNECT SAMPLE EQUIPMENT
MANUAL
1 OP 1 HP
25 MIN BLOCK 12-8
REMOVE VALVE OPERATOR AND REPLACE COVER PLATE #2
MANUAL
1 OP 1 HP
30 MIN BLOCK 12-9
SURVEY AND REMOVE SAMPLE HOOD
SAMPLING/WELD STATION GANTRY CRANE
1 OP 1 HP
2 HR 35 MIN
20 MIN BLOCK 12-10
POSITION AND START LEAK TEST EQUIPMENT
MANUAL
1 IP 1 HP
60 MIN BLOCK 12-11
LEAK TEST PORTS ON MCO TOP
MANUAL
1 IP 1 HP
10 MIN BLOCK 12-12
REMOVE ALL LEAK TEST EQUIPMENT
MANUAL
1 IP 1 HP
30 MIN BLOCK 12-13
REMOVE GUARD RAILS INSTALL TEMPORARY TRENCH SHIELDING AND COVERS
SAMPLING/WELD STATION GANTRY CRANE
2 OP 1 HP
15 MIN BLOCK 12-14
REPLACE SAMPLING STATION PLUG IN PIT COVER
WELD STATION GANTRY CRANE
1 OP 1 HP
30 MIN BLOCK 12-15
PLACE MHM OVER SAMPLING STATION, LOWER SHIELD SKIRT
MHM
2 OP 1 HP
15 MIN BLOCK 12-16
REMOVE COVER PLUG AT SAMPLING STATION
MHM PLUG HOIST
2 OP 1 HP
30 MIN BLOCK 12-17
RETRIEVE MCO AND POSITION IN MHM CASK
MHM MCO HOIST
2 OP 1 HP
15 MIN BLOCK 12-18
PLACE SAMPLING STATION PLUG BACK IN COVER
MHM PLUG HOIST
2 OP 1 HP
15 MIN BLOCK 12-19
RAISE MHM SHIELD SKIRT
MHM
2 OP 1 HP
13
4 HR 0 MIN
GO TO BLOCK 13-1 THIS SHEET
6 HR 35 MIN TOTAL
FROM BLOCK 2-26 SHEET 3 OR BLOCK 12-19 THIS SHEET
VALIDATION MCO PLACEMENT IN STORAGE TUBE
13
SH 1 & 2
15 MIN BLOCK 13-1
REMOVE TUBE PLUG COVER AND SET ASIDE
PURGE CART CRANE
2 OP 1 HP
15 MIN BLOCK 13-2
INSTALL MHM INTERFACE RING
PURGE CART CRANE
2 OP 1 HP
30 MIN BLOCK 13-3
MOVE MHM TO THE STORAGE TUBE, LOWER SHIELD SKIRT
MHM
2 OP 1 HP
7
15 MIN BLOCK 13-4
REMOVE STORAGE TUBE PLUG
MHM PLUG HOIST
2 OP 1 HP
30 MIN BLOCK 13-5
TRANSFER VALIDATION MCO TO STORAGE TUBE
MHM MCO HOIST
2 OP 1 HP
15 MIN BLOCK 13-6
REPLACE TUBE PLUG
MHM PLUG HOIST
2 OP 1 HP
15 MIN BLOCK 13-7
RAISE MHM SHIELD SKIRT
MHM
2 OP 1 HP
15 MIN BLOCK 13-8
MHM TO STAGING AREA
MHM
2 OP 1 HP
16
14
2 HR 30 MIN
GO TO BLOCK 14-1 THIS SHEET
15 MIN BLOCK 13-9
REMOVE MHM INTERFACE RING
PURGE CART CRANE
2 OP 1 HP
15 MIN BLOCK 13-10
INSTALL TUBE PLUG COVER
PURGE CART CRANE
2 OP 1 HP
30 MIN
3 HR 0 MIN TOTAL
FROM BLOCK 13-8 THIS SHEET
RETRIEVAL OF VALIDATION MCO FOR SCHEDULED MONITORING ACTIVITIES AND WELDING
14
SH 1 & 2
15 MIN BLOCK 14-1
REMOVE TUBE PLUG COVER AND SET ASIDE
PURGE CART CRANE
2 OP 1 HP
15 MIN BLOCK 14-2
INSTALL MHM INTERFACE RING
PURGE CART CRANE
2 OP 1 HP
30 MIN BLOCK 14-3
MOVE MHM OVER STORAGE TUBE LOWER SHIELD SKIRT
MHM
2 OP 1 HP
7
15 MIN BLOCK 14-4
REMOVE STORAGE TUBE PLUG ASSEMBLY
MHM PLUG HOIST
2 OP 1 HP
30 MIN BLOCK 14-5
RETRIEVE MCO AND POSITION IN MHM CASK
MHM MCO HOIST
2 OP 1 HP
15 MIN BLOCK 14-6
REPLACE STORAGE TUBE PLUG
MHM PLUG HOIST
2 OP 1 HP
15 MIN BLOCK 14-7
RAISE MHM SHIELD SKIRT
MHM
2 OP 1 HP
15 MIN BLOCK 14-8
MOVE MHM TO SAMPLING/WELD STATION
MHM
2 OP 1 HP
3
2 HR 30 MIN
GO TO BLOCK 3-1 SHEET 4
15 MIN BLOCK 14-9
REMOVE MHM INTERFACE RING
PURGE CART CRANE
2 OP 1 HP
15 MIN BLOCK 14-10
INSTALL TUBE PLUG COVER
PURGE CART CRANE
2 OP 1 HP
30 MIN
3 HR 0 MIN TOTAL
FROM BLOCK 5-2 SHEET 5
OFF-NORMAL GAS SAMPLE
15
SH 1 & 2
BLOCK 15-1
RECOVERY FOR OFF-NORMAL GAS SAMPLE FROM CASK
SEALED MCO STRATEGY
B1234006
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U.S.DEPARTMENT OF ENERGY
DUKE ENGINEERING & SERVICES HANFORD, INC
TWV-SW-370252
FLUOR DANIEL, INC.
GOVERNMENT SERVICES OPERATING CO
OPERATIONAL SEQUENCE
BLOCK FLOW DIAGRAM
VALIDATION MCO OPERATIONS
SNF - CANISTER STORAGE BUILDING
W - 379
80460210
CSB
FG RITCH
NONE
212H
REFERENCE DRAWINGS
NEXT USED ON
B-8
March 29, 2000

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