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MSRE PROCEDURES FOR THE PERIOD BETWEEN EXAMINATION AND ULTIMATE DISPOSAL

(Phase III of Decommissioning Program)

R. H. Guymon

ABSTRACT

This document describes the condition of the MSRE and specifies procedures to be followed after the post-operation examinations and before the ultimate disposal of the fissile and radioactive material in the reactor. The fuel salt will be kept frozen in the sealed drain tanks, within secondary containment whose only opening is through filters to a stack. Surveillance will consist of remote monitoring and daily visits by X-10 plant personnel. Personnel access will be controlled by the security fence around the reactor building. The MSRE Procedures specify remedial actions for abnormal conditions. Also specified are procedures and responsibilities for maintenance, modifications, and removal of surplus equipment.

Keywords: molten-salt reactors, MSRE, procedures, storage, surveillance, administration, containment, flowsheets, maintenance, operations, ORNL, plans, testing.

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A. INTRODUCTION

The retirement or decommissioning of the MSRE involves several phases. Phase I is the period between the end of power operation and the post-operation examinations, which is Phase II. Phase III is the interim period between the completion of the examinations and the final disposal which is Phase IV.

During Phase III, some of the information given in the MSRE Design and Operations Reports (Refs. 1 through 9) and the facility drawings will still be applicable. Much of the equipment will not be in service, however, and most of the procedures which were followed during operation will no longer be applicable. This report describes the systems which will be used and specifies the normal conditions and surveillance required during Phase III. It also lists the more probable abnormal situations which could develop and prescribes remedial actions. The system of access control, approvals required for maintenance and changes, and responsibilities are delineated. This document supersedes all previous operating procedures for the MSRE.

B. DESCRIPTION AND NORMAL OPERATING CONDITIONS

Most of the equipment and instrumentation involved during Phase III is shown in Figure B-1. Pertinent information on the instruments in service is given in Table B-1. Plan views of the building showing evacuation routes are shown in Figure B-2. The most often used abbreviations are given in Table B-2. Master, marked-up, copies of the flowsheets (D-AA-A-40880 to 40890), the instrument application drawings (D-AA-B-40500 to 40515) and the electrical power distribution drawing (E-20794-ED-153-D) will be kept up to date and available in the MSRE control room in Building 7503. Another up-to-date set of drawings will be kept in the outermost room of the office building (Room 17, Building 7509).

About one-half of the fuel salt (5,460 lbs) is stored in FD-1 and the other half (4784 lbs) in FD-2. All of the flush salt (9,460 lbs) is

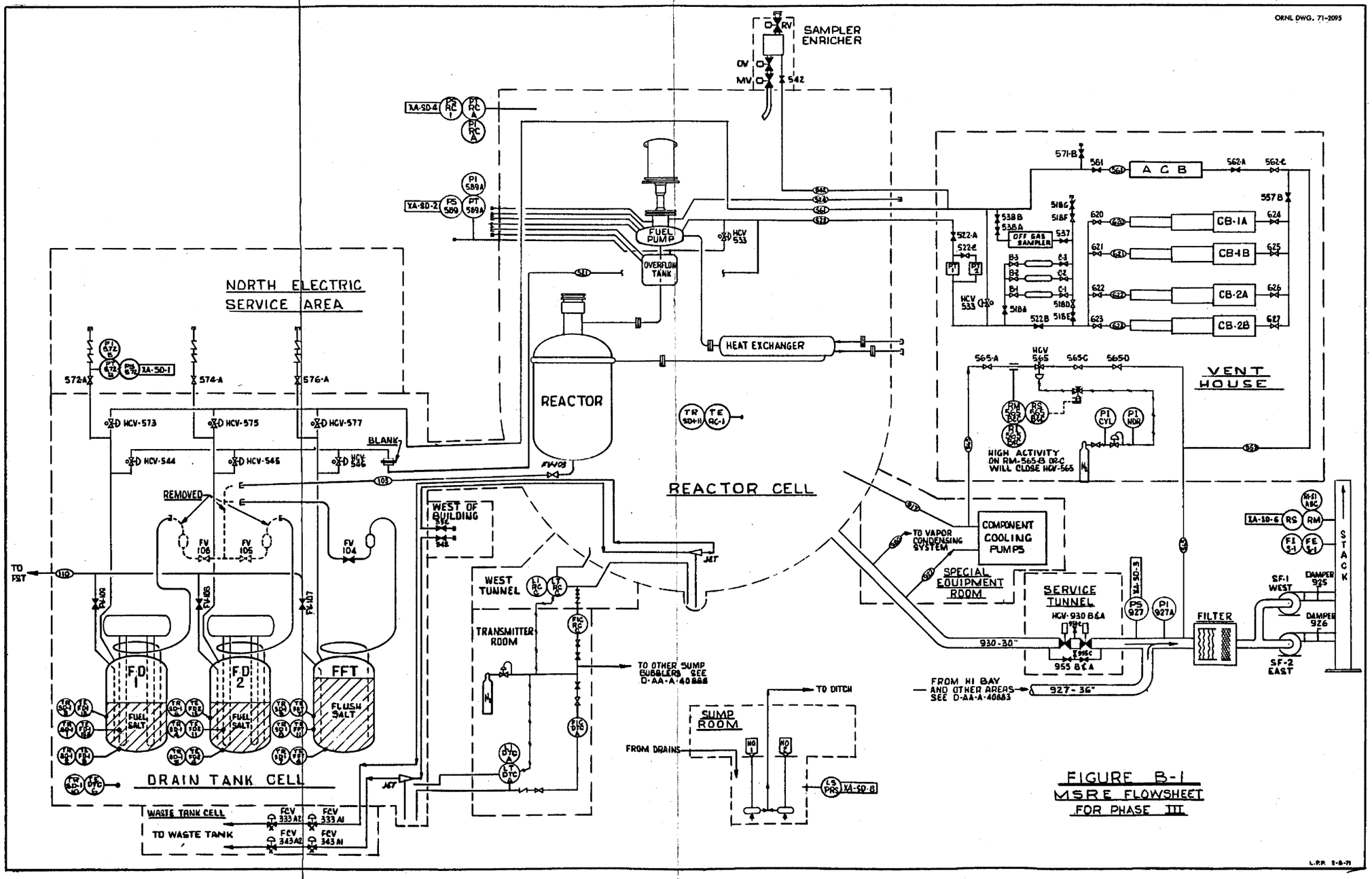


Fig. B-1. MSRE Flowsheet for Phase III

Table B-1 INSTRUMENTATION

Read-Out Instrument			Primary Element		Annunciator*		
No.	Location	Range	No.	Variable Monitored	No.	Switch No.	Setpoint
FI-S1	Stack Pnl.	0-1 in. H_2O**	FE-S1	Stack Flow			
LI-RC-C	TR	0-20 in. H_2O	LE-RC-C	RC Sump Level			
LI-DTC-A1	TR	"	LE-DTC-A1	DTC Sump Level			
LI-FSC-A	TR	0-52 in. H_2O	LE-DC-C	DC Sump Level			
LI-FSC-A	TR	"	LE-FSC-A	FSC-Sump Level			
LI-FSC-A	TR	"	LE-TC-A	TC Sump Level			
LI-FSC-A	TR	"	LE-SC-A	SC Sump Level			
LI-FSC-A	TR	"	LE-WTC-A	WTC Sump Level			
---	---	---	LS-PRS	Pump Room Sump Level	XA-SD-8	LS-PRS	↑
PI-572B	ACR	0-50 psig	PT-572B	FD-2 Pressure	XA-SD-1	PS-572	↑2 psig
PI-589A	ACR	0-50 psig	PT-592B	FP Pressure	XA-SD-2	PS-589	↑0.5 psig
PI-927A	Stack Pnl.	-8-0 in. H_2O	PI-927A	Stack Filter Inlet Suction	XA-SD-3	PS-927	↑-1 in. H_2O
PI-RC-A	MCR	-15-50 psig	PT-RC-A	RC Pressure	XA-SD-4	PS-RC-1	↑1 psig
RI-565-B	ACR	0-100 mR/hr	RM-565-B	RC Air Activity***	XA-SD-5	RS-565-B	↑20 mR/hr
RI-565-C	ACR	0-100 mR/hr	RM-565-C	RC Air Activity***	XA-SD-5	RS-565-C	↑20 mR/hr
RI-S1-A	ACR	****	RM-S1-A	Stack β,γ activity	XA-SD-6	RS-S1-A	<6000 c/m
RI-S1-B	ACR	****	RM-S1-B	Stack α activity	XA-SD-6	RS-S1-B	<6000 c/m
RI-S1-C	ACR	****	RM-S1-C	Stack Iodine Activity	XA-SD-6	RS-S1-C	<6000 c/m

