



## Chapter 5

# Contingency & Recovery Plan and Final Audit

This is the last phase of Year 2000 Project. There are two Major Activities involved, The Final Audit and the Contingency & Recovery Plan. In this chapter, the activities in this chapter would prepare the organization for the Millennium Crossover in term of equipment and the resources. This would involved the Preventive and Proactive activities in case of any disaster.

The First activity is the Contingency and Recovery Plan for CSM to handle the situation when there is problem before the Problem Happens.

## Contingency & Recovery Plan

Base upon the Risk Analysis that Y2K team completed earlier, the Plan can be develop into three major areas:

1. Financial
2. Operation
3. Legal Liabilities

However, the scope of this Contingency Plan would mainly focus for the Operation. In the operation area, the preparation would need to separate into the Contingency Plan and Recovery Plan.

The Contingency Plan is the Plan that CSM would need to follow to minimize the impact of the Year 2000 problem. The Discovery Plan is the plan to handle the situation after it happened.

### ***Contingency Plan***

CSM Y2K team has develop the strategies to handle the situation that might happens during the transition. This would include the planning in term of resources and manpower. The key strategies are:

1. Plant Shutdown Before the Millennium Crossover.

2. Plant Startup after the Millennium Crossover.
3. Facilities, Tools, and Emergency Response Team Preparation.
4. Vendor Technical Support all night.
5. No Activities during the Millennium Crossover (2 hrs before & 2hrs after).
6. Process Setup Test Right after the Crossover.
7. Rehearsal of Y2K Crossover on November 9, 1999 (9/9/99)
8. Develop the Recovery Plan.

These strategies are based upon the assumption that the impact of Y2K Crossover is coming from external factors and/or some Internal equipment during crossover. There are several areas that need to focus in order to ensure the transition is smooth. These three areas are :

1. Facilities.
2. Production
3. Support Systems.

However, before the Y2K need to develop the detail plan for each of the System, the Y2K need to prepare for the Plant shutdown to ensure the prevention is effective. As per strategies discussed earlier, the Plant shutdown plan need to work out smoothly for the transition period. In normal case, the Annual Plant shutdown would be around Mid of every year. By moving the Annual Plant shutdown to before New Year would ensure that there are no Production Work In Process (WIP) could be affected by the Year 2000 Problem. Another good reason is the resources that need to handle the situation would have 100% concentration for the problem to reduce the unnecessary down time that might occur in the organization.

The Timeline below is the plan for the Y2K Crossover. This plan is mainly explain the Facilities shutdown Plan. However, the whole production area would not be able to operate without the facilities. Therefore, the rest of the plan (Production Equipment and Support Equipment) would be based around the Facilities Shutdown Plan. In this plan, the shutdown started since December 30, 1999 at 8:00 am. The shutdown preparation would take time to shutdown the facilities in phases. The complete shutdown would be around December 31, 1999 at 20:00. This would leave time buffer for 4 hours before the Y2K Crossover. At this timeframe, there should not be any production or equipment operating. This can be ensured by the cut-off of electricity and other facilities. The shutdown of the electricity would give time for facilities to do the annual maintenance of

the system. By having no equipment working at that time would greatly reduce the impact that might cause the whole system malfunction. The maintenance would be completed in phases as the timeline below. However, the most important of all the most fundamental facilities are DI water, Electricity, Air Supply and Safety Monitoring System would be able to operate at January 1, 2000 by 12:00. At this time the production equipment and Support System would be starting up in phases according to the required facilities. At January 3, 2000 0:00, the Facilities would be fully Qualify and the Production area would be ready for the production.

Facility Status	No air con N2 @ 4 bar																Full GN2, PN2 & CDA available																																															
	DI water																All power restored, 30% air con(main fab)/30% exhaust																																															
Y2K cross over																Process cooling water restored.																																																
Shutdown																In house vacuum																																																
Start-up																Main Fab, PH3B & 22K, 50% air con restored																																																
																Exhaust restored fully, CDA and Process vacuum																																																
																MDA for Implant																																																
																All gases / Life safety system restored																																																
																Full environmental control (RH & Temp), Clean room certified.																																																
Date	30/12				31/12				1/1				2/1				3/1				4/1																																											
Time	8 12 20				8 20 22				0 2 4 6 8				20				2/1				3/1				4/1																																							
Day	Day1																Day2																Day3																Day4															
Shift																																																																
Time (hrs)	36	32	28	24	20	16	12	8	4	0	2	4	6	8	10	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92																												
M/C Type/Qty																	No Electricity																																															
1 01-AMT83																																																																
2 02-AMT83																																																																
3 03AMT83																																																																
4 01-TCP96																																																																

Figure 5.1 : Facilities Shutdown Plan

In this Chapter, the more detail plan would be more in detail for Facilities preparation only, since the impact is great to the Production Equipment. The Facilities Equipment, Production Equipment and Support Systems are tested to be Y2K ready. Therefore, the emphasis would be the prevention of Facilities Failure.

From this plan, the Support System, like Wafer Tracking System (PROMIS), Automated Material Handling System, Computer Integrated Manufacturing System (CIM) would be able to come up with their plan to support the production at 0:00 of January 3, 2000.

For Fab 1 the Support System is considering quite simple due to lacking of all the new communication systems and wafer handling. Therefore, in this case the example of the plan would be the case of newer Fab SMP. The support system has come up with the Plan to do their shutdown and backup independently from the facilities. Their Startup is faster than the facilities. This is due the fact that they do not required any maintenance in their computer system. They only need to backup all of the important data before the Y2K Crossover. All necessary information would be printout into hardcopy in case of data lost. In this SMP Fab case, there are many Support Systems to consider of, they

are PROMIS, CIM, Pacemaker, Oracle Discoverer, Domino Notes/Intranet/COLAS, and Oracle Finance. By the time the Facilities turn on the Power the Support Computerize systems would be ready to handle the data.

System	Server/Database	Duration	Resources	30 Dec 1999 0800 0830 1700	31 Dec 1999 2000 2100 2200 2300	1 Jan 2000 0030 0100 0200
<b>Promis</b>	SMP01 & SMP02					
1.1 Log out all users from system		15 mins				
1.2 Backup IE powerhouse report		30 mins	Tape			
1.3 Print W/P Report & Lot Held Report (2 cps)		30 mins				
1.4 Deactivate cron job		15 mins				
1.5 Promis Split Shadow		30 mins				
1.6 Shutdown Promis System		15 mins				
1.7 System Idle (Crossover Period)		90 mins				
1.8 Startup Promis System		15 mins				
1.9 Check/Test application		15 mins				
1.10 Activate cron job		15 mins				
1.11 Resume Operation		15 mins				
<b>CIM</b>	SLDB05, AMGE01, AM5C01, AM6I01, AM5T01, AM5X01, AM5D01, AM5L01,					
2.1 Shutdown SLDB database		15 min				
2.2 Backup SLDB - incremental (redo logs)		30 min	1 Tapes			
2.3 CIM/Area & Bay Shutdown (Export Area DB)		30 min	7 Tapes			
2.4 System Idle (Crossover Period)		90 mins				
2.5 Startup Area & Bay/ Check / Test application		30 min				
2.6 Resume Operation		15 min				
<b>Pacemaker</b>	SMPSGSUPACED1, SMPSGSUPACEI2					
3.1 Log out all users from system		10 mins				
3.2 Copy necessary reports to PC h/disk		30 mins	Printer			
3.3 Deactivate Cron jobs		10 mins	PC h/disk			
3.4 Backup scripts & data- incremental		15 mins				
3.5 System Idle (Crossover Period)		90 mins				
3.6 Check / Test application		30 mins				
3.7 Activate cron job		10 mins				
3.8 Resume Operation		15 mins				
<b>Oracle Discoverer</b>	SMPSGSUPACE01, SMPSGSUPACE02 APSPROD, APSTEST					
4.1 Log out all users from system		10 mins				
4.2 Deactivate Cron jobs		10 mins				
4.3 Backup databases (incremental)		180 mins	Tape			
4.4 Shutdown Database		10 mins				
4.5 System Idle (Crossover Period)		90 mins				
4.6 Startup Database		10 mins				
4.7 Check / Test application		30 mins				
4.8 Activate cron job		10 mins				
4.9 Resume Operation		15 mins				
<b>Domino Notes/Intranet/COLAS</b>	SMPNSG01, SMPCOLAS					
5.1 Log out all users from system		10 mins				
5.2 Databases Backup (incremental)		20 mins	Tape			
5.3 Shutdown application server		10 mins				
5.4 System Idle (Crossover Period)		90 mins				
5.5 Startup application server/Check/Test appln		20 mins				
5.6 Resume Operation		15 mins				
<b>Oracle Financial</b>	CSMORA					
6.1 Log out all users from system		15 mins				
6.2 Shutdown Oracle applications		30 mins				
6.3 Databases & files Backup		300 mins	Tape			
6.4 Startup application & release sys for report printing		300 mins	Printer			
6.5 Disable users login & deactivate the cron job		30 mins				
6.6 Shutdown Oracle applications		30 mins				
6.7 System Idle (Crossover Period)		90 mins				
6.8 Startup applications & databases/Check/Test appln		30 mins				

