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May 29, 2007

United States Nuclear Regulatory Commission
Attn: Document Control Desk
1 White Flint North
11555 Rockville Pike
Rockville MD 20852

Re: 2006Annual Report for University of California Davis/ McClellan Nuclear Radiation Center, Docket No. 50-607, License No. R-130

To Document Control Desk:

Attached is the 2006 annual report for the McClellan Nuclear Radiation Center, submitted in accordance with the reporting requirements of the Technical Specifications document MNRC-0004-DOC-13 paragraph 6.7.1.

Thanks and Regards,

Robert G. Flocchini PhD
Facility Director
McClellan Nuclear Radiation Center

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NRR

UC DAVIS

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McCLELLAN NUCLEAR RADIATION CENTER

2006

ANNUAL REPORT

Docket Number 50-607
License Number R-130

1. Introduction

The University of California, Davis McClellan Nuclear Radiation Center (MNRC) consists of a research reactor and associated radiography and positioning equipment. This MNRC Annual Report is published each year in support of the license provided by the United States Nuclear Regulatory Commission (NRC). The aforementioned license is for the operation of a steady-state TRIGA™ reactor with pulsing capability.

It is the intent of this document to provide information relevant to the safe operation of the UCD/MNRC. A brief description of the MNRC facility and administration is followed by operational events and health physics information concerning this facility during CY 2006.

2. UCD/MNRC Facility Description

The UCD/MNRC is located on the McClellan Industrial Park site; the reactor is housed in Building 258. The McClellan Industrial Park site is approximately 2600 acres, located eight miles northeast of Sacramento, California.

The UCD/MNRC facility is a three level 14,720 sq. ft. rectangular-shaped enclosure that surrounds a 2 MW research reactor. The UCD/MNRC provides four neutron beams and four bays for radiography. All four bays are capable of using radiography film techniques, but Bays 1 and 3 will normally use electronic imaging devices. Space, shielding and environmental controls are provided by the enclosure for neutron radiography operations performed on a variety of samples. Adequate room has been provided to handle the components in a safe manner.

In addition to the radiography bays, the UCD/MNRC reactor also has several in-core facilities ranging from a pneumatic tube system to a central irradiation facility.

For more detailed information on the UCD/MNRC project, the reader is referred to the UCD/MNRC Safety Analysis Report.

3.0 UCD/MNRC Administration

UCD/MNRC Organization. The UCD/MNRC is licensed by the Nuclear Regulatory commission (NRC) to operate under the provisions of operating license R-130.

The University of California Regents have designated the Chancellor at UC Davis to be the license holder. The UCD Chancellor has in-turn delegated the Vice Chancellor for Research to be the licensee of record.

The UCD/MNRC is under the direction of the UCD/MNRC Director, and reports to the Vice Chancellor for Research.

4.0 Facility Modifications (Section 50.59 of 10CFR Part 50), and experiments.

The 50.59 review performed in 2006 did not involve changes to either the Technical Specifications or the Safety Analysis report, but did/will require changes to facility or system drawings. As a result the 2006 50.59 was classified as Class III Facility Modification.

Facility Modification Number	Date Opened
FM-III-06-01 Replace AC-2 Summary: Replace AC-2 with a new unit.	3/3/06

5.0 New Approved Experiments

1. BBU-47 Radiography authorization

6.0 Licensing and Regulatory Activities

6.1 NRC Items

a. Two Senior Reactor Operators were re-licensed in May.

b. The Nuclear Regulatory Commission performed two inspections: 1-3 August, and 27-30 November, 2006.

6.2 Nuclear Safety Committee (UCD/NSC)

a. The annual NSC audit of the UCD/MNRC was conducted during the month of December.

b. Two NSC meetings were held: 12 June, 2006 and 15 December, 2006 at MNRC

7.0 OPERATIONS

Reactor Operations performed troubleshooting and analysis throughout the year to determine the cause of, and correct, various Alerts/Alarms that resulted in callbacks. These actions continue since not all occurrences have been eliminated. Note that McClellan Park renovations are ongoing and loss of utility services occur during those renovations.

OPERATING HISTORY:

TOTAL OPERATING HOURS THIS YEAR:	1578.93
TOTAL OPERATING HOURS:	37967.87
TOTAL MEGAWATT HOURS THIS YEAR:	2256.36
TOTAL MEGAWATT HOURS:	53082.50
TOTAL NUMBER OF PULSES PERFORMED THIS YEAR:	5
TOTAL NUMBER OF PULSES PERFORMED:	473

UNSCHEDULED REACTOR SHUTDOWNS and NOTED PROBLEM AREAS:

In 2006, there were eight (8) unscheduled shutdowns at the MNRC reactor facility. The following is a list of the unscheduled shutdowns:

2006 REACTOR SHUTDOWNS

Type of Failures	Total Number
CSC	1
Other	7
TOTAL NUMBER OF SHUTDOWNS IN 2004	8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CSC	0	0	1	0	0	0	0	0	0	0	0	0
Other	2	0	0	0	0	2	0	0	1	0	1	1
Notes	1, 2		3			1, 2			4		1	5

Notes:
1: Water Main break resulting in loss of utility services
2: Shim 1 drop
3: CSC Hi-Res monitor locked up
4: Cooling Tower fan grounded out
5: Bay door/shutter interlock relay trip

January

1. There were two unplanned shutdowns in the month of January.

   a. On 1/23, the reactor was shutdown due to a water main break in the supply header upstream of the facility. Water service was restored after several hours.

   b. On 1/27, the reactor was shut down to troubleshoot shim 1 rod drop during level adjustments. See paragraph 3 below.