*All annunciators repeat at ORNL Central Waste Monitoring Facility (Building 3105).

**See calibration curve for conversion to flow.

***High activity indication (>20 mR/hr) on either RSS-565-B or -C will close HCV-565.

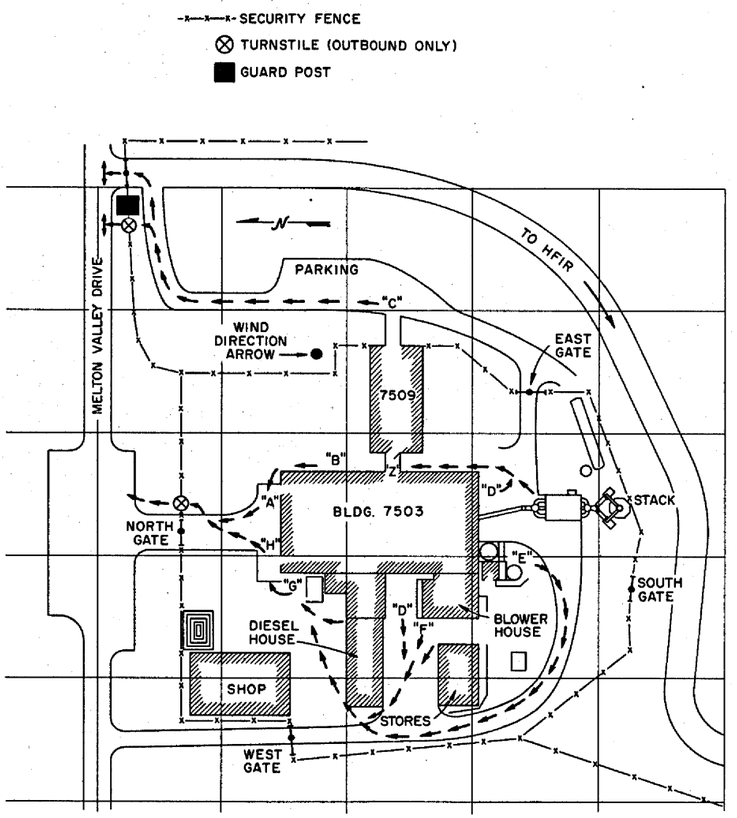
****Range switching is provided. These also indicate as well as annunciate at the ORNL Central Waste Monitoring Facility (Building 3105).

Table B-1 Instrumentation
(continued)

Read-Out Instrument			Primary Element		Annunciator*		
No.	Location	Range	No.	Variable Monitored	No.	Switch No.	Setpoint
RI-7001	Hi Bay	0-5000 cpm	RM-7001	Hi Bay Constant Air Monitor	XA-SD-7	RS-7001	4000 cpm
RI-7012	Hi Bay	0-25 mR/hr	RM-7012	Hi Bay Monitron	XA-SD-7	RS-7012	25 mR/hr
TR-SD-1-1	ACR	0-1000°F	TE-FD1-19A	FD-1 temp. -- Probe			
TR-SD-1-2	ACR	0-1000°F	TE-FD1-5	FD-1 temp. -- Bottom			
TR-SD-1-3	ACR	0-1000°F	TE-FD1-15	FD-1 temp. -- Lower side			
TR-SD-1-4	ACR	0-1000°F	TE-FD2-19A	FD-2 temp. -- Probe			
TR-SD-1-5	ACR	0-1000°F	TE-FD2-5	FD-2 temp. -- Bottom			
TR-SD-1-6	ACR	0-1000°F	TE-FD2-15	FD-2 temp. -- Lower side			
TR-SD-1-7	ACR	0-1000°F	TE-FFT-4	FFT temp. -- Bottom			
TR-SD-1-8	ACR	0-1000°F	TE-FFT-11	FFT temp. -- Lower Side			
TR-SD-1-9	ACR	0-1000°F	TE-FFT-7	FFT temp. -- Mid Side			
TR-SD-1-10	ACR	0-1000°F	TE-DTC-6	DTC temp. -- SE			
TR-SD-1-11	ACR	0-1000°F	TE-RC-1	RC temp. -- SW			

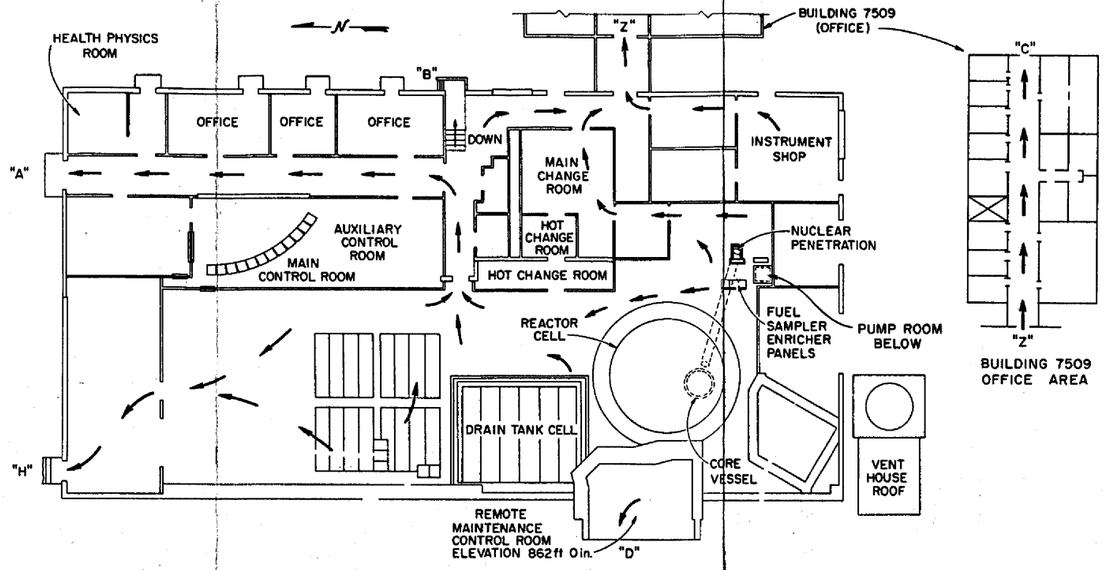
*All annunciators repeat at ORNL Central Waste Monitoring Facility (Building 3105).

****Range switching is provided. These also indicate as well as annunciate at the ORNL Central Waste Monitoring Facility (Building 3105).