Figure 5.2 : SMP Supports shutdown Plan

For Production Equipment, the shutdown Plan would follow the facilities. However, some of the key concept need to keep in mind that the equipment that

required some of the facilities during shutdown need to plan the shutdown ahead of the Facilities. For instance, Implant Department need to have MDA system and Scrubber to handle toxic gas during shutdown. Therefore the planning should allow some time buffer to ensure the completion before facilities cut of. For starting up as well, the team need to emphasize on the facilities needed to startup are ready before the startup time.

For Implant module, the preparation for the plant shutdown to coincide with the Facilities shutdown planning. This plan need to allocate the resources to sustain the activities and emergency incident that might happens. Another planning need to keep in mind is that most of Implant member are ERT member as well (Emergency Response Team). This team is the staff representative from each module to be a first strike team to respond to the emergency situation. Therefore, during the millennium crossover, the Implant staff might not be able to cover the emergency situation and protect the equipment at the same time.

In this plan for Implant module will include the time usage planning for each activity to have better time calculation and the time tracking. This plan need to consider the emergency system that required for the module before the equipment is startup. For implant case, the MDA, toxic gas monitoring system is a must before turn on any toxic gas. The setup after the initial startup of the equipment is necessary to ensure the quality of the equipment before release for production.



**Startup Activities****HCI**

<b><u>Activities</u></b>	<b><u>Time</u></b>
1. Power up m/c, water cooling, turn on all pumps	1 hr
2. Start cryo-pumps regen	6 to 8 hrs
3. Replace DI cartridge and filters	1 hr
4. Source PM	4 hrs
5. Put m/c to high-vac and turn on all gas bottles	2 hrs
6. Source outgas	1 hr
7. Setup Argon beam	1/2 hr

**MCI**

<b><u>Activities</u></b>	<b><u>Time</u></b>
1. Power up m/c, water cooling, turn on all pumps	1 hr
2. Start cryo-pumps regen	6 to 8 hrs
3. Replace DI cartridge and filters	1 hr
4. Source PM	2 hrs
5. Put m/c to high-vac and turn on all gas bottles	2 hrs
6. Source outgas	1 hr
7. Setup Argon beam	1/2 hr

**Process Setup****HCI**

<b>Machine</b>	<b>Activities</b>	<b>Time</b>
1	Standard setup test (RS and Particle), low energy test	1.5 hour
4	Standard setup test (RS and Particle), low energy test	1.5 hour
5	Standard setup test (RS and Particle) include one poly wafer, low energy test, QBDSL Qual	2.0 hour
7	Standard setup test (RS and Particle)+ low energy test	1.5 hour

**MCI**

<b>Machine</b>	<b>Activities</b>	<b>Time</b>
2	Standard setup test (RS and Particle), low dose test	1 hour
3	Standard setup test (RS and Particle), low dose test	1 hour
6	Standard setup test (RS and Particle), low dose test	1 hour
8	Standard setup test (RS and Particle), low dose test	1 hour

**Methology Tools**

<b>Equipment</b>	<b>Activities</b>	<b>Time</b>
Thermal Wave	1. Machine stabilization after start up	6-8 hours
	2. Check machine reference	1 hour
Heat Pulse	Reprogramming heat pulse software, T.C wafer check	1 hour
Prometrix	Check with calibration wafer	1 hour

Table 5.1 : Implant Process Setup Plan

From the planning, Implant module will arrange the manpower for the Shutdown and Startup period to be

1. At least 6 persons for equipment staff from normal 3 to 4 persons.
2. For process staff, it is necessary to have them in place during the process setup, just in case of any quality issue the staff can be work to resolve the issue immediately. Therefore at least 2 staff is necessary for the setup period.
3. However, according to plan the setup time of the last three equipment will be span over beyond 8 pm., which have to consider the manpower allocation for process staff, since there are no process support beyond 8 pm. The manpower allocation need to arrange with the staff themselves to ensure the communication is cover the working period to avoid the confusion that might happens.



The finish time of the startup is around 48<sup>th</sup> hour after the millennium crossover. This would be at the same time as the facilities fully startup and certified for production. Actually, the startup of Implant would take longer time if Implant module want to proceed with the full annual maintenance. However, due to the urgency in the startup of the equipment, the maintenance activities would greatly cut down to process only necessary maintenance. The rest of the maintenance item would required the Implant team to execute them accordingly when the time is available during the production.

For the Vendor support for the Y2K crossover night, the organization would prefer to pay the Vendor to standby at the customer's site to ensure the transition as smooth as possible. In normal case, the Y2K service provider would offer the package of the Service to the organization to choose for the best fit for the organization's need. The Table below is the example of one of the Y2K Service Provider Y2K package service offer. The organization have to define the level of the support to be just the Phone Support, Site Engineer Support, etc. This would have to consider case by case for the Equipment.


				
<i>Worldwide Support Operations</i>				
<b>Y2K Support Offerings at a Glance</b>				
<b>Response Time Support</b>				<b>Site Engineer</b>
<i>Support Element</i>	<i>Millennium 1</i>	<i>Millennium 2</i>	<i>Millennium 3</i>	<i>Standard Eng. On-Site</i>
<b>On-Site Support</b>				
Coverage Period	Friday-Monday (1)	Saturday-Sunday (2)	N/A	Saturday-Sunday
Coverage Hours	24 hours	8 hours, 1st Shift	N/A	8 hours, 1st Shift
Repair Response (3)	4 covered hours	4 covered hours	N/A	On-site
Repair Labor	Billable	Billable	N/A	✓
On-site Escalation	(4)	(4)	N/A	(4)
Off-Shift Emergency On-site Coverage	✓	N/A	N/A	Billable
Preventive Maintenance	N/A	N/A	N/A	N/A
Guaranteed Uptime	N/A	N/A	N/A	N/A
<b>Customer Response Center Services</b>				
Telephone Coverage Period	Friday-Monday (1)	Friday-Monday (1)	Friday-Monday (1)	Friday-Monday (1)
Coverage Hours	24 hours	24 hours	24 hours	24 hours
Technical Assistance	✓	✓	✓	✓
Off-Shift Emergency Telephone Coverage	✓	✓	✓	✓
Parts Identification and Ordering	✓	✓	✓	✓
Parts Order Processing	✓	✓	Per entitlement	Per entitlement
Call Tracking	✓	✓	✓	✓
<b>Parts</b>				
Consumables	Per entitlement	Per entitlement	Per entitlement	Per entitlement
Repair	Per entitlement	Per entitlement	Per entitlement	Per entitlement
Stocking Locations	Per entitlement	Per entitlement	Per entitlement	Per entitlement
<b>Additional Services</b>				
Y2K Related Applications Support	✓	N/A	N/A	N/A
<b>Pricing</b>				
US List, Warranty/Contract Customers	\$5,500 + \$285/hr site fees (5)	\$1,500 + \$285/hr site fees (5)	\$1,000 (5)	\$5,000 (5)
US List, Time & Material Customers	\$5,500 + \$360/hr site fees (5)	\$1,500 + \$360/hr site fees (5)	\$1,000 (5)	\$5,000 (5)
All programs and options may not be available for all locations. Please consult your local service manager.				
<b>Key</b>				
(1) From close of business day Friday, 12/31/1999, to beginning of business day Monday, 1/3/2000				
(2) Saturday, 1/1/2000, and Sunday, 1/2/2000				
(3) Typical; Response varies for customers 50 miles outside dispatch location and depends upon active workload				
(4) Escalation support to begin after Monday, 1/3/2000, per entitlement				
(5) Price is per engineer / product covered				
✓ :	Included			
<b>Billable:</b>	Charged at prevailing time-and-materials rates; subject to engineer availability			
<b>Per Entitlement:</b>	As specified under Warranty, Contract or Time and Materials Agreement			
<b>N/A:</b>	Not applicable during the Y2K rollover period			