2. There was one callback to the facility in January. The CSC display showed a locked in Magnet power supply voltage and Magnet power warning locked in. The alarms would not clear. The alarms were acknowledged. The control rod magnet power supply switch/breaker was found in the off/tripped position. The breaker/switch was reset, and the locked in alerts/alarms on the CSC display cleared. Operations and Engineering personnel were unable to assess the exact cause of the open breaker/switch, but it appears to be related to the power supply loss/spikes experienced over the holiday shutdown period.

3. Shim 1 control rod dropped from approximately 800 units during a rod leveling. The reactor was shut down, Operations personnel found the control rod dash pot mechanism was hanging up near the top of rod travel. This caused the rod to drop off as the drive motor pulled the control rod magnet apart during withdrawal. The control rod dash pot sleeve was lubricated with silicon spray, and the rod shaft was cleaned to minimize friction. This is a known problem with the dash pot assemblies.

February

1. There were no unplanned shutdowns during the month of February.

2. There is a potential that circuitry in the UPS, or possibly in the DAC is becoming unstable. We have experienced several large building power transients lately that might be contributing factors. Operations personnel are monitoring the instrumentation for any signs of instability or malfunction. This item will continue to be a focus of the Operations and Engineering staff.

3. There were two callbacks to the facility from 1 February to 28 February. The CSC display showed a locked in Demineralizer System low flow alarm, with 6 gpm displayed on the status monitor. The alarm was cleared by starting pumps and then securing. Flow returned to an indicated 0 gpm.

4. The demineralizer system is exhibiting unusual behavior. There were three instances where the system indicated flow when there were no pumps operating, with conductivities showing higher than expected values. These problems resolved by cycling pumps. The electronics engineer has investigated and can not find a problem with the system. One potential cause is water incursion due to a roof leak above the demineralizer cage area. Operations personnel will monitor the system, and continue investigation.

March

1. There was one unscheduled shutdown in the month of March. On 3 March, the CSC Hi-Resolution monitor locked up. The reactor was shutdown. The original monitor was repaired and swapped back in.

2. There is a potential that circuitry in the UPS, or possibly in the DAC is becoming unstable. We have experienced several large building power transients lately that might be contributing factors. Operations personnel are monitoring the instrumentation for any signs of instability or malfunction. This item will continue to be a focus of the Operations and Engineering staff.

3. The demineralizer system is exhibiting unusual behavior. There have been instances where the system indicated flow when there were no pumps operating, with conductivities showing higher than expected values. These problems resolved by cycling pumps. The electronics engineer has investigated and can not find a problem with the system. Operations personnel will monitor the system, and continue investigation.

4. There were 7 callbacks to the facility in the month of March.

   a. One callback was due to multiple alarms. See the anomaly report.

   b. One callback was due to a UPS fault. The fault cleared upon acknowledgement.

   c. One callback was due to a Rod Withdrawal Prohibit message, which cleared upon acknowledgement.

   d. Four callbacks were due to Magnet Power Low and/or Demineralizer Pump Low Flow. Most alarms cleared upon acknowledgement, but on one occasion rebooting the CSC computer was required to clear the message.

April

1. There were no unscheduled shutdowns during the month of April.

2. During the period, Reactor Operations personnel were called back 8 times.

   a. One inadvertent alarm the via the Command Post line – reset.

   b Two Demineralizer flow low alarms- reset by cycling pumps.

   c. Two UPS fault alerts – reset upon acknowledging.

   d. Two Rod Withdrawal Prohibit alerts – reset upon acknowledging.

   e. One Security System fault – Reset.

May

1. There were no unscheduled shutdowns during the month of May

2. There were 15 callbacks to the facility in the month of May.

   a. Four Demineralizer flow low alarms – reset by cycling pumps.

   b. Two Demineralizer flow low alarms and Low Magnet Supply alarm- reset by cycling pumps and acknowledging alerts.

   c. One Low Magnet Supply alarm – reset upon acknowledging.

   d. Eight Rod Withdrawal Prohibit alerts – reset upon acknowledging.

June

1. There were two unscheduled shutdowns in the month of June.

   a. On June 6, the reactor startup was aborted on the way to 1.5 Megawatts due to control rod Shim 1 falling off during withdrawal. The reactor was shutdown to investigate cause. The dashpot follower sleeve was stuck in the down position, causing the control rod magnet to decouple during withdrawal. The dashpot was disassembled, lubricated, and reassembled. Rod operability checks for Shim1 were satisfactory, with a rod drop time of 0.39 seconds.

   b. On June 28, the reactor was shutdown due to a loss of building water pressure. A contractor broke the water main while working at another location on McClellan Park, causing a loss of the water supply header.