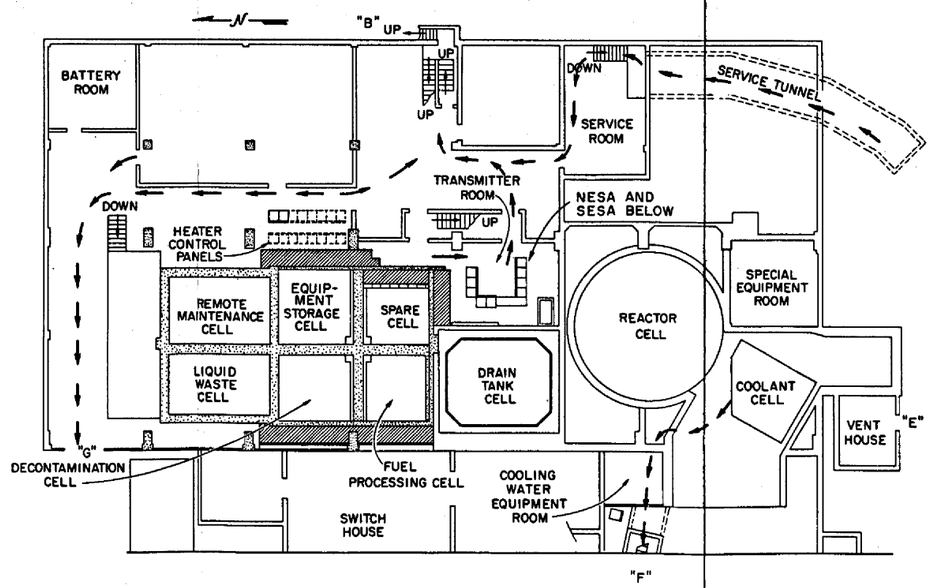


PLOT PLAN — MSRE AREA

ORNL-DWG 71-995



BLDG. 7503 — 852-ft LEVEL



BLDG. 7503 — 840-ft LEVEL

Fig. B-2. Emergency Evacuation Routes

Table B-2

EQUIPMENT AND LOCATION ABBREVIATIONS

AB	Auxiliary Board	MB	Main Board
ACB	Auxiliary Charcoal Bed	MCR	Main Control Room
ACR	Auxiliary Control Room	NESA	North Electric Service Area
BH	Blower House	PR	Pump Room
CB	Charcoal Bed (main)	PRS	Pump Room Sump
CC	Coolant Cell	RC	Reactor Cell
CDC	Coolant Drain Cell	RMC	Remote Maintenance Practice Cell
CDT	Coolant Drain Tank	SC	Equipment Storage Cell
CT	Cooling Tower	S1	Stack
DC	Decontamination Cell	SESA	South Electric Service Area
DH	Diesel House	SER	Special Equipment Room
DTC	Drain Tank Cell	SF	Stack Fan
FD	Fuel Drain Tank	SFA	Stack Filter (fan) Area
FFT	Fuel Flush Tank	SH	Switch House
FSC	Fuel Storage Cell	ST	Service Tunnel
FST	Fuel Storage Tank	TC	Spare Cell
HB	High Bay	TR	Transmitter Room
HCP	Heater Control Panel	VH	Vent House
		WR	Water Room
		WT	Liquid Waste Tank
		WTC	Waste Tank Cell

stored in FFT. The salt is at ambient temperature and pressure with all heaters turned off. The salt fill lines (104, 105, and 106) have been severed and are blanked in the drain tank cell. Salt is frozen in the transfer freeze valves (107, 108, and 109). The equalizer line (521) between the tanks and the fuel circulating system has been blanked in the drain cell. The helium supply lines (572, 574, 576) are capped. The vent valves (HCV-573, -575, -577, and -533) are open (since they are fail-open valves) but HV's-542, -522A, -522B, -538B, -571B, and -561 in the vent house are closed. Thus there normally is no purge or vent from the tanks. The drain tanks and the flush tank gas spaces are interconnected through the vent valves and the equalizer valves (HCV-544, -545, -546). The pressure in the tank system is indicated and annunciated by PIA-572 in the auxiliary control room. The drain tank and other temperatures can be read on TR-SD-1.

The fuel circulating system contains only residual amounts of flush salt. The system was opened at the reactor, fuel pump, heat exchanger, and line 103. These openings were sealed in various ways and were shown not to leak excessively at 5 psig. Since some of the heat exchanger tubes were cut out, the main coolant salt lines (200 and 201) communicate with the fuel system and were therefore welded shut just outside the reactor cell. The system is at ambient temperature and pressure. The helium supply lines (516, 592, 593, 596, 589, 599, and 600) are capped. The main vent line (522) is closed by HV-522A and the upper offgas line (524) is capped in the Special Equipment Room. The pressure is indicated and annunciated by PIA-589 in the Auxiliary Control Room.

The coolant salt (3,575 lbs) is in the coolant drain tank, at ambient temperature and pressure. Freeze valves 204 and 206 are frozen to separate it from the coolant circulating system. The helium supply valve (HV-511B) is closed and the vent line is blanked off to isolate the tank.

The coolant circulating system contains only residual amounts of coolant salt. It has been opened in several places and is lightly sealed (masking tape). There are no helium inputs to the system or vents from it.

The main charcoal beds are isolated by valves 522B and 557B. The auxiliary charcoal bed is isolated by valves 561 and 562A.

The reactor and drain tank cell membranes are sealed and the blocks are secured. The ventilation valves (930B and 955B) are closed and locked. The cells are vented to the stack through line 565. (HCV-565 is kept open by pressure from a cylinder of nitrogen.) Activity in the line is monitored by RIA-565 B and C. High activity indication on either detector will close HCV-565 and annunciate in the auxiliary control room. All other lines and penetrations into the cells are mechanically sealed.

Stack fan SF-1 is in service and SF-2 is in standby (damper 925 open and 926 closed). All three stack filters are in service. Most of the building ventilation flow is from the high bay with smaller amounts from other areas including the chemical processing cell. (The relative distribution is not critical.) The stack flow is indicated by FI-S1 at the stack. The pressure at the inlet to the filters is indicated and annunciated by PIA-927A. The α, β-γ, and iodine activities in the stack are indicated and annunciated in the auxiliary control room and at the ORNL Central Waste Monitoring Facility (CWMF).

All water lines to the reactor and drain tank cells have been disconnected. The water levels in all cell sumps can be checked using the bubbler level indicators, but no annunciation is provided. The waste tank is essentially empty and can also be checked using a bubbler level indicator. The pump-room sump, which collects water from the filter pit, french drains, etc., is automatically pumped to the drainage ditch by the sump pumps. High level in this sump is annunciated.

The fire alarm and sprinkler system is in service and maintained by the ORNL fire department.

C. SURVEILLANCE

Surveillance of the MSRE shall be adequate to prevent the development of any condition that would threaten personnel safety or the continuity of other ORNL activities.

Radioactive and fissile materials are so contained and situated that criticality is prevented and the probability of any significant release to

the environment is extremely small. The potentials for increasing temperature and pressure in the containment or the development of other potentially damaging conditions are limited so that such conditions can arise only slowly, if at all. Thus the continuous presence of personnel at the reactor site is not required. Surveillance therefore consists of scheduled visits for data-logging and checking plus the continuous monitoring at the ORNL Central Waste Monitoring Facility of key signals from the MSRE instrumentation.

Each day a member of the ORNL Central Waste Monitoring Group shall enter the reactor building to make observations as required on a Daily Log Form. During the last week of each month a qualified member of the Reactor Division shall make an inspection of the reactor building, record data, and make checks as required on a Monthly Log Form. Equipment and instrumentation shall be maintained on a regular schedule and as required by personnel of the ORNL Plant and Equipment Division and Instruments and Controls Division.