Figure 5.3 : Vendor' Proposed Service Solution

In each Fab, they need to develop their Contingency Plan to handle each Fab. This is due to the fact that each Fab having their difference limitation. The example below is Fab 1 Contingency Plan to handle the Y2K Crossover. This plan is develop by Y2K team in order to provide the complete Plan. Implant module was involved in the plan formulation as well to ensure the facilities are cover the module.

### **Fab1, Y2K Contingency Plan.**

#### Objectives

- To provide an organized and thorough procedural framework for Fab 1 Y2K Team and Modules Personnel to carry out during and after the millennium cross over for year 2000 if necessary.
- To identify the contact personnel of system check and recovery action in case of Y2K failures.

#### Preparation

<b>Date and Time</b>	<b>Action to be taken</b>	<b>Who</b>
30/12/1999	Backup all the recipes, machine constants/configuration and operating software.	All Modules
31/12/1999	All the lots must be staged correctly by 10:00PM.	MFG
31/12/1999 , 10:00 PM	No production lots running and all equipment must be idle until 1/1/2000, 00:30 AM.	MFG
1/1/2000, 00:30 AM	After cross over to Year 2000, Engineering groups have to check all the date and display. Test the equipment functioning and cycle a few dummy/test wafers before release to MFG. IT and Facility will confirm that no Y2K issue on their system and inform Ops Center at 00:45am. All Y2K members will assemble at Ops Center and review the status and proceed manufacturing activities if no Y2K failure in Fab 1.	All Modules, MFG, IT, Facility

Table 5.2 : Facilities Preparation Plan

(1) To establish the following list.

Standby Personnel list of All Department.

On-Site / Standby Vendor Support.

(2) Synchronization of all systems time clock.

The synchronization should be started from 01-Dec-1999 and should be done by 28-Dec-1999. The clock reference shall be available from calling the telephone service at 1711.

(3) The cargo elevator is not allowed to use from 31-Dec-1999, 11:30pm to 01-Jan-2000, 00:00am for safety reason.

**The possible impact and followup actions.**

Impact	External/ Internal	Contact Person	Consequences	Followup actions	Who
Power Glitch / Brown out	External	Peter Lim	Fab eqpt down Fab evacuate if environment tracking system is failure.	PM/Corrective action for affected eqpt. Follow the fab evacuate procedure.	ALL
Water Supply cut off	External	Peter Lim	Shutdown the eqpt that use DI water.	Facility group will inform the status whether the water supply is recovered back. Modules have to wait for announcement	Modules
Eqpt hang / Software corrupte d	Internal	Respective Modules	Unable to run production.	Verify the cause of issue. If it is related to Y2K cross over issue, roll back date or follow up with vendor if problem is complicated..	Respective Modules

Table 5.3 : Possible Impact and follow up actions

### **Incident report system.**

- Upon any incident of failure that related to Y2K cross over, the respective modules personnel shall inform to Fab1 Ops center, Orchard room.
- Ops center will co-ordinate among the modules / Fabs.
- Incident description, action taken and follow up action items shall be recorded in Y2K Equipment Recovery Form.
- After millenium cross over, Y2K Team members report the status in Ops center at 00:45am.

### ***Recovery Plan***

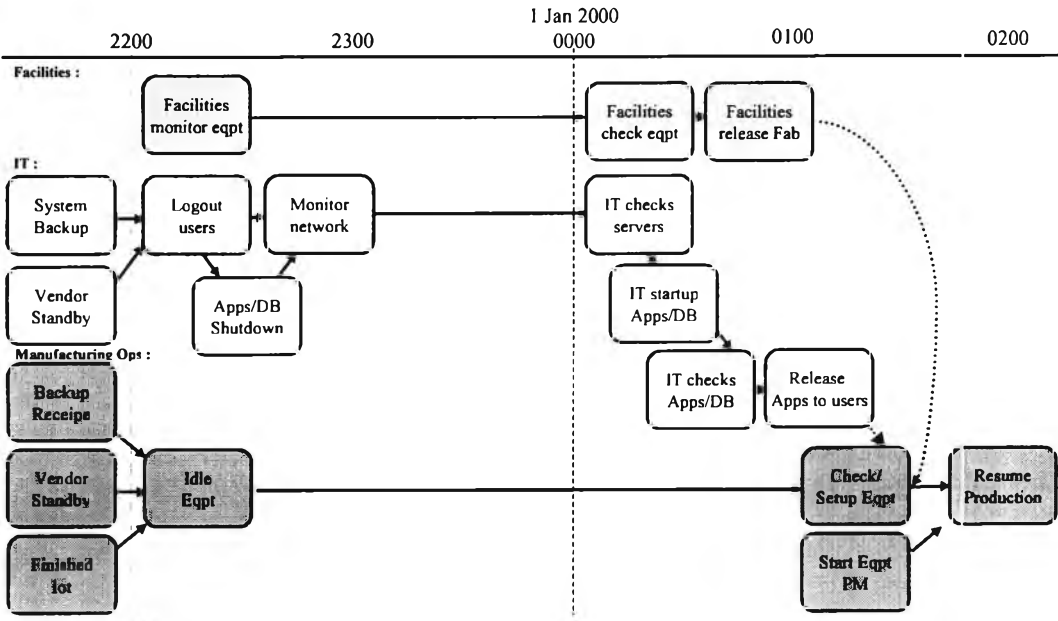
In order to have good recovery plan, Y2K team need to assume the possible scenarios that might happens. Keep in mind that, all of the plan is base on the assumption that major problem would come from external factors. From these scenarios, the Y2K team can have the contingency plan for the situation that might occur.

This is the scenarios that Fab 1 has listed out:

1. Ideal Case – No Problem happens to the Facilities. There is no shutdown in the Electrical Power. Facilities would just monitoring the system during crossover.
2. Production Equipment Bug - The problem happens only to the Production Equipment during Startup. The support from the Equipment Vendor would be crucial to fix the problem before the production commencement.
3. Total Power Failure – This is the worse case that can happens. There are no other facilities can be operate without Electricity. The Field Service Support during the crisis is crucial to the whole organization commitment. These failure would not affect production equipment since they are all shutdown completely before Y2K Crossover.
4. Normal Power Stored – In case of Power Failure but the power can be restore afterward. All of the original plan can be execute accordingly with delay from the power problem.

The Chart below are the flow of the event for each case with time frame indication.