2. There was 1 callback to the facility in the month of June.

   a. One Demineralizer flow low alarm – reset by cycling pumps and rebooting the CSC computer

July

1. There were no unscheduled shutdowns in July.

2. The building water pressure dropped to below 35 psig, the pressure required for operations at 1.5 MW and higher. This resulted in operating at less than 1.5 MW for several days. McClellan Park experienced several total loss of water header pressures over one weekend due to construction in July. Sacramento Municipal Water District personnel monitored supply pressure to the building backflow preventer and pressure regulator manifold, which was satisfactory. Per the water district personnel, cycling the pressure several times in one day causes sediment and rust to break free from the piping and affect regulators. Facility personnel adjusted the building water supply pressure regulator to raise building water pressure back up to the pressure noted at the outlet of the header supply regulator. Measured pressure at ECCS-GA-1 is now greater than 35 psig, and operations at 1.5MW and above are permitted.

3. There were 2 callbacks to the facility in the month of July.

   a. One UPS fault, which cleared upon acknowledgement, but activated again several minutes later. The second alarm cleared on acknowledgement.

   b. One Rod Withdrawal Prohibit alert, which cleared on acknowledgement.

August

1. There were no unplanned shutdowns during the month of August.

2. There were 2 callbacks to the facility in the month of August.

   a. One UPS fault, which cleared upon acknowledgement.

   b. One Rod Withdrawal Prohibit alert, which cleared on acknowledgement.

September

1. There was one unscheduled shutdown in the month of September. On September 8 the cooling tower fan failed during reactor operations. The reactor was shutdown to install new conduit and wiring supplying the cooling tower fan motor.

2. There were 2 callbacks to the facility in the month of September for security system issues. Issues resolved by replacing a faulty sensor.

October

1. There were no unscheduled shutdowns or callbacks during the month of October.

November

1. There was one unscheduled shutdown in the month of November.
   On 11/30, MNRC experienced a total loss of building water. A contractor broke the water main near the facility. This is a recurring issue at McClellan Park, as this is the third occurrence this year to affect operations at MNRC. The McClellan Park property management company is working in conjunction with the City of Sacramento to upgrade various services, and there are quite a few contractors working in the area with heavy machinery.

2. There were 5 callbacks to the facility in the month of November. All 5 callbacks were on the same day, and all were for the Rod Withdrawal Prohibit alert on the CSC. MNRC personnel have been in contact with General Atomics to try to isolate the problem. Monitoring and troubleshooting will continue until this problem is resolved.

3. Following shutdown on 2 November, the fire alarm system activated, and the fire water header pressurized. The alarming signal was a Zone 6: Duct Detector. No cause for the alarm was found by either MNRC personnel or Sacramento Metro Fire Department personnel. The probable cause was due to scheduled preventive maintenance that MNRC and a contractor performed earlier in the day, where the Semi-Annual HVAC inspection included cleaning, operational checks, and restoring the furnace sections of the HVAC units to service. Subsequent furnace operation could have burned enough accumulated dust within the furnace itself to set off the duct detector. No further problems have been noted.

December

1. There was one unscheduled shutdown in the month of December.
   On 12/20, MNRC experienced an External 1 and External 2 scram. Both the Bay 4 door, and its shutter indicated open. Investigation revealed that the radiographer had "bumped" the door closed to prevent damaging experiment sensing lines and cables that were strung through the door to test equipment in the staging area. Bumping the door closed until the "Door Shut" indication energized did not position the door far enough to pick up the External 1 and External 2 limit switches. When the shutter was opened, the reactor scrammed. The experiment cables were rerouted, and the door shut completely, picking up all three limit switches and energizing their relays. Radiographers were cautioned to insure the bay doors are completely shut prior to opening the shutter.

2. There were 5 callbacks to the facility in the month of December.

   a. 4 callbacks were for the Rod Withdrawal Prohibit alert on the CSC. MNRC personnel have been in contact with General Atomics to try to isolate the problem. Monitoring and troubleshooting will continue until this problem is resolved.

   b. 1 callback was for a UPS fault warning on the CSC which cleared upon acknowledgement.

7.2 ANOMALIES:

During 2006, there were 2 reported anomalies at the MNRC facility. The specifics are listed below by month.

February

There was one reported anomaly during the month of February. From the anomaly report, dated 2/9/06:

Describe the reactor conditions prior to the anomaly and what occurred during the anomaly: Upon starting the Reactor CAM in the morning, it was noted that the Reactor Room Ventilation did not shift completely into recirculation mode, as it normally does when it alarms as part of the start-up cycle. AC-1 went off and its damper closed, but none of the other dampers shifted. Resetting the CAM Alarm Reset at the TCP restored the system to normal. It was initially thought that the condition was caused by immediately resetting the alarms at the CAM upon energizing, resulting in the system not fully going into recirculation before the alarms were cleared.

What actions were taken to correct the anomaly:
A CAM alarm was induced manually to verify proper operation as per OMM 5620. This did not happen, and reactor operations were suspended pending investigation. Upon investigation by the electrical engineer, the problem was determined to be between the CAM and the actual damper controllers. The only known system in between is the Temperature Control Panel (TCP) in the control room. The EE first instruction was to push the "RX ROOM EXH DAMPERS OVERRIDE" button, which appears to have reset all relays and return the system to normal operation.
Preventative maintenance item 5620-M1 was performed satisfactorily, twice.
Normal reactor operations were resumed.