When any of a selected list of variables goes out of limits (prescribed in Table B-1) alarms occur both in the reactor building and at the ORNL Central Waste Monitoring Facility in Building 3105. When an alarm occurs, one person from the group on duty at the CWMF shall go to the MSRE site, enter the main control room and take appropriate action to restore normal conditions.

Corrective actions for foreseeable abnormal situations are prescribed in Section E of these Procedures. In addition, experienced former members of the MSRE operations staff shall be designated and available on call for assistance in meeting needs that may arise. (See Fig. K-1.)

The ORNL Plant Protection Division provides protection against entry by unauthorized personnel (see Section J) and against fire damage.

D. DATA

1. Control-Room Log

Every significant event or action affecting the reactor shall be recorded in a journal-type logbook that is kept in the control room. Some items which shall be included in this log are:

Equipment started or stopped.

Valves opened or closed.

Switches or breakers opened or closed.

Procedures or parts of procedures started, worked on, or completed.

Changes in setpoints of switches.

Annunciations, and action taken.

Abnormal conditions or malfunctioning equipment found.

Maintenance and other non-operational jobs done.

The person who makes an observation, or takes action, or is in charge of any job shall be responsible for seeing that an entry is made. Log entries shall be sufficiently descriptive for others to understand and each shall include time, date, and the name of the person making the entry.

Carbon copies of the logbook sheets will be removed when the monthly log is taken and will be stored in a file cabinet in Room 17, Building 7509.

2. Periodic Logs

The Daily Log includes recording various readings as indicated on Form D-1. This form prescribes "Log Limits" and identifies the appropriate corrective action if a variable is outside these limits. (Corrective actions, identified on Form D-1 by a letter, are detailed in Section E of these Procedures.)

The Monthly Log, which shall be filled out during the monthly inspection, is Form D-2. This form requires reading the salt tank temperatures, the waste tank level and 7 sump levels. It also has spaces for indicating that other routine monthly tasks have been done.

Form D-1

DAILY LOG — PHASE III

Location		ACR	ACR	ACR	ACR	ACR	ACR
Description		FD-1 Temp	FD-2 Temp	FFT TEmp	DTC Temp	RC Temp	RC Press.
Primary Element		TE-FD-1-19A	TE-FD-2-19A	TE-FFT-4	TE-DEC-6	TE-RC-5	PT-RC-A
Readout		TR-SD-1-1	TR-SD-1-4	TR-SD-1-7	TR-SD-1-10	TR-SD-1-11	PI-RC-A
Alarm Limits		no alarm	no alarm	no alarm	no alarm	no alarm	± 1 psig
Log Limits		<200°F	<200°F	<200°F	<150°F	<150°F	-2 to +0.5
What to do if* Out of Limits		A	B	C	D	E	F
Init.	Date/Time	Reading °F	°F	°F	°F	°F	psig

*See Section E.

Form D-1

DAILY LOG — PHASE III

Location		ACR	ACR	ACR		ACR			
Description		FD-2 Press	FP Press	RC Activity		Stack Activity			
Primary Element		PT-572B	PT-589A	RM-565B	RM-565C	β-γ	α	I_2	
Readout		PI-572B	PI-589A	RI-565B	TI-565C	SI-1A	SI-1B	SI-1C	
Alarm Limits		↑2 psig	↑0.5 psig	↑20 mR/hr	↑20 mR/hr	<6000*	<6000*	<6000*	
Log Limits		<1.5 psig	<0.5 psig	<10 mR/hr	<10 mR/hr	<1500	<1500	<1500	
What to do if** Out of Limits		G	H	I	I	J	J	J	
Init.	Date/Time	Reading							
		psig	psig	mR/hr	mR/hr	cpm	cpm	cpm	

*Setpoint is adjustable and will normally be set lower than 6000 cpm.

**See Section E.

Form D-1

DAILY LOG — PHASE III

Location		Stack Panel	Stack Panel	VH	VH	HB	HB
Description		Vacuum	Flow	N_2 Cyl.	N_2 Header	CAM	Monitron
Primary Element		PE-927A	FE-S1	PE-Cyl.	PE-Hdr	RE-7001	RE-7012
Readout		PI-927A	FI-S1	PI-Cyl.	PI-Hdr	RI-7001	RI-7012
Alarm Limits		↑-1.0 in. H_2O	No Alarm	---	---	4000 cpm	25 mR/hr
Log Limits=		<-1.5 in. H_2O	>0.4 in. H_2O	>200 psig	30-50 psig	<4000 cpm	<25 mR/hr
What to do if* Out of Limits		K	K	Replace	Adjust	L	L
Init.	Date/Time	Reading					
		In. H_2O	In. H_2O	psig	psig	cpm	mR/hr

*See Section E.

Form D-2

MONTHLY LOG

(To be taken during the last week of each month)

NOTE: NOTIFY WASTE MONITORING GROUP BEFORE STARTING

Item	Limits	What to do if out of Limits	Jan or July	Feb or Aug	Mar or Sept	April or Oct	May or Nov	June or Dec
Date Log was Taken	--	--						
Initial	--	--						
Review Daily Logs	--	--						
Review Console Log	--	--						
Record TR-SD-1 Temps	--	--	--	--	--	--	--	--
1 - TE-FD1-19A	<200°F	A						
2 - TE-FD1-5	"	A						
3 - TE-FD1-15	"	A						
4 - TE-FD2-19A	"	B						
5 - TE-FD2-5	"	B						
6 - TE-FD2-15	"	B						
7 - TE-FFT-4	"	C						
8 - TE-FFT-11	"	C						
9 - TE-FFT-7	"	C						
10 - TE-DTC-6	<150°F	D						
11 - TE-RC-1	"	E						

Form D-2

MONTHLY LOG

Item	Limits	What to do if out of Limits	Jan or July	Feb or Aug	Mar or Sept	April or Oct	May or Nov	June or Dec
Date Log was Taken	--	--						
Initial	--	--						
Check that HCV-565 is open	--	F						
Record Sump Levels	--	--	--	--	--	--	--	--
Set N_2 Supply at 20 psig	--	--						
WT Level	<100"	M						
RC-C Sump Level	< 15"	N						
DTC-A1 Sump Level	"	O						
DC-C Sump Level	"	P						
FSC-A Sump Level	"	Q						
TC-A Sump Level	"	Q						
SC-A Sump Level	"	Q						
WTC-A Sump Level	"	Q						
Turn off N_2 Cylinder	"	"						
File Data	--	--						
Review Stack Release Reports	--	--	x		x	x	x	x
Write 6-month report	--	--	x		x	x	x	x
Run Annual Tests	--	--	x	x	x	x		x

Form D-2

MONTHLY LOG

Tour the building. Inspect each of the following areas for hazards or malfunctioning items or abnormal radiation. Punch-list any repairs which are needed. Take cutie pie or chirper on tour.*

Location	Jan or July	Feb or Aug	Mar or Sept	April or Oct	May or Nov	June or Dec
Control Room						
7503 Offices						
7509 Offices						
Instrument Shop						
Change Room						
High Bay						
High Bay North						
N.E. of 7503 (underground water leaks)						
Steam Supply Line						
Air Intake Filters and Heaters						
Shop						
Diesel House						
Switch House						
Remote Maintenance Control Room	x	x	x	x		x
Water Room						
Blower House						
CDT Cell						
Special Equipment Room	x	x	x	x		x
Cooling Tower						
South Electric Service Area	x	x	x	x		x
Vent House						
Stack Area						
High Bay South						
Sump Room	x	x	x	x		x
840 Level						
Transmitter Room						
North Electric Service Area						
Service Tunnel						

*Notify key holders of abnormal radiation or contamination areas. (See Section J.)