# Y2k Cross-over event flow

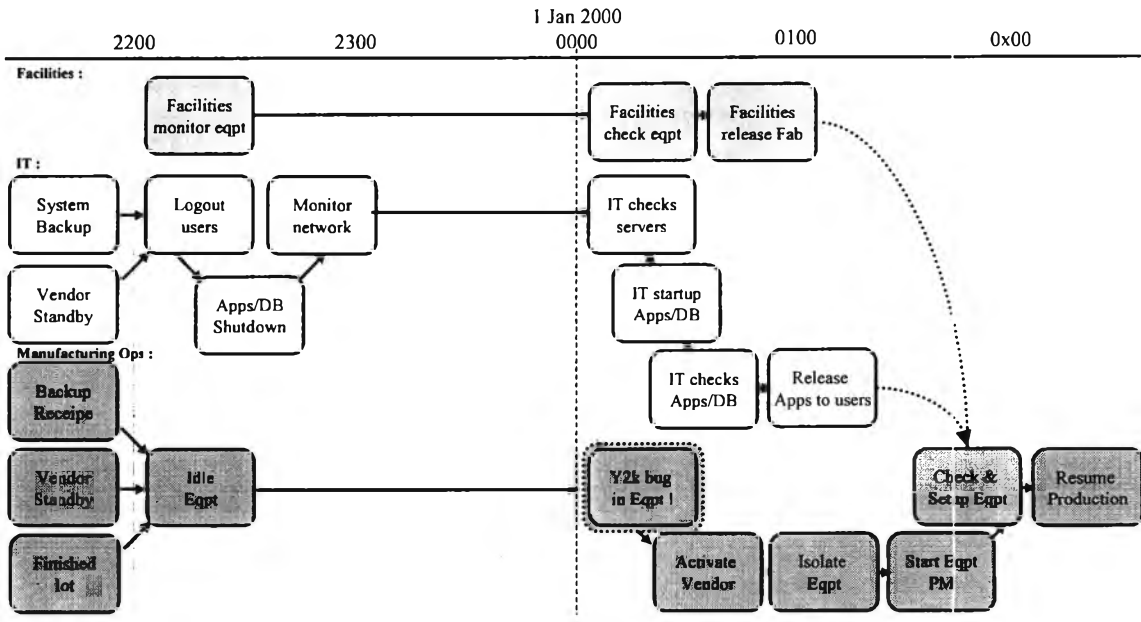


Date: 19 Aug 1999

Figure 5.5: Y2K Event Flow (Ideal Case)

## EQPT Y2K BUG RECOVERY

# Y2k Cross-over event flow



Date: 19 Aug 1999

Figure 5.6: Y2K Event Flow (Y2K Bug Recovery)

## TOTAL POWER FAILURE

# Y2k Cross-over event flow

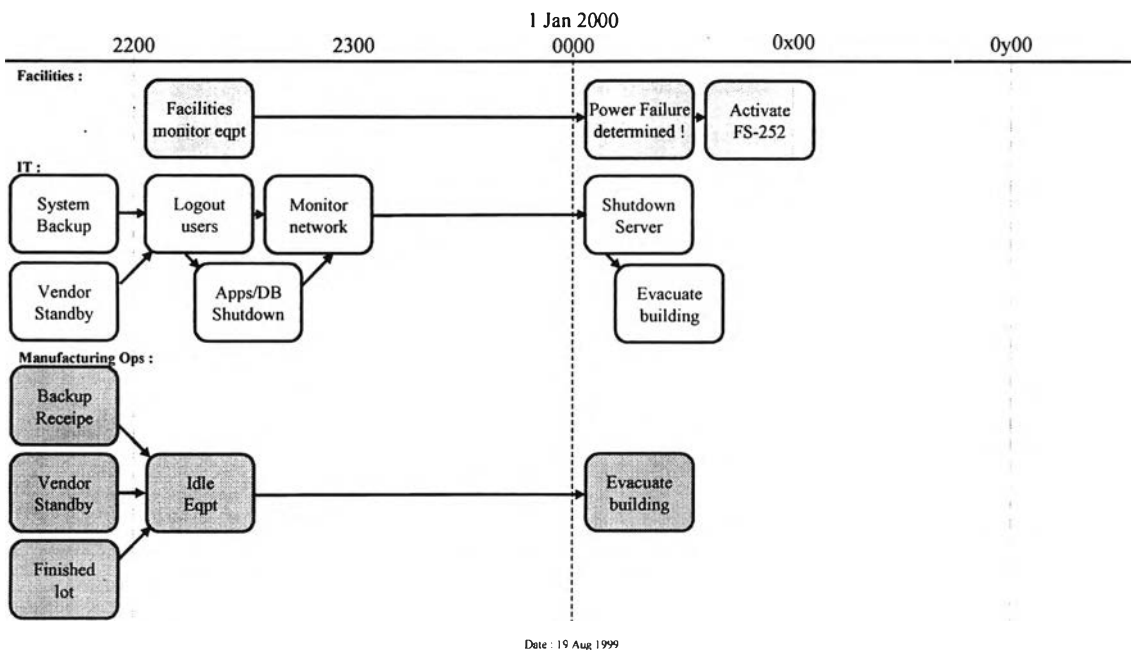


Figure 5.7: Y2K Event Flow (Total Power Failure)

## NORMAL POWER STORED

# Y2k Cross-over event flow

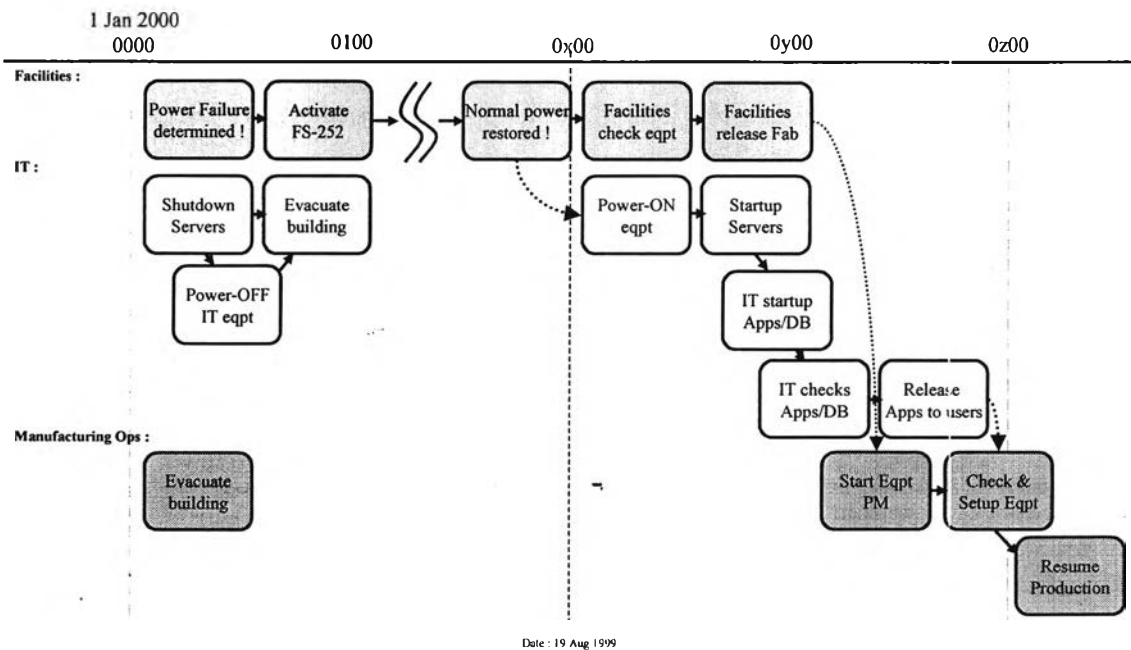


Figure 5.8: Y2K Event Flow (Normal Power Stored)

From these scenarios, CSM's has come up with the detail execution plan to handle them. The document below are the internal Plan that Y2K team members coordinate with the Facilities to come up with the concrete plan. As mentioned earlier, the Facilities is most crucial to all of the Production Equipment. CSM's Y2K Compliant Project is ensuring only Equipment in CSM. However, the external factors are still in question. Therefore, the Facilities is the only interaction to the external during that time frame. In this case, the Annual Plant Shutdown is prevent all of the Production Equipment to damage the WIP, however, it is still possible that the problem might still exist.