What corrective actions are needed to prevent this anomaly from reoccurring in the future:
All operators were briefed to ensure they understand that turning on the Reactor Room or Iodine-125 CAM should cause the reactor room ventilation to shift completely into recirculation, resulting in all associated indicating and warning lights on the TCP. If this does not happen the cause should be investigated immediately before the reactor is operated.

March

There was one reported anomaly during the month of March. From the anomaly report, dated 3/23/2006:
Subject: UCD/MNRC Facility Loss of site power.

On 3/22/06 at 1715 hours, facility personnel were called back to the facility in response to an alarm/warning received by the UC Davis Police Law Enforcement Desk. During the time it took to arrive at the facility, an additional call back request was received from the fire/security alarm company.

Upon arriving at the facility, it was apparent that the facility had suffered a partial loss of power based on initial indications of some lights on and others failing to energize. Initial investigation found that the breakers for fan EF-3 had tripped (trip free position) and no other obvious problems were noted. The EF-3 breakers were reset and closed, several seconds later these breakers again tripped open. The emergency propane generator was also noted to be running. The CSC console was de-energized upon arrival to the facility.

The Reactor Supervisor was notified of the above occurrence and also returned to the facility. At approximately 1930 hours the facilities 480/208/120 transformer made unusual noises and it rapidly became apparent that the facility had lost one (1) phase of the three (3) phase input power. A check of the buildings input power confirmed that one phase read 480 VAC, another phase read approx. 208 VAC, and the third phase read significantly <100 VAC. The Reactor Supervisor opened the main input breaker to building thus securing all off site power to the UCD/MNRC.

The Sacramento Municipal Utilities District (SMUD) was called to inquire about the power loss. At approx. 2030 hours, unusual noises were heard coming from the high voltage switch and transformers between buildings 248 and 258. At 2100 hrs SMUD completely de-energized this section of the power grid and upon inspecting the high voltage switch assembly discovered that one of the high voltage connectors had suffered severe damage.

Shortly after facility power was secured, it was noted that personnel were unable to exit via the personnel gates as they would not open.

At about 2205 3/22/06 a security alarm sounded apparently sensing a failure in the telephone lines.

UCD/MNRC personnel (Senior Reactor Operators) were on site throughout the entire time the site power was lost, making frequent tours of the facility.

Between the hours of 2230 3/22/06 and 1015 3/23/06 SMUD personnel replaced the failed high voltage switch assembly and enclosure.

At 1015 3/23/06 power was restored to the UCD/MNRC facility and the main input power breaker was closed. Immediately the fire alarm systems sounded (both water and halon), the normally dry fire mains began filling with water and the halon bottle beneath the radiography control room discharged. This was in addition to the CSC console rebooting and the alarms from the console adding to the noise.

The Sheriffs department responded to the facility with at least 5 cars and 6 officers as a result of the alarms.

Alarm maintenance personnel assistance was requested to restore the systems to normal and to troubleshoot why the systems responded the way they did on restoration of power.

At about 1300 hours, all facility loads were restored with the exception of EF-3, the Bay 2 radiography console, and the Alpha-Beta counter in the HP lab. All Pre-start and start-up checks were completed SAT and the Reactor Supervisor granted permission to restart the Reactor.

Actions to prevent future occurrences:

Both the loss of site power and single phase operation due to off-site equipment failure is the responsibility of SMUD and there is nothing that UCD/MNRC personnel can do to prevent such occurrences in the future.

Investigation found that the fire alarm panels had totally depleted back up batteries and these have been replaced. In addition, the batteries in the security panel were replaced as they were found to be at least 5 years old. All of the batteries had voltage checks performed on them during normally scheduled maintenance, but not load tested. The Building Manager and Security Manager will ensure that the back up batteries will be inspected, checked and load tested during periodic planned maintenance and replaced on a 3-5 year cycle for all fire and security systems. It should be noted that neither the self-test function nor the charging circuits for these systems indicated any problems with the batteries.

The alarm system contractor is investigating the possibility of including a surge suppression circuit to the fire panels to prevent alarm signal generation on re-energizing the panels.

7.3 MAINTENANCE OTHER THAN PREVENTIVE:

January

1. PV-38 packing was adjusted after leakage discovered during inspections.
2. Replaced a broken blower drive belt on AC-4
3. Replaced a broken lock wire found during inspections on PV-26
4. Swapped south camera for east, east to manufacturer for repair. A new camera was subsequently installed in the south camera housing.
5. Lubricated Shim 1 control rod dashpot. Operability checks performed sat. Drop time 0.39 seconds.

February

1. Troubleshoot and repair Bay 2 rollup door.
2. Troubleshoot and repair failure to shift on alarm during test in the Reactor Room Ventilation system
3. Replaced DAC cabinet fan
4. Replaced photohelic gage following failure of weekly "Hi flow" CAM checks in the Bay Continuous Air Monitor (CAM).