E. ABNORMAL CONDITIONS

Whenever the log limits are exceeded or an annunciation occurs, corrective action is necessary. To plan in advance for all possible trouble is impractical. An attempt has been made to anticipate some of the more probable difficulties and suggest remedial actions. "What to do if out of limits" columns have been included in the logs (Forms D-1 and D-2) and in the list of annunciators (Table E-1). Letters in these columns refer to the suggested action given in Table E-2. Power outages are covered in Section F.

Table E-1

ANNUNCIATION

Annunciator No.	Switch No.	Cause of Annunciation	What to Do If Out of Limits *
XA-SD-1	PS-572	High FD-2 Pressure	G
XA-SD-2	PS-589	High FP Pressure	H
XA-SD-3	PS-927	Low Ventilation Suction	K
XA-SD-4	PS-RC-1	High RC Pressure	F
XA-SD-5	RS-S1-A	Hi Stack Activity (β-γ)	J
	RS-S1-B	Hi Stack Activity (α)	J
	RS-S1-C	Hi Stack Activity (Iodine)	J
XA-SD-6	RS-565B	Hi RC Air Activity	I
	RS-565C	Hi RC Air Activity	I
XA-SD-7	RS-7001	Hi Air Activity	L
	RS-7012	Hi Radiation	L
XA-SD-8	LS-PRS	Hi Pump Room Sump Level	R

*See Table E-2.

NOTE: Loss of electrical power will also annunciate at the ORNL Central Waste Monitoring Facility (Building 3105).

Table E-2

ABNORMAL CONDITIONS

Code	Variable Out of Limits	Corrective Action
A	FD-1 Temp	If TE-FD1-19A (TR-SD-1-1) indicates greater than 200°F, other FD-1 temperatures should be checked (TR-SD-1-2 & 3). If these are less than 200°F, notify the MSRE Supervisor on the next regular work day. If all three temperatures are greater than 200°F, notify him as soon as possible and check that all heaters are off. If TR-SD-1 fails, read the temperatures with a portable instrument and have TR-SD-1 repaired on the next regular work day.
B	FD-2 Temp	If TE-FD2-19A (TR-SD-1-4) indicates greater than 200°F, other FD-2 temperatures should be checked (TR-SD-1-5 & 6). If these are less than 200°F, notify the MSRE Supervisor on the next regular work day. If all three temperatures are greater than 200°F, notify him as soon as possible and check that all heaters are off. If TR-SD-1 fails, read the temperatures with a portable instrument and have TR-SD-1 repaired on the next regular work day.
C	FFT Temp	If TE-FFT-4 (TR-SD-1-7) indicates greater than 200°F, other flush tank temperatures should be checked (TR-SD-1-8 & 9). If these are less than 200°F, notify the MSRE Supervisor on the next regular work day. If all three temperatures are greater than 200°F, notify him as soon as possible and check that all heaters are off. If TR-SD-1 fails, read the temperatures with a portable instrument and have TR-SD-1 repaired on the next regular work day.
D	DTC Temp	If TE-DTC-6, (TR-SD-1-10), indicates greater than 150°F, other drain tank cell temperatures should be checked (Patch panel 208 to 212). If these are less than 150°F, notify the MSRE Supervisor on the next regular work day. If they are greater than 150°F, notify

Table E-2

ABNORMAL CONDITIONS
(continued)

Code	Variable Out of Limits	Corrective Action
D (con't)		him as soon as possible and check that all in-cell heaters are turned off. If TR-SD-1 fails, read the temperatures with a portable instrument and have TR-SD-1 repaired on the next regular work day.
E	RC Temp	If TE-RC-1 (TR-SD-1-11) indicates greater then 150°F, other reactor cell temperatures should be checked. (Patch panel 82 to 90.) If these are less than 150°F, notify the MSRE supervisor on the next regular work day. If they are greater than 150°F, notify him as soon as possible and check that all in-cell heaters are turned off. If TR-SD-1 fails, read the temperatures with a portable instrument and have TR-SD-1 repaired on the next regular work day.
F	RC Press.	If PI-RC-A indicates greater than 0.5 psig or less than -2 psig or if XA-SD-4 annunciates, check in the vent house that HCV-565 and V-565A, C, and D are open. If not, push reset buttons on RE-565 B & C in the control room and open the hand valves. If the pressure is still out of limits and cell air activity is normal, vent the cell by opening V-955 A and B in the service tunnel. After about 30 minutes, close V-955 A and B. Notify the MSRE Supervisor on the next regular work day. If PI-RC-A or XA-SD-4 fails, have it repaired on the next regular work day. If both fail, notify the MSRE Supervisor as soon as possible.
G	FD-2 Press.	If PI-572B reaches 2 psig or XA-SD-1 annunciates, vent the drain tanks to the stack by opening V-561 and V-562A in the vent house. When the pressure is 0 to 1 psig, close V-561 and V-562A. Notify the MSRE Supervisor on the next regular work day. If the pressure reaches 5 psig, notify the MSRE Supervisor as soon as possible. If PI-572B or XA-SD-1 fails, have it repaired on the next regular work day. If both fail, notify the MSRE Supervisor as soon as possible.

Table E-2

ABNORMAL CONDITIONS
(continued)

Code	Variable Out of Limits	Corrective Action
H	FP Press.	If PI-589A reaches 0.5 psig or if XA-SD-2 annunciates, vent the fuel system to the stack by opening V-522A, V-561, and V-562A in the vent house. When the pressure is 0 to 0.1 psig, close V-522A, V-561, and V-562A. Notify the MSRE Supervisor on the next regular work day. If the pressure reaches 5 psig, notify the MSRE Supervisor as soon as possible. If PI-589A or XA-SD-2 fail, have them repaired on the next regular work day.
I	RC Activity	If RI-565B or C reach 20 mR/hr or if XA-SD-5 annunciates, (or if the instruments fail) close V-565C in the vent house and notify the MSRE Supervisor on the next regular work day.
J	Stack Activity	If RI-S1-A, B, or C in the auxiliary control room indicate abnormal stack activity, i.e. >1500 c/m, notify the MSRE Supervisor on the next regular work day. If any exceed 6000 c/m, notify him as soon as possible. If any instrument should fail, repairs should be made as soon as possible.
K	Ventilation	If FI-S1 is less than 0.4 in. H_2O (~ 15,000 cfm) or if PI-927A is less than 1.0 in. H_2O vacuum, or if PI-927A annunciates on XA-SD-3, check that one stack fan is operating properly and there is a good flow of air into duct 935 in the southeast corner of the high bay. If ventilation is adequate, notify the MSRE Supervisor on the next regular work day. If neither stack fan is in operation, or if ventilation flow is low, start the alternate stack fan as follows: Stop both stack fans from the control room. Open the discharge damper on the stack fan to be operated (Damper 925 for SF #1 - west and damper 926 for SF #2 - east). Close the discharge damper

Table E-2

ABNORMAL CONDITIONS
(continued)

Code	Variable Out of Limits	Corrective Action
K (continued)		(926 or 925) on the other stack fan. Start the desired stack fan. (It may be necessary to energize the proper breaker in the switch house. This is G3-24 for SF #1 and G4-34 for SF #2. Notify the MSRE Supervisor on the next regular work day. If the above does not correct the difficulty, notify the MSRE Supervisor as soon as possible. If any of the instruments fail to function, have them repaired on the next regular work day.
L	Personnel Monitors	If RI-7001 indicates high air activity (>4000 cpm) or if RI-7012 indicates high radiation (>25 mR/hr.), have Health Physics survey the area. If abnormal conditions are found, notify the MSRE Supervisor as soon as possible. If instrument failure occurs, repairs should be made as soon as possible. Notify the MSRE Supervisor on the next regular work day.
M	WT Level	If WT level is greater than 100 inches, transfer the contents to the Melton Valley Waste Station as follows: Call ORNL Waste Station (Telephone 3-6234) and report volume to be pumped. When permission to transfer is obtained, remove blocks and set valves as follows in the Remote Maintenance Practice Cell: Open V-300. Close V-301, V-302, V-303B, V-305A, V-305B, and V-307. Start the waste pumps. (It may be necessary to energize breaker G4-4 in the switch house.) Throttle V-305A to give flow acceptable at Melton Valley Waste Station. PI-305 should not exceed 35 psig. When desired amount has been transferred, stop pump. Close V-300 and 305A and replace blocks on remote maintenance practice cell. Record waste tank levels in the console log (before and after transfer).