### **Facilities Year 2000 Contingency and Recovery Plan**

#### **1. Objectives**

The objective of this contingency plan is to provide an organized and thorough procedural framework for the Facilities Year 2000 SWAT Team in preparing CSM facilities department prior, during and after the millennium cross over for year 2000.

The plan will also identify the specific personnel in charge of system check and recovery in case of system failure, as well as provide guidelines for coordination between respective FABs Operation.

The basic concept of this contingency plan is to provide a systematic approach to manage emergencies and recovery plan for CSM facilities:

##### **a. Preparation**

Preparations of facilities before 31 Dec 1999 for plant warm shutdown; the duration is 2hours before and 2 hours after the midnight crossover.

##### **b. Response**

Transition from 1999 to 2000.

##### **c. Resumption**

Post check for resumption of facilities systems.



## 2. Facilities Y2K SWAT Organization Chart

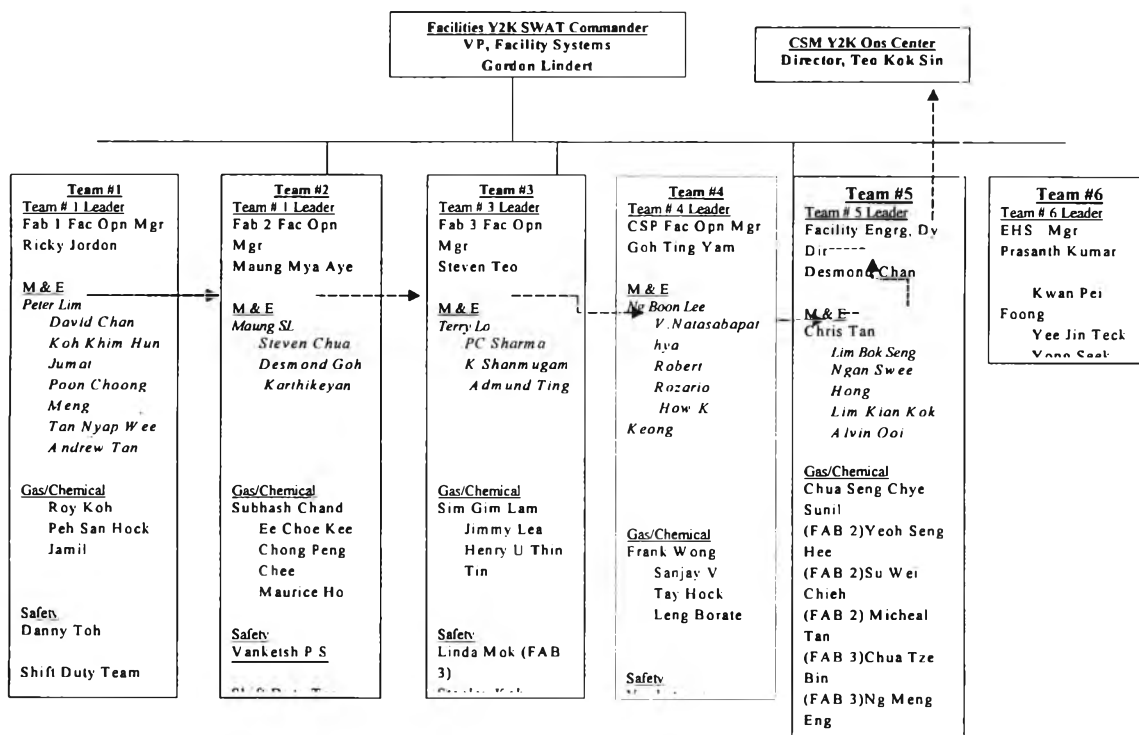


Figure 5.9: Facilities Y2K SWAT organization Chart

### 3. Preparation

#### 3.1 Formulate Standby Personnel List

The facility Year 2000 SWAT Team Organization Chart shall be developed with the responsibilities of the personnel in charge of the systems.

The site Facilities Engineering Department will be providing engineering support to respective FABs during the transition period on 31 Dec 1999.

The Environment, Health and Safety Department will be also activated on 31 Dec 1999 to provide support to respective FABs in safety aspect and in the case of total plant evacuation.

### **3.2 On-site Vendor Support**

Coordination with purchasing department for critical vendors ' on-site support. A vendor lists has been developed to provide emergency contact.

### **3.3 Readiness Check of Emergency Power Source**

The respective FAB facility operation shall be checking the readiness of the generator prior 31 Dec 1999. A test has been scheduled on 28 Dec 1999 on all generators on standby in addition to monthly test-run.

### **3.4 All buffered supply tanks to be top-up.**

Facility operation shall be checking the supply level of the buffer tanks such as:

- a. Domestic Water Tanks
- b. Process Water Tanks
- c. DI supply tanks
- d. Diesel Tanks

All buffered water tanks shall be fully top-up on 30 Dec 1999 and 31 Dec 1999 before 10:00 p.m. The Diesel Tanks shall be topped-up after the generator test on 28 Dec 1999.

### **3.5 Facility Systems Resumption Check List**

A facility systems checklist shall be documented and verified against prior releasing the facilities systems to FAB operations. The respective FABs operation will check and logged all critical systems parameters before and after the millennium crossover.

The systems check list will provide a means to verify all systems functionality

### **3.5 Hot Lines support from utilities suppliers**

In addition to the usual telephone landlines for emergency contact, the emergency contact number shall be also be available by mobile Phone and Pager. This is necessary for any failures in the PABX systems in both suppliers and CSM.

The emergency contact number for the following agencies shall be available:

- a. Singapore Power Grid
- b. CSM License Electrical Engineer
- c. PUB Water Department
- d. Shell Eastern petroleum (Pte) Ltd. (For order of Diesel)
- e. Civil Defence Force
- f. Chubb
- g. Telecom

### **3.6 Synchronization of all systems time clock**

All facilities systems clock shall be synchronized before 28 Dec 1999. The synchronization exercise shall start from 01 Dec 1999. The clock reference shall be available from calling the telephone service at 1711.

### **3.7 Grounding of Elevator from 31 Dec 1999 10:00 pm to 01 Jan 1999 00:30 am**

The passenger and cargo elevators shall be grounded during the transition period to prevent any possible failure.

### **3.8 Breach of Security**

As a contingency against potential intruders trying to take advantage of the Year 2000 event, the extra security guards will be put on alert and going for rounds to check the premises.

## **Response**

This phase covers the transition period from 31 Dec 1999 10:00 p.m. to 01 Jan 2000 00:30 am. The main responsibility of the SWAT is to monitor any abnormalities in the systems and carry out the necessary remedies to bring the system back to normal.

The following paragraph covers the possible scenarios that may be encountered during the transition period.

In the case of any system abnormalities or failure, the Y2K SWAT team will inform the Year 2000 Ops Center through designated hotlines. The communication links from respective FAB is through team #5 (Desmond Chan, Alternative: Chris Tan) to the Ops Center; as shown in the SWAT Organization Chart indicated by the dotted lines.

#### 4.1 Power Failure

One of the potential problems during the transition period is Power failure due to external factors. Respective FAB Facility Management System (FMS) has the capability to monitor the electricity supply.

The electricity supply reading shall be monitored closely on 30 Dec 1999, 31 Dec 1999 (at 10:00 am), 01 Jan 2000 (at 00:30 am) for any over -voltage sign due to possible reduce in consumer load in Singapore. Trending record shall be available for the SWAT team to access the situation.

##### a) Voltage Swing

- The following procedure have been identified :
- Call PowerGrid to validate disruption.
- Ask PowerGrid for clarification fax
- Inspect FAB and Facility equipment status.
- Inform Key Personnel about incident
- Check with TechSemi, FAB 1, FAB 3 for further information
- Print out the main voltage trend chart and FMS print out.
- Electrical Engineer to log in the PUB Disturbance File
- Collect Move Lost or Wafer Lost data from the PC.