March

1. Shifted from north to south resin bank due to depletion of resin.
2. T/S and repair wiring failure causing over current conditions on the Bay 1 Staging Area East crane.
3. Performed Bay 2 shield and shutter interlock checks and ripcord scram checks following mainline contactor replacement in Bay 2 console.
4. Replenished and replaced Halon bottle for Control Room fire suppression system following discharge during power transient upon restoration of power to facility. Replaced all backup power batteries in the Fire Suppression and Alarm systems

April

1. Replaced all three main power leads from the cooling tower fan controller to motor to correct low ground readings.
2. Replaced EF-3 blower motor with a new motor to correct low ground readings. Ran new wiring from the controller to the motor. Ground readings sat.
3. Replaced the 12 Lead Acid batteries in the Corby security system due to age/failure to charge
4. AC-2: Removed old and installed new 7 ½ ton air conditioner/heater unit per FM-III-06-01.
5. Replaced failed CSC Hi-Res monitor with spare. Old unit lost cursor and video output, zero output on DC power supply.

May

1. Replaced both EF-1 and EF-2 drive belts.
2. Replaced Reactor Room Ventilation HEPA filter after installed filter failed annual DOP test
3. Replaced south reactor tank light.

4. Reset Low Source Level RWP set point on the NM-1000 to attempt eliminating spurious RWP messages after Rx S/D.
5. Replaced on service He supply bottle.
6. Replaced poly-flo tubing for AC-3, 4,5,6,7 Flow Proof switch sensing lines
7. Repaired broken latch and replaced the burned out brake solenoid on the facility front gate mechanism.
8. Equipment Room Rad-vac failed annual DOP test. New vac to be assembled and tested at a later date
9. Demineralizer area RAM failed weekly source check. Recalibrated.
10. The Reactor Room CAM Iodine channel failed the weekly source check. Recalibrated.

June

1. Replaced failed Fire Suppression water flood system check valve
2. Disassembled, lubricated, and reassembled Shim 1 dashpot follower. Op checks sat, drop time 0.39 seconds
3. Replaced failed condenser fan motor and blades on AC-6
4. Contractor repaired cracked copper elbow in the condenser and recharged the unit on AC-6
5. Adjusted sheave rollout on EF-3 to equalize tension on the two belts, replaced two failed belts on unit

July

1. Replaced AC-1 condenser fan motor, blades, and run capacitor
2 Removed, inspected, cleaned, and replaced the Heat Exchanger secondary inlet strainer to resolve a drop in differential pressure.
3. Replaced 4 main line contactors in the Bay 4 crane controller
4. Troubleshot and repaired HV-1. Repaired damaged 110 VAC control wiring at the connector block.
5. Drained and repaired a leaking seam in the Secondary Cooling Tower.
6. Replaced the failed left foot detector and recalibrated the Equipment Room exit Hand and Foot Monitor

August

1. Repaired AC-3 condenser drain pan piping.
2. Replaced reactor south tank light bulb.
3. Replaced EF-3 in-line pre-filter due to loading.
4. Replaced worn drive belts on HV-1 blower.
5. Replaced damaged weather stripping on HV-1, 2, and 3.

September

1. Replaced drive belts on EF-3
2. Replaced HV-3 fan drive belt
3. Replaced master key switch in the Bay 2 Interlock Box
4. Replaced grounded cooling tower fan motor power supply wiring and conduit
5. Replaced faulty Security System sensor in Zone 3
6. Replaced the failed CAM room A/C unit with a 12000 BTU unit

7. Replaced master key switch in the Bay 1 Interlock Box
8. Swapped Reactor and Bay CAM monitors, both operating sat.

October

1. MNRC completed the annual maintenance shutdown cycle in the month of October. Included in the maintenance are the following reactor related items:

a. Performed a "lift check" of all elements to verify freedom of movement. Two elements were not check (M-1 and M-5) due to ECCS chimney interference. The Instrumented Fuel Elements were also left in place.
b. Annual fuel inspections were performed satisfactorily. No abnormalities were found.
c. Annual Control Rod and Annual Transient Rod inspections were performed. Based on issues reported at another research reactor, connector fasteners were checked for problems. None were found.
d. Control Rod Operability checks, Indication Linearity checks, and Scram Times were checked. No problems were found. Measured scram times are as follows

Transient Rod:	0.47 seconds	Shim 3:	0.38 seconds
Shim 1:	0.40 seconds	Shim 4:	0.38 seconds
Shim 2:	0.37 seconds	Regulating Rod:	0.39 seconds

e. Rod Calibration measurements were performed with the following results

Transient Rod:	$2.16	Shim 3:	$2.43
Shim 1:	$2.61	Shim 4:	$2.55
Shim 2:	$2.37	Regulating Rod:	$2.63

f. The Shutdown Margin was calculated at $6.06.
g. A Reactor Power Calorimetric was performed following the calibration and change-out of the NPP-1000, with no adjustments required on either instrument detector.
h. At Power scram testing of both nuclear instrument channels was sat. The NM-1000 channel scrammed at 104%, and the NPP-1000 scrammed at 107%.