Table E-2

ABNORMAL CONDITIONS
(continued)

Code	Variable Out of Limits	Corrective Action
N	RC Sump	If LI-RC-C indicates a level greater than 15 inches in the reactor cell sump, jet the water to the waste tank as follows: Record LI-RC-C and waste tank level in the console log. Connect steam to line 332 on the west side of the building. Connect instrument air or nitrogen to the valve operators of FCV-333A1 and A2 and open them. Open the steam supply to line 332 and jet the sump. When complete, remove steam supply and cap line 332. Remove air or N_2 supply to FCV-333A1 and A2. Record LI-RC-C and waste tank level in the console log.
O	DTC Sump	If LI-DTC-A1 indicates a level greater than 15 in. in the drain tank cell sump, jet the water to the waste tank as follows: Record LI-DTC-A1 and waste tank level in the console log. Connect steam to line 342 on the west side of the building. Connect instrument air or nitrogen to the valve operator of FCV-343A1 and A2 and open them. Open the steam supply to line 342 and jet the sump. When complete, remove steam supply and cap line 342. Remove air or N_2 supply to FCV-343A1 and A2. Record LI-DTC-A1 and waste tank level in the console log.
P	DC Sump	If the level in the decontamination cell exceeds 15 in., pump it to the waste tank as follows: Record the sump level and the waste tank level in the console log. Remove the blocks from the remote maintenance practice cell. Close V-300, V-302, V-307, and 303A. Open V-303B and V-301. Start waste pump from RMPC and pump DC to WT. Stop pump and close V-303B and V-301. Record DC sump level, LI-DC and waste tank level in the console log.

Table E-2

ABNORMAL CONDITIONS
(continued)

<table>
<tr><th>Code</th><th>Variable Out of Limits</th><th>Corrective Action</th></tr>
<tr><td>Q</td><td>Aux. Sumps</td><td>If the level in any of the auxiliary cell sumps exceeds 15 in., jet the water to the waste tank as follows: Record the sump level and the waste tank level (LI-WT) in the console log. Open proper jet supply valves (these are located in the NE corner of the transmitter room).
<table>
<tr><th>Cell</th><th>Level Element</th><th>Jet Supply Valves</th></tr>
<tr><td>Fuel Storage</td><td>LE-FSC</td><td>V-321, V-311B</td></tr>
<tr><td>Equipment Storage</td><td>LE-SC</td><td>V-317, V-311B</td></tr>
<tr><td>Waste Tank</td><td>LE-WTC</td><td>V-315A, V-315B</td></tr>
<tr><td>Spare</td><td>LE-TC</td><td>V-319, V-311B</td></tr>
<tr><td>Remote Maintenance Practice</td><td>None</td><td>V-315A, V-323</td></tr>
</table>
When jetting is complete, close the valves and record the sump level and the waste tank level in the console log.</td></tr>
<tr><td>R</td><td>PRS Level</td><td>If the pump room sump level annunciates, check the pump room to see if it is flooded. (Entrance is in the SE corner of the high bay.) Do not enter without the exhaust fan in operation and another person on hand for emergency. If possible, check the float switches of both sump pumps. If the sump cannot be emptied with the pumps, try jetting the coolant drain cell sump (which connects with the pump room) using steam through lines 309 and 310.</td></tr>
</table>

F. POWER OUTAGES

A power outage at the MSRE should not cause much difficulty and should not be hazardous. An alarm will occur at the ORNL Control Waste Monitoring Facility unless they also lose power; in that case no alarm will occur until their power trouble is corrected.

When power is available, a stack fan should be started. HCV-565 should be opened by pushing the reset buttons on RE-565 B and C, and the high-bay CAM and monitron should be checked. A log should be taken to assure that everything is within limits and that nothing appears abnormal in the area. Check that there is no water in the pump room (observe from 852 level). Freeze protection should be considered in the winter. The MSRE supervisor should be notified on the next regular work day.

G. ANNUAL TASKS

The fuel and flush salt in the drain tanks will be heated once a year to recombine fluorine. An annual check will be made to determine that all valving and electrical switches are in the proper position, that standby equipment will operate if needed and that the annunciator and control switches have the proper setpoints. The following check lists are used to accomplish this.

		Init.	Date/Time
1.	**Recombine Fluorine by Heating the Drain Tank**		
1.1	Close switches 1 - 7 in Panel FD-1-1, switches 1 - 6 and 11 in Panel FD-2-1, and switches 1 - 6 and 11 in Panel FFT-1 (North end of 849 level) and energize Breaker G5-BB.	____	____
1.2	Push FD-1-1, FD-2-1, and FFT-1 "ON" buttons and raise or lower settings to get approximately 9 amps on the heaters (HCP-8).	____	____
1.3	Open and leave V-561 and 562A open to vent the drain tanks.	____	____
1.4	Record temperatures daily in Table G-1 until the salt has been above 300°F for at least one week (do not exceed 500°F).	____	____
1.5	Turn heaters off and open switches 1 - 7 in Panel FD-1-1, switches 1 - 6 and 11 in Panel FD-2-1, and switches 1 - 6 and 11 in Panel FFT-1 and rack out Breaker G-5-BB.	____	____
1.6	Close V-561 and V-562A.	____	____
1.7	Record temperatures daily in Table G-1 until temperatures are less than 250°F.	____	____

NOTE: Add helium as necessary through V-518A to keep FD-1 pressure between 0 and 2 psig. (See G-3 for valving.)

Table G-1

Temperature Readings

TR-SD-1 Pt. No.		1	2	3	4	5	6	7	8	9
TE No.		FD-1-19A	FD-1-5	FD-1-15	FD-2-19A	FD-2-5	FD-2-15	FFT-4	FFT-11	FFT-7
Init.	Date/Time									

	Init.	Date/Time

2. Pressure Test of the Reactor and Drain Tank Cells

2.1 Connect the reference side of the hook gage in the transmitter room to the in-cell reference volume. (Penetration A-27 in the NESA.) Open the hook gage equalizer valve. ____ ____

2.2 Connect the other side of the hook gage to the drain tank cell (Penetration A-5 in the NESA). ____ ____

2.3 Close HCV-565 using handswitch in the control room. ____ ____

2.4 Connect a portable diesel air compressor to line 342 at the west side of the building (840 level). ____ ____

2.5 Pressurize the cell through line 342 to approximately 6 psig* per PI-RC-A in the control room. As the cell is pressurized, note the pressure at which PS-RC-1 annunciates on XA-SD-4. _____ psig. If the alarm does not occur between 0.5 and 1.5, the switch should be reset. Record final setting _____ psig. ____ ____

2.6 Disconnect the compressor from line 342, cap the line and soap check. ____ ____

2.7 Close the hook gage equalizer valve. Record and plot the hook gage reading and PI-RC-A once per shift until the leak rate is established (minimum of 48 hrs). Acceptable leak rate is 400 scfd at 5 psig. Use the following formula for calculating the leak rate.

$$L = 1000 \frac{\Delta P}{t}$$

where L = leak rate in standard cu ft per day
ΔP = change in pressure during test in inches of water (from the hook gage)
t = duration of the test in hours.