Normal Voltage	Hi /Lo
22KV	23.32 KV (+ 6%)  21.12 KV (-6%)
415V	439.9 V (+6%)

	398.4 V (-6%)
208 V	220.48 V (+6%) 199.68V (-6%)

Table 5.4: Voltage Swing Tolerance

## b) Total Power Failure

In the case of total power failure, the power failure response plan shall be activated as accordance to the document FS-252 Emergency Response Management Plan for All FABs.

The following systems are supplied through the Emergency Power Supply in case of power failure.

1. Exhaust System – Scrubber, General & Solvent Exhaust system.
2. Silane Exhaust System
3. VLF
4. Make Air Units .
5. Lifts
6. DI System – minimal
7. Process Water System, Process Cooling System
8. Process vacuum
9. Air Compressor
10. Safety System – MDA Panel, Gas Monitoring System
11. Gas Distribution System
12. Chemical Distribution System – Control system
13. Sub FAB, Stair cases lighting
14. Fire Protection System
15. Security System

The emergency power source is delivered through the generators in respective FAB and its capacity to supply the critical life safety system is as follows:

	FAB 1	FAB 2	FAB3/SMP	CSP
Duration of Diesel Tank Supply	13 hrs	20 hrs	20 hrs	20 hrs

Table 5.5: Emergency Power Supply Duration by Diesel Engine

## 4.2 Systems Failure

Upon any incident of systems failure, the respective FAB system engineers shall implement their escalation procedure to recover the system and investigate if the problem is related to Year 2000 problem.

The Y2K Ops center is to be informed in the case of any system failure through the communication link to team #4.

A sample of the critical systems is attached in the plan.

All critical systems' vendor shall be on site for support to the respective FAB; the vendor list is as attached with this plan.

## 4.3 Water Cut-off

The buffered tanks for respective FABs are as follows:

	FAB 1	FAB 2	FAB3/SMP	CSP
Domestic Water Tank	75 m <sup>3</sup>	60 m <sup>3</sup>	60 m <sup>3</sup>	66 m <sup>3</sup>
Process Water Tank	-	3742.6 m <sup>3</sup>	4464 m <sup>3</sup>	4529 m <sup>3</sup>
Duration of Supply	2 hrs	18 hrs	24 hrs	20.5 hrs

Table 5.6: Emergency Water Supply

In the case of water supply cut-off, the respective FAB shall be monitor the water level consumption closely and to inform the key personnel.

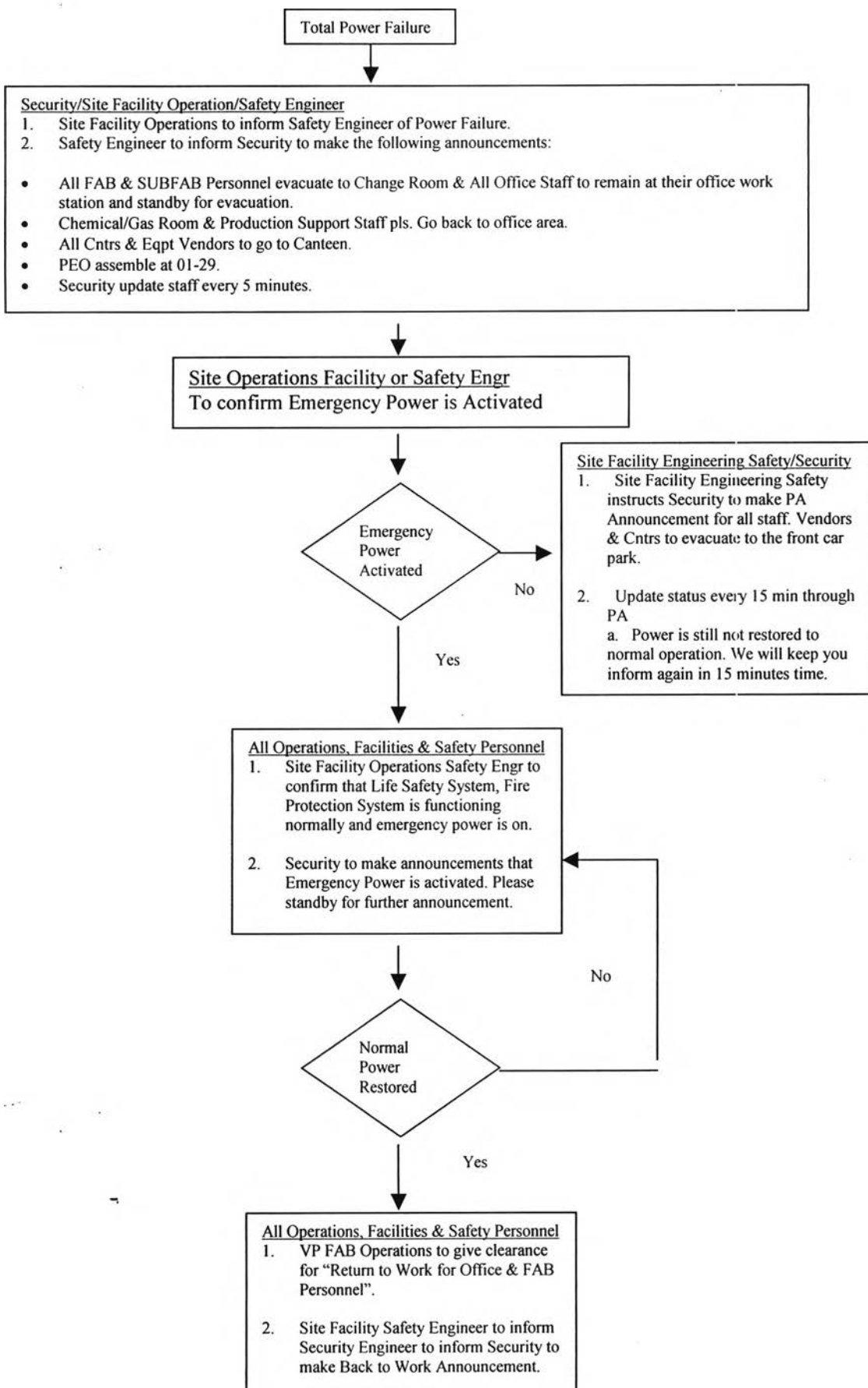
In the case emergency, water trailer shall be activated to provide continual supply until the PUB Water Department confirms the resumption of supply.

## **5. Resumption**

Upon the resumption time, the respective FAB facility Ops Mgr. (i.e. Team #1, Team #2, Team #3) shall confirm that all systems are functioning normally before informing the respective FAB operation that there is clear to startup the production. The critical systems checklist can provide a check on these systems.

A sample of the facility resumption checklist shall provide as a final check on the Clean room, Reticle room and DI Water Supply.

**Figure 5.10 Total Power Failure Response For Staff/Contractor/Vendors**





**RELEASING FAB FOR PRODUCTION**

Originator : \_\_\_\_\_ Date : \_\_\_\_\_

Remarks : \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

<b>• Data attached:</b>		<u>Specs.</u>	<u>Results</u> <u>(Mod A / B)</u>	<u>Date / time of</u> <u>results obtained</u>
<u>Cleanroom :</u> (1-5)	1. Particle count	_____	_____	_____
	2. Pressure	_____	_____	_____
	3. Temperature	_____	_____	_____
	4. Relative humidity	_____	_____	_____
	5. Exhausts	(Gen) _____ (Scr) _____ (Sol) _____	_____	_____
<u>Reticle room</u> (6-10)	6. Particle count	_____	_____	_____
	7. Pressure	_____	_____	_____
	8. Temperature	_____	_____	_____
	9. Relative humidity	_____	_____	_____
	10. Exhausts	(Gen) _____ (Scr) _____ (Sol) _____	_____	_____
<u>Facility DI</u> <u>water supply:</u> (11-17)	11. Dissolved O <sub>2</sub>	(Cold) _____ (Hot) _____	_____	_____
	12. Particle count	(Cold) _____ (Hot) _____	_____	_____
	13. Pressure	(Cold) _____ (Hot) _____	_____	_____
	14. Resistivity	(Cold) _____ (Hot) _____	_____	_____
	15. Temperature	(Cold) _____ (Hot) _____	_____	_____
	16. TOC	(Cold) _____ (Hot) _____	_____	_____
	17. Bacteria results	(Cold) _____	_____	_____