2. Changed out "North" Demineralizer System expended resin bottles, installed two new bottles, and placed in standby.
3. Determined cause of building and perimeter exterior lighting failure. Replaced security light sensor on the roof.
4. Replaced the "safety edge" hose in the silicon door, and replaced the air/safety switch on the Bay 2 rollup door.
5. Disassembled/reassembled Helium System pressure switch HV-4 to free up sticking mechanism during Helium system pressure switch setpoint checks.
6. Found and repaired a broken wire on the 10 turn potentiometer on Shim 1.
7. Removed CSC computer hard drive, cloned drive, verified cloning successful, reinstalled original drive.
8. Removed DAC computer hard drive, cloned drive, verified cloning successful, reinstalled original drive.
9. Replaced burned out indicator lamp in the Demineralizer Pump #2 motor controller.
10. Rebuilt eyewash station following failure of Quarterly inspection. Included new isolation valve and actuator, and new spray heads.
11. Repaired intermittent power loss to External Perimeter Camera #3. Swapped inputs at quad splitter, found and replaced defective cable.

November

1. Applied new sealant to several seams in the tower to reduce/stop leakage.
2. Replaced EF-2 drive belt.
3. Removed and replaced with new filter housing retaining clips in the F-2 filter housing.
4. Contractor adjusted safety edge limit switch to correct erratic operations on the Bay 2 rollup door.
5. Locksmith replaced stairwell lock core, adjusted back shed locking devices.
6. Replaced AC-3 proof of flow d/p detector and sensing lines.

December

1. Changed out on service Helium supply bottle
2. Repaired leaking condenser on AC-3, recharged unit.
3. Replaced failed igniter on AC-13.
4. Replaced worn pulleys and sheaves on HV-1, 2, and 3.
5. Checked power supply voltages on DISO-64 assembly for troubleshooting RWP alerts, all voltages sat.
6. Troubleshot Bay CAM high particulate reading. Found the Particulate Channel High Voltage set almost double the required value. Source checked sat. Printouts indicate **no** manual reset of high voltage. Returned voltage to correct value, checks sat

7.4 Training

January

1. Operations personnel and Reactor Operator trainees attended 2 sessions in the ongoing Physics/Reactor Theory series. This series is now complete.

February

1. Several Operations personnel took the Reactor Theory and Physics biannual (re)qualification examination.
2. Operations, radiography, and several facility personnel attended Red Cross CPR/First Aid/Safety training in February.
3. All Senior Reactor Operators attended Emergency Plan and Procedures, and recent changes to Emergency Procedures (Rev 2) training.
4. All Senior Reactor Operators attended Normal, Abnormal, and Emergency Operating Instruction training.

March

1. Several operations staff attended a 4 hour Design and Operating Characteristics class.
2. All SRO's attended Regulations and Administration training in preparation for the biannual SRO requalification exam.
3. 3 SROs took and passed the biannual requalification examination.

April

1. All TLD wearers attended the annual ALARA training.
2. All TLD wearers attended training on Radiation Safety Procedures Rev. 16

May

1. Two Senior Reactor Operators were re-licensed by the Nuclear Regulatory Commission.
2. The RSO attended IATA air shipment training.

June

1. Operations personnel attended training on the revision to the Emergency Plan.
2. Operations personnel attended training on the revision to the Control Room Computer procedures.
3. Two Senior Reactor Operators successfully completed their Bi-annual requalification exams.
4. All Senior Reactor Operators successfully completed the Annual Operator's Exam.

July

1. Operations personnel attended training on the latest revision to the Environmental Compliance and Health and Safety plan
2. The RSO attended a California Department of Toxic Substance Control workshop on the new Uniform Hazardous Waste Manifest.

August

There was no scheduled training held in August.

September

1. During the month of September, Senior Reactor Operators attended Fuel/Fuel Handling training

October

1. Radiation Safety Officer/Senior Reactor Operator attended Ludlum Instrument Calibration and Repair class.
2. Two Reactor Operator trainees attended Neutron Irradiator installation training.
3. Six MNRC personnel attended training for PPE for spills and Radiation Survey training.