____ ____

2.8 When the test is complete, open the hook gage equalizer valve. ____ ____

*Do not exceed 10 psig.

		Init.	Date/Time
2.9	Open HCV-565 and vent the cells to atmospheric pressure.	____	____
2.10	Disconnect the hook gage and cap the lines at penetrations A-5 and A-27 in the NESA.	____	____

3. FD-2 and FP Pressure

(To be done after drain tank temperatures have cooled below 250°F following the fluorine recombination.)

3.1	Connect a nitrogen cylinder with regulator to V-518G in the vent house and check that fitting does not leak.	____	____
3.2	Check that the auxiliary charcoal bed inlet valve 561 is closed and V-522B is closed.	____	____
3.3	Open V-522A, and V-518A, B1, C1, F, and G and pressurize systems until PS-589 annunciates on XA-SD-2 _____ psig. (Do not exceed ~ 0.6 psig on PI-592B.) Adjust setpoint if necessary to 0.4 to 0.6 psig. Record final setting _____ psig.	____	____
3.4	Close V-522A and pressurize drain tanks until PS-572 annunciates on XA-SD-1 _____ psig. (Do not exceed 2.5 psig on PI-572B.) Reset PS-572 to 1.5 to 2.5 psig if necessary. Record final setting _____ psig.	____	____
3.5	Close V-518A, B1, C1, F, and G and remove nitrogen cylinder and cap line at 518G.	____	____
3.6	Open V-561 and V-562A and vent DT's to atmospheric pressure.	____	____
3.7	Then open V-522A and vent FP to atmospheric pressure.	____	____
3.8	Close V-522A, V-561, and V-562A.	____	____

4. Ventilation System

4.1	Record FI-SI _____ in. H_2O (should be greater than .5 in. H_2O), PI-927A _____ in. H_2O (suction should be more than 1.5 in. of water). Record which stack fan is in service _____.	____	____

		Init.	Date/Time
4.2	Stop both stack fans and note pressure at which PS-927A annunciates on XA-SD-3 _____ in. H_2O. If necessary, reset PS-927A to -0.9 to -1.1 in. of water as indicated on PI-927A. Record final setting _____ in. H_2O.	____	_____
4.3	Manually switch dampers to operate alternate stack fan. Damper 925 should be open to operate SF-1 West. Damper 926 should be open to operate SF-2 East.	____	_____
4.4	Start other stack fan and record FI-S1 ____ in. H_2O (should be greater than .5 in. H_2O) and PI-927A _____ in. H_2O (suction should be greater than -1.5 in. water). Record which stack fan is in service ___.	____	_____

NOTE: It may be necessary to energize the proper breaker in the switch house. This is G3-24 for SF #1 and G4-34 for SF #2.

4.5	Set up for and put SF-1 in service. Open breaker G4-34.	____	_____

5. RC Air Activity

5.1	Check that alarm settings on RS-565B and C are 20 mR/hr by pressing the alarm buttons. Adjust if necessary. Adjust calibrate to 0.3 mR/hr.	____	_____
5.2	Have a Health Physicist insert a source in lead shielding around RE-565B in the vent house and note that XA-SD-5 annunciates and that HCV-565 closes. (Observe valve located below the grating in the north side of the vent house.)	____	_____
5.3	Remove source, reset RS-565B in ACR and note that HCV-565 opens and XA-SD-5 clears.	____	_____
5.4	Have a Health Physicist insert a source near RE-565C and note that XA-SD-5 annunciates and that HCV-565 closes.	____	_____
5.5	Remove source, reset RM-565C in ACR and note that HCV-565 opens and XA-SD-5 clears.	____	_____

6. Sump Pumps

Two people are required for the following. Be sure to turn on the blower and allow to run for about 5 minutes before entering the pump room.

		Init.	Date/Time
6.1	Add water to the pump room sump. When sump pump "A" starts, physically hold the float switch on sump pump "A" down.	____	____
6.2	Note that sump pump "B" starts and LS-PRS annunciates on XA-SD-8 (before the floor is flooded), stop adding water.	____	____
6.3	Release both pump float switches and note that annunciation clears and both pumps stop when sump level is normal.	____	____

7. Miscellaneous

The following miscellaneous checks should be completed annually.

7.1	Check that equipment valves, switches, etc., are as indicated in Table G-2.	____	____
7.2	Check results of annual DOP test of stack filters.	____	____
7.3	Review results of monthly stack monitor checks.	____	____
7.4	Review results of monthly personnel radiation monitor checks.	____	____
7.5	Review list of programmed maintenance being done and results of previous year's maintenance work.	____	____

Table G-2

Miscellaneous Equipment Check

Location	What to Check	Required Condition	Check when Complete
SE	V-542	Tagged Closed	
HB	935 filter	Clean	
ST	HCV-930A	Closed	
ST	HCV-930B	Locked Closed	
ST	V-930C	Closed	
ST	V-955A	Closed	
ST	V-955B	Locked Closed	
ST	V-955C	Closed	
TR	V-514C	Tagged Closed	
TR	All LKD Valves	Closed	
Near TR	Dist. Panel 1A-5	Tagged closed	
SH	G3-3	Tagged Closed	
SH	G3-24	Tagged Closed	
SH	G4-34	Tagged Open	

Table G-2

Miscellaneous Equipment Check
(continued)

Location	What to Check	Required Condition	Check when Complete
CDT Cell	V-511B	Tagged Closed	
VH	V-518 A, E, & G	Tagged Closed	
VH	V-518G	Capped	
VH	V-522 A & B	Tagged Closed	
VH	V-537	Tagged Closed	
VH	V-538 A & B	Tagged Closed	
VH	V-571B	Tagged Closed	
VH	HCV-565	Open	
VH	V-565 A, B, & C	Tagged Open	
VH	V-557B	Closed	
VH-	V-562A	Closed	
VH	V-562C	Open	
VH	V-561	Tagged Closed	
Stack	Damper 925	Open	
Stack	Damper 926	Closed	
Stack	SF-1 (West)	Running	
Stack	SF-2 (East)	Not Running	

H. MAINTENANCE AND REPAIRS

Operating equipment which fails should be repaired as soon as possible. The urgency depends upon the consequences. Table E-2 lists most of the possible process repairs and delineates the importance of each.

Repairs will be done only with the approval of the ORNL Central Waste Monitoring Group, the MSRE Maintenance Supervisor, or the MSRE Supervisor (or his representative). The person initiating the request for repairs will be responsible for the safety of personnel and the facility.

During regular working hours a Punch List form (FORM H-1) will be filled out and given to the Maintenance Supervisor (Fig. K-1) who will expedite the repairs. Any deviation from the punch list should be approved by the requestor. When the work is complete, the punch list will be returned to the Maintenance Supervisor who will be responsible for entering all details in the console log and filing the completed punch list in Room 17, Building 7509.

On other shifts, the ORNL shift supervisor shall arrange to have the repairs made and shall be responsible for getting the details recorded in the console log.

Most of the programmed maintenance will be done during the last week of each month when the monthly log is being taken. Permission must be obtained from the Maintenance Supervisor, the MSRE Supervisor, or his representative before doing these.

No modification will be made to the facility without the approval of the MSRE Supervisor or his supervisors.