**Comments:** \_\_\_\_\_

Department	Name	Signature	Date
Facility			
OPN			
YE			
QA			

Figure 5.11: Fab Release Form

### Critical Systems Check List

No.	Systems	Status	Time
1	FAB Power Supply – 208 V		
2	Facility Power Supply – 415 V		
3	UPS Power Supply – MIS, FAB and FMS		
4	FMS System		
5	Facility Support Power (Emergency) Supply		
6	Chilled Water System		
7	Make Up Air Units and VLF Status		
8	Boiler and Hot Water Distribution System		
9	CleanRoom Operation @ Specified Limit		
10	Scrubber Exhaust		
11	Solvent Exhaust		
12	General Exhaust		
13	Amonia Exhaust		
14	Process Cooling Water System		
15	Process Water (PumpHouse) System		
16	Process Vacuum System		
17	House Vacuum System		
18	Air Compressor and Dryer		
	UPW Plant		
	Module A – CDI and HDI		
19	Module B – CDI and HDI		
20	WWT Plant		
21	Non-Fab HVAC		
22	Soxal Gas Farm		
23	Specialty Gas System		
24	Chemical Distribution System		
25	MDA Safety Monitoring System		
26	Fire Protection System		

Table 5.7: Critical Equipment Checklist

After all of these checklist are completed and found no error, the facilities will release the Fab for Production. As the plan need to clearly define the responsibilities to avoid any miscommunication that might cause the during the emergency. This plan is also plan according to the facilities scenarios that might occur, which are:

1. Voltage Swing,
2. Total Power Failure
3. System Failure
4. Water Cut-off

In This plan, the flow chart of the Total Power Failure is use to explain the tasks that required to do in emergency case. The Contact List need to be distribute through out the staff in the organization during the Y2K Crossover to ensure any incident the communication is sufficient and effective.

The Table below is another example of the Recovery Form for the equipment owner to fill in after the incident happened. This form would document all of the scenarios that happens for future reference.

**CHARTERED SEMICONDUCTOR MANUFACTURING**

**DRAFT**

**Disaster Recovery Activation Plan**

**System Name:**

**System Id Number:**

This form was completed by

Name :

Contact No :

Fab/section :

Date:

Revised by

1. Name :

Contact No :

Fab/sectionicn :

Date:

2. Name :

Contact No :

Fab/section :

Date:

3. Name :

Contact No :

Fab/section :

Date:

**Section 1. PURPOSE**

This plan identifies the anticipated Y2K problems and responsibilities for activities for problem resolution

**Section 2. BACKGROUND**

This system was commissioned in \_\_\_\_\_ and is currently maintained by \_\_\_\_\_.

Hardware Platform:

Operating Systems:

System Application Language:

This System interfaces with:

a.

b.

c.

**Section 3. BRIEF SYSTEM OR DEVICE MISSION –**

**Section 4. RESPONSIBILITIES –**

**Organization**

**Point of Contact**

**Section 5. System Failure After Y2K Milestone**

There should be a list of Recovery Actions pertaining to each Trigger Point. Please use different sheet for every Trigger Point.

CHARTERED SEMICONDUCTOR MANUFACTURING	
<b>Trigger Point No :</b>	
<b>1. Description :-</b>	
<b>Activation Approval Person:</b>	<b>Contact No:</b>
<b>2. Action(s)</b>	
<b>Section 6. IMPACTS TO INTERFACING SYSTEMS</b> Identifies impacts to interfacing systems. Identifies the hardware, software, communications, and process interfaces affected by the contingency plan.	

Figure 5.12: Disaster Recovery Form

### ***Y2K Rehearsal on November 8, 1999***

All of the Plan is ready in place, however, it does not ensure that the staff that have to use them is experience enough to handle the situation without any delay. Therefore, the training of the real situation is important to the Y2K team. Y2K Team has selected November 8, 1999 to be the manning date. And all of the Fab use this date to rehearse the activities that need to be done during the Y2K Crossover as well. By having all of the staff, Equipment, Procedure ready and well practice would help to reduce the panic during the real situation. Y2K team Select this date because of another reason as well. This Date is another potential problematic date (9/9/99) in computer system. Some of the System would misinterpret the date format. Therefore, by Select one equipment from each module to roll the date to December 31, 1999 to represent the scenario. Y2K Team will audit and Check the equipment as if it is a real situation. However, others equipment that having the problem because of the 9/9/99 date format may happens as well. All of the Y2K Team, Equipment and Procedure are all there. Therefore, it would reduce the unnecessary down due to 9/9/99 Problem. The Summary of the Agenda below is the internal plan for the rehearsal date on 8/9/99 crossover to 9/9/99.

### **Fab1Y2K Rehearsal**

#### **Y2K Manning Dates**

8 Sep 1999 2330hrs to 9 Sep 1999 0030hrs

#### **Y2K Operation Center**

Orchard Room (Tel: 7781207)

#### **Y2K Team Members**

**Coordinators** : Soe Lwin, Peter Lim & Kelvin Lim

**Members** : LumSF(CT), Jason Lee(Diff), HoKY(Etch), Surawut(Impl), LimTH(Litho), GohPH(TF), BoeyKP(Etst), Kelvin Lim(PC), Peter Lim(Fac), LeeBT(YE), EngEJ(IT), LimKC(Purchasing)

#### **Activities**

1. Select equipment to simulated the Y2k crossover on 9 Sep by adjusting the date (01-Laser, 06-Lam44, 01-San, 06-NV,

#### **Who**

Y2K Team

#### **When**

06 Sep 99

01-EPI, B5-Dev & 01-KS450)		
2. Generate standby personnel contact list (CSM & Vendor) for mobilisation	Y2K Team	06 Sep 99
3. Backup all recipes, machine constants/configuration, operating software & IT database	Y2k Team	06 Sep 99
4. No production run on equipment selected from item 1 from 2330 to 0030	Kelvin	08 Sep 99
5. Prepare 5 set of WIP & Idle reports at 2330hrs	Fab Coord	08 Sep 99
6. Y2K members assemble in Opn Room at 2330hrs (Confirm Headcount)	Y2K Team	08 Sep 99
7. Y2K members proceed to work area at 2345hrs & check all equipment after crossover	Y2K Team	08 Sep 99
8. Y2K members report status in Opn Room at 0030hrs	Y2K Team	09 Sep 99

#### Possible Impact

- No Impact
- Power Glitch/Brown Out
- Water Supply Cut Off
- Eqpt hang/Software

#### Follow-up Actions

1. Activate ERT to comb Fab if require	Y2K Team	09 Sep 99
2. Review impact to Fab Equipment from 0030 to 0100	Y2K Team	09 Sep 99
3. Activate standby personnel if require from 0100 to 0130	Y2K Team	09 Sep 99
4. Establish equipment priority list by 0100hrs	Y2K Team	09 Sep 99
5. Report activities every 2 hours to Opn Room	Y2K Team	09 Sep 99
6. Review Equipment Status & Activities at 0800hrs in Opn Room	Y2K Team	09 Sep 99

After the rehearsal the result is positive, all of the equipment rollover without any problem. The rest of the equipment do not have any of 9/9/99 Problem. There is no Production WIP affected by this Date.

## Final Audit & Certification

The Audit is needed to ensure the readiness of the organization compare to the international standard. As mention earlier in the previous chapters, the readiness through out the supply chain is important to ensure the problem would not cause any problem for the suppliers and customers. The affect may vary according to the severity of the system.