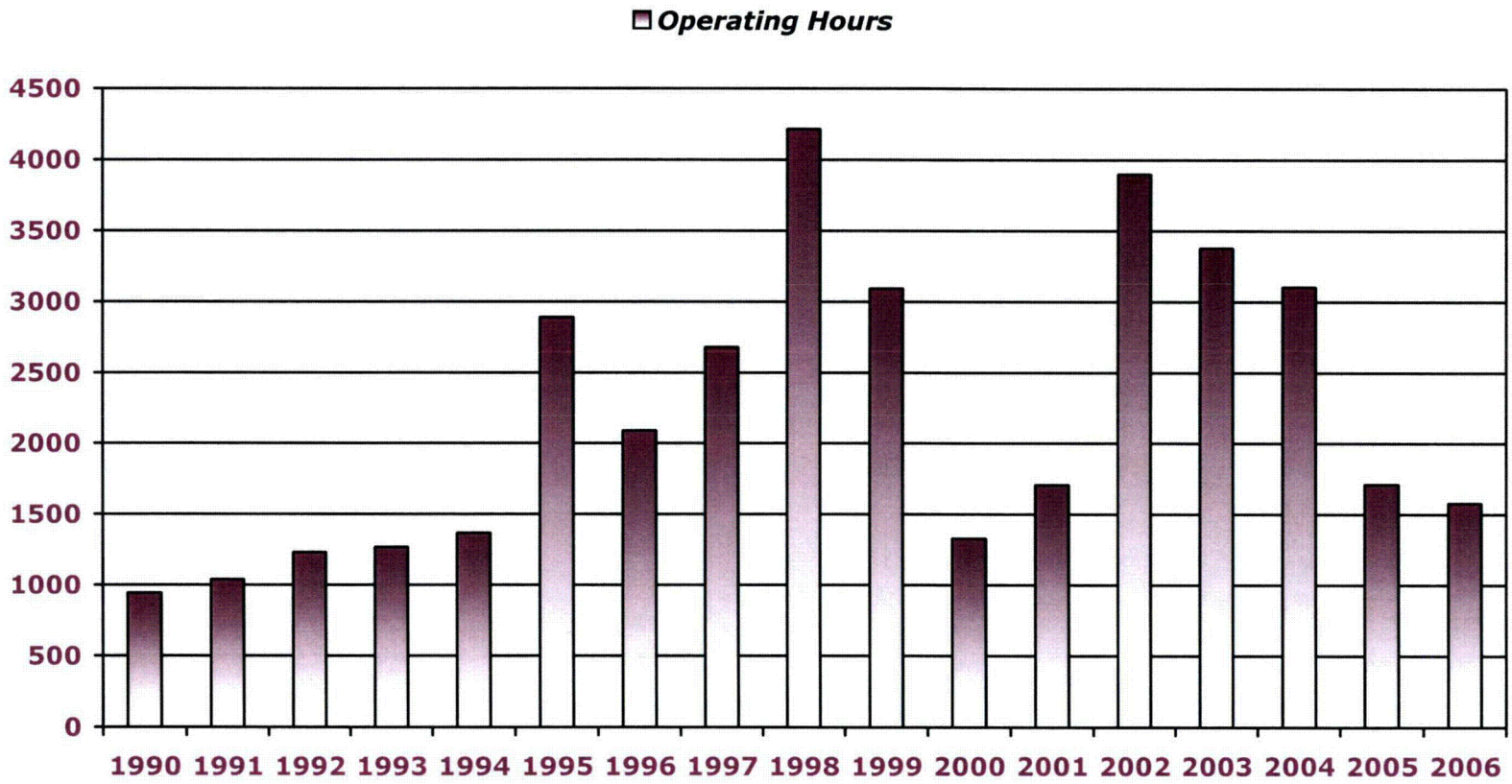
November

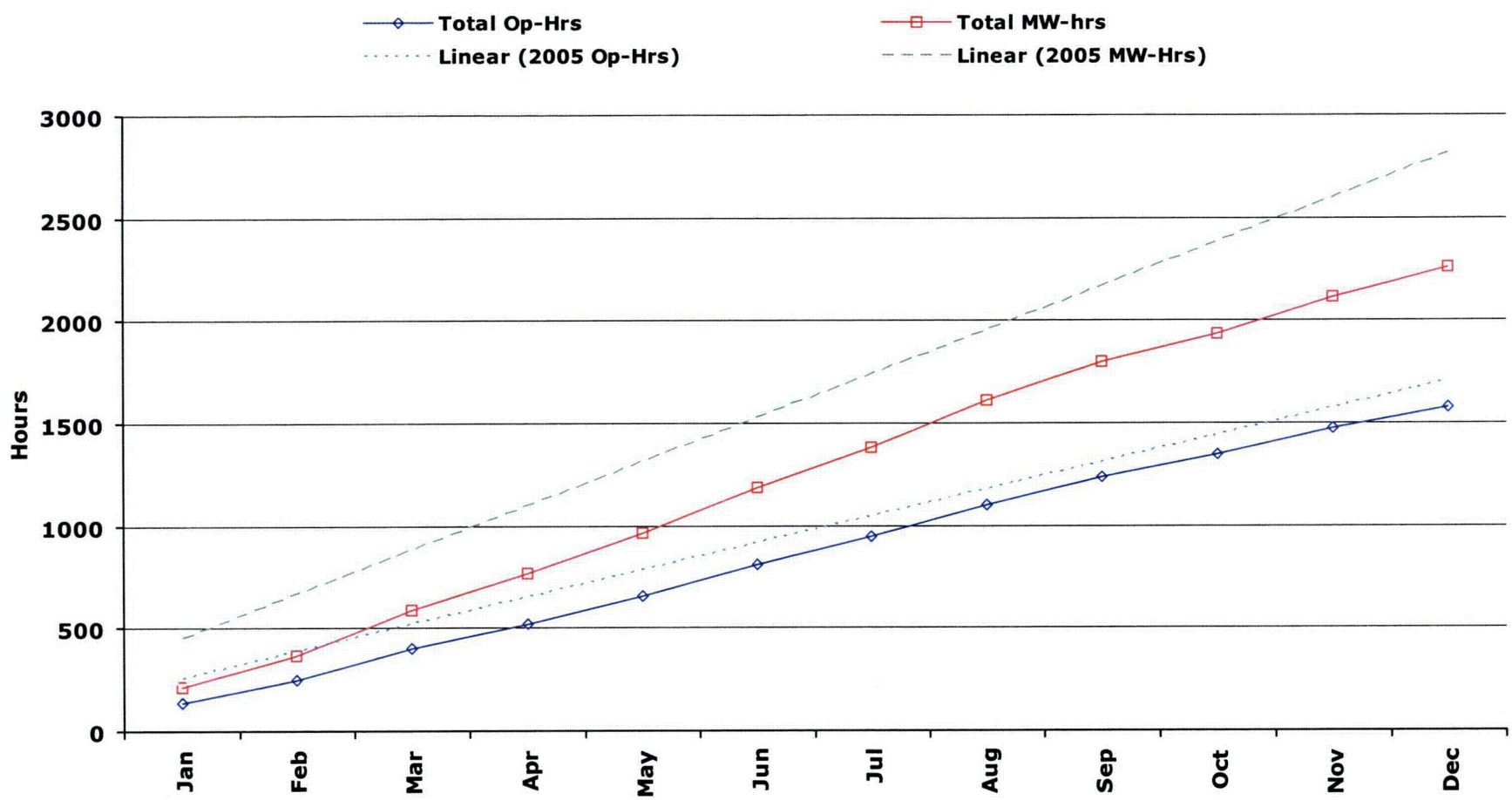
1. MNRC personnel participated in an Annual Security/Radiological drill with various outside agencies.
2. Three Senior Reactor Operators underwent training for reactor pulses and performed reactor pulses for Practical factors refresher.
3. Three MNRC personnel attended training for PPE for spills and Radiation Survey training.
4. MNRC personnel attended training on stairwell contamination and corrective actions.