I. REMOVAL OF EQUIPMENT OR INSTRUMENTATION

Equipment and instrumentation needed for the interim storage of the fuel or for the future transfer or processing of the fuel will be retained intact. Other things may be removed if needed after obtaining the approval of the MSRE Surplus Property Custodian, the MSRE Supervisor, or Assistant MSRE Supervisor. All ORNL procedures will be strictly adhered to (see ORNL-SPP-37). In addition an MSRE Property Transfer Form I-1, and Punch

Form H-1. MSRE PUNCH LIST

To Priority Date

Location Requested by:

Equipment, Line No., etc.

Description of Work to be Done:

Precautions:

Estimated Cost:

Approval to proceed:

Describe work done if different from above:

Job Completed and Accepted by: Date:

Form I-1. MSRE SURPLUS EQUIPMENT TRANSFER

Item: _____ Tag No. _____

Quantity and Units: _____

Brief Description: _____

_____

_____

Location at MSRE: _____

Property No.: X- _____

Requested by: _____ Date: _____

For use in: ☐ MSRP; ☐ Other (specify) _____

Charge removal costs to: _____

When needed: _____

Transfer approved by: _____ Date: _____

Item received by: _____ Date: _____

List, Form H-1, will be filled out for each item or group of items removed. A file of these will be maintained in Room 17, Building 7509. If special precautions are necessary, these should be described fully on the Punch List.

J. ACCESS CONTROL

As indicated in Fig. B-2, an 8-foot lighted security fence completely encloses a compact area immediately surrounding the MSRE buildings. Two gates in the fence (North and West Gates) open onto Melton Valley Drive (a road posted as "Official Use Only"). The other two gates and the office building door are inside the controlled-access HFIR-TRU-TURF area. All four gates and the office door will normally be kept locked. On the office door and on each of the four gates is a sign of the form indicated below, where the blanks contain the names and phone numbers of (1) the MSRE Supervisor, (2) the Assistant MSRE Supervisor, (3) the MSRP Associate Director, and (4) the MSRP Director.

CONTROLLED ACCESS AREA

DO NOT ENTER WITHOUT PERMISSION

Persons Authorized to Give Permission:

_____ _____

_____ _____

_____ _____

_____ _____

Normal entrance to the MSRE Area will be through the guard gate on the HFIR Access Road, then through either the office door, the East Gate or the South Gate. Keys to the door and these two gates will be issued to a limited number of people, including the MSRP Associate Director, the MSRE Supervisor, the MSRE Surplus Property Custodian, the Assistant MSRE Supervisor, the MSRE Maintenance Supervisor, the ORNL Waste Monitoring Group, and the ORNL Shift Supervisors.

The North and West gates will have security-type locks which are controlled by the ORNL Guard Department. Only a limited number of people will be authorized to have the Guard Department open these. These will include the MSRP Associate Director, the MSRE Supervisor, the MSRE Asst. Supervisor, and the ORNL Shift Supervisors. These gates will not be left open without a guard in attendance.

There will be radiation and contamination outside of the containment cells. Where required, Radiation and Contamination Zones will be identified and protection provided as prescribed by ORNL procedures. Monthly radiation and safety surveys will be made to assure that no inadequately guarded hazards exist. Those persons having keys will be advised of any limitations on use of the area, and it will be their responsibility to so advise anyone that they admit to the area.

K. ORGANIZATION AND CHANGES

The organization chart for the MSRE during Phase III is shown in Fig. K-1. The MSRE supervisor has the prime responsibility for the area. He must approve of any changes in the procedures or modification of the facility. A master up-to-date copy of the procedures will be kept in Room 17, Building 7509. All changes will be initialed and dated. If significant modifications are needed, others in the MSRP project will be consulted.

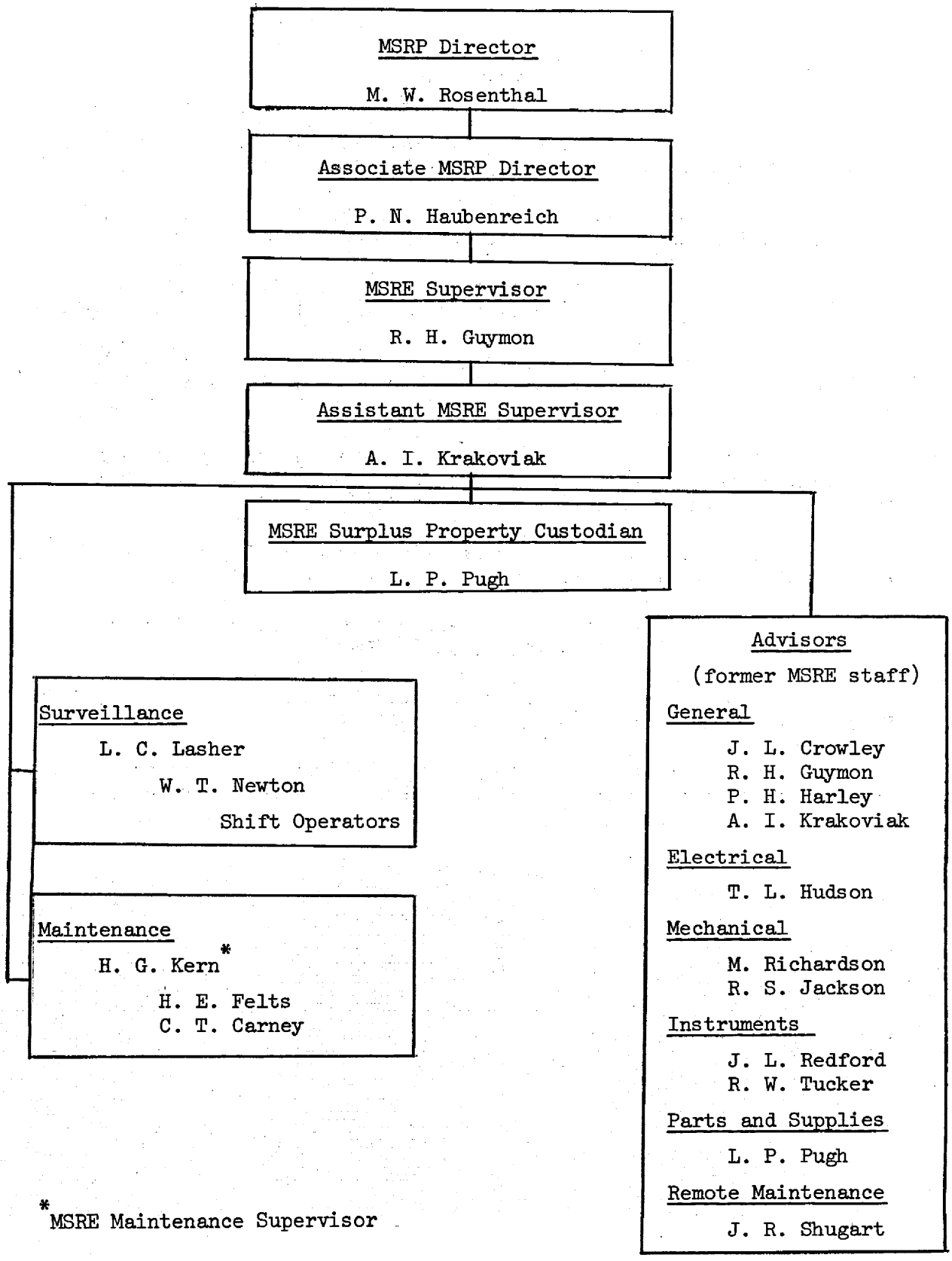


Fig. K-1. MSRE Organization Chart (January, 1971)

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Internal Distribution

1. R. G. Affel
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88-89. Central Research Library
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