In CSM case, the audit done by Hewlett-Packard. HP is our technology & financial partner and our major customer. Therefore, by helping us to audit the organization would secure their supply of the product. The audit was done in October 6, 7 1999. This audit is Sponsored by the ICBM Management Team. According to the timeline is suppose to be October 1, 1999, which is consider behind time slightly only. The Audit is done by the HP personal to ensure the comment is not bias toward the working culture of Singapore. The executive summary is:

*“The CSM effort to prepare for the Y2K event was significant and in fact is still underway (98% complete). They have significantly reduced their exposure and are substantially compliant and in our opinion, are “Y2K Ready.” Business continuity and Y2K contingency plans look very strong for CSM Fab #2 and #3. However, it is strongly recommended that CSM address the absence of Disaster/Recovery Plans (DRPs). If an unforeseen incident occurs (e.g., computer virus, sabotage, flood, or ??), a pre-agreed upon plan for ANY disaster response and a signed off contingency plan from your major user/customer ensures the ultimate “safety net” is in place. This is required to cover what could impact CSM’s production capability, but was never thought of or planned for. Who knows what will happen?”*

- The CSM Y2K Assessment Team

(More Detail in Appendix E)

From the comment about the Y2K readiness of CSM is positive. As we can see that the effort that the Y2K team put into the project is worth it. However, the recommendation is valid that CSM do not have the proper Disaster Recovery Plan to handle such Disaster (Flood, Fire, Virus, etc.). From the experience CSM gained from



studied and preparing the Contingency Plan for Millennium Crossover would give CSM better preparation and develop the Disaster recovery Plan in the Future.

## **Conclusion and Recommendation**

### **Conclusion**

The implementation of Year 2000 Compliance program and the contingency plan to handle the situation during millennium crossover for Implant Module is seems to be strong and Y2K ready within less than two and a half years since the first phase.

The risks that Implant module would expose if the Y2K Project is not done or completed within time would be:

1. Unknown Problem – This would make Implant module spend countless resources to take precaution actions due to all of the equipment components might contains bug.

2. The Damage may cost Implant module to repair the equipment during millennium crossover afterward for weeks. This would also include the manpower and the money spend for the damaged equipment.

3. The pressure from production to implant module for insufficient production time in case of equipment down.

4. Cost of damaged WIP (Work In Process) during the equipment malfunction. This category would include the clean up cost of these mess to prevent contamination to other product.

5. Safety of the Staff working on the equipment during millennium Crossover is in jeopardy.

6. No manpower available during holiday. Without proper awareness program the employee may not want to work during millennium crossover and cause insufficient manpower to operate, handle, prevent any incident that might happens.

With the full-blown analysis on the internal factor, the equipment under Implant Module, Implant module not just prevent all the risks mentioned above but also achieve the benefits as follow :

1. It gave CSM and Implant staff confident that they would pass year 2000 without any problem.
2. The decision made on upgrade based on system analysis yield the reduction of upgrade cost significantly from USD 1.2 million to USD 8,000 for Implant module.
3. In the operation Level, this would give Implant Module better resources allocation to implement and handle the crisis that might happens. Since the impact are manageable, the resource that need to spend to fix the problem would be greatly reduced. This save a lot of manpower, money, tools and equipment for implant module to concentrate on preventive not reactive.

However, most of the preventive action is necessary to prevent from the external factors, facilities, since CSM has no control over the external factors. A well planned scheme that develop from the module representative, including Implant Module, to cover all the aspects of the interaction of facilities to the production equipment would dramatically reduce the impact of the organization business operation. In CSM case, the plan was audited by CSM's partner and customer, Hewlett-Packard. This would also ensure the recognition of the effort in reducing risks is up to the international standard in the organization level.

The benefits that CSM achieving from accredited 'Year 2000 Ready' status and 'Strong Contingency Plan' is unable to quantify. However, it can be qualify as competitive advantages as:

1. Ensure No Operation Interruption – By having all of the plans ready and there is actually no production at the crossover, this would prevent the operation

disaster. This would allow CSM to concentrate in fixing the problem only. Isolating the problem the key effort. Implant module would be able to control the damage and prevent other system to damage the Implant equipment.

2. Risks Reduction – With the contingency plans, the risk involve in the operation and safety are greatly reduced. The chance that can cause the overall system breakdown is minimized, which also helped individual system, which help to reduce the time for solving the problem as well.
3. Perceived CSM's Image – Customers would greatly appreciate the effort in business risk reduction. Hence, the trust in the production capability would also benefit the overall CSM's business.
4. Met International Recognition Standard – This achievement is one of the standard that CSM has met so far. At the moment CSM has achieve ISO9002, ISO1400, Y2K Ready and QS9000 is on the way. This will build confidence for customers that CSM has met all of the international standards and capable of providing services at this standard. Internal staff included Implant module would benefit from cross functional work experience.
5. Technology Partner willing to proceed in Strategic Alliance (eFAB) – This is another key effort to build the Semiconductor data Communication standard in this Industry. With the Year 2000 Ready status, which is the key concern in the Information Technology world, the progress in interfacing the communication system is rapid. Our Partners, Lucent Technology and Hewlett-Packard are expecting us to meet their standard before any interfaces take place.
6. Staff are trained to handle new Implementation – The continuous improvement is one of CSM's philosophy. By keep implementing new standard the employee will gain the experience in handle the international project and response faster.

7. Ensure 'On-time Shipment Date' (OSD) – OSD is the key to increase the profit margin of the company. There are many ways to increase the profit margin, however, the easiest way is to increase the product price. In real world this is difficult to achieve. Since the customer will not pay for higher price. But in Wafer Fab, the depreciation of product is dramatic, therefore, shipment on-time is greatly benefit the customers. Hence they willing to increase the price for the same product. By eliminate the Y2K effect (by have no production) in the OSD scheme, the product price will not damper.
8. No Damage to Production WIP – This benefit is similar to the previous benefit. The difference is this benefit is to the production planning directly. In normal case, the loss in production WIP due to quality problem would require the production to rush the specific product to the customers. This would result in great cost incur to that product, which eventually effect other production line as well.
9. Improve Relationship with the Y2K Service Providers – Y2K service providers are trained to handle such requirement in developing the technical solution in the specified time line. This would benefit the organization in long term to rely on such capability. Implant module also gained the tighter relationship and support from the vendors.
10. Reduction in Implementation Cost – After full analysis in Implementing Y2K Compliance, the selection in upgrade only necessary system has greatly reduce the cost of upgrade. In Implant area the correction cost is reduced from full upgrade \$1.2 million to \$8,000.

## **Recommendation**

There are two areas that Implementing New Change to organization can be improve.

1. Organization - The long term strategic growth of CSM is necessary to adopt the international standard to reduce any trade barriers that might occur. As per recommendation from Hewlett-Packard about the Disaster Recovery Plans (DRPs), is

another challenge for CSM to meet the international standard. Actually, it is also a good practice that the organization should have the plan to handle such Disaster. However, the determination of the likely disaster is necessary. CSM need to study the possible disaster that suit to this region. This is because the disaster that happens in USA and Taiwan may not happens in Singapore. On the other hand, the risk that Singapore expose is not the same as in Taiwan. With the knowledge and experience in the implementation and Contingency Plan for Year 2000 Project would greatly reduce the time for the organization to prepare for other disaster recovery plans.

2. Implant Module – The success of implementing Y2K compliance to implant equipment have gave the new understanding of how the date are involved in the system time calculation. And also the development of contingency plans would lead to further enhancement in these areas:

2.1 New Centralize Data gathering system – Due to the cost constraint during the Y2K implementation had limited the choice to upgrade this system to handle the data from 6 implanter machines. With this system the data tracking, monitoring would be more efficient and allow process engineer to interpret the data on real time basis to reduce the exposure of any quality problem.

2.2 Disaster Recovery Plan – Internal disaster might happens anytime, for instance small fire in maintenance area, and Implant module do not have the procedure or contact person in place. The contingency plan would allow the problem to resolve before the real Fab evacuation, which mean a lot of product would be damage and safety are in jeopardy.