December

There was no scheduled training held in December.

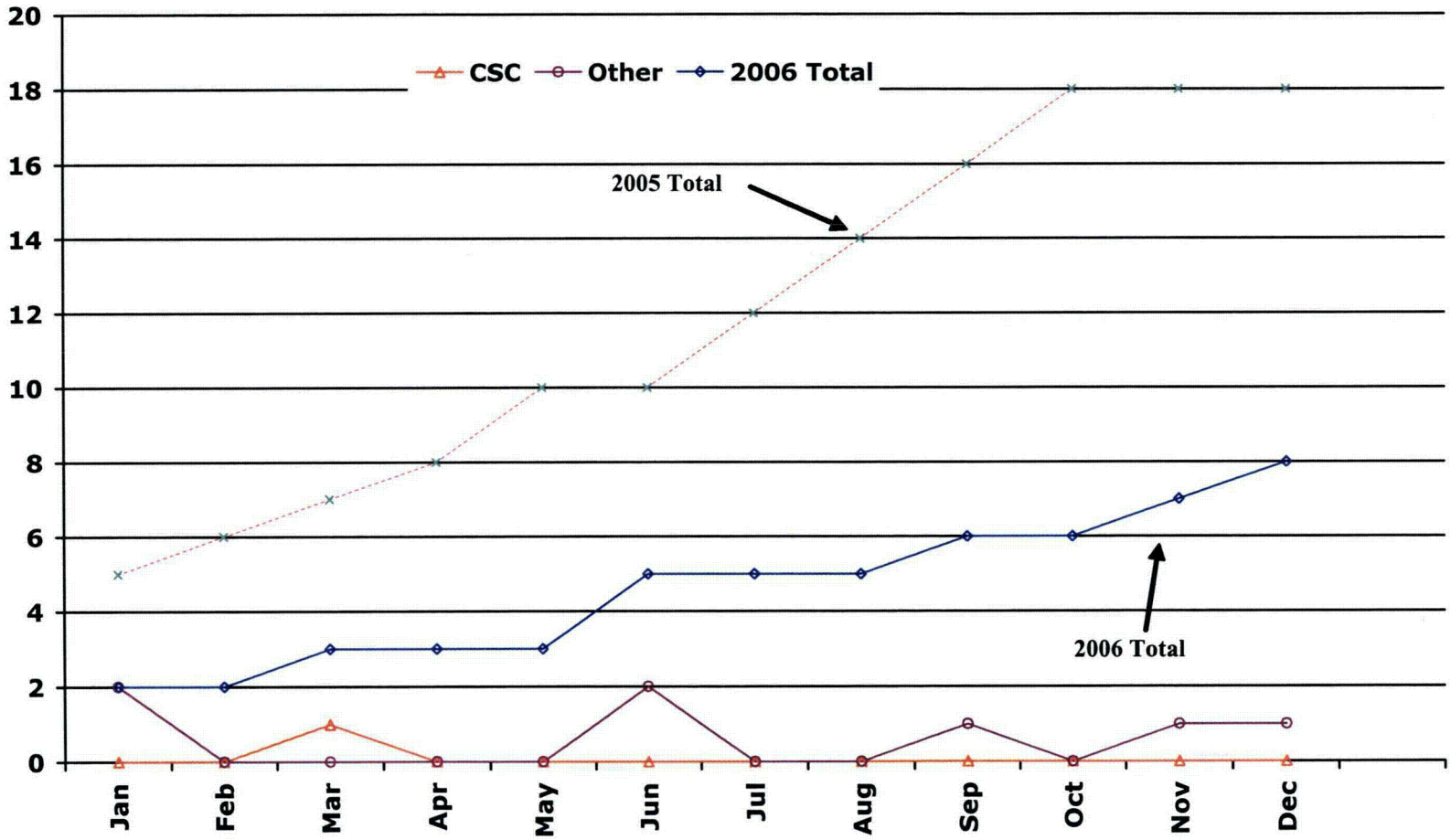
UCD/MNRC Operating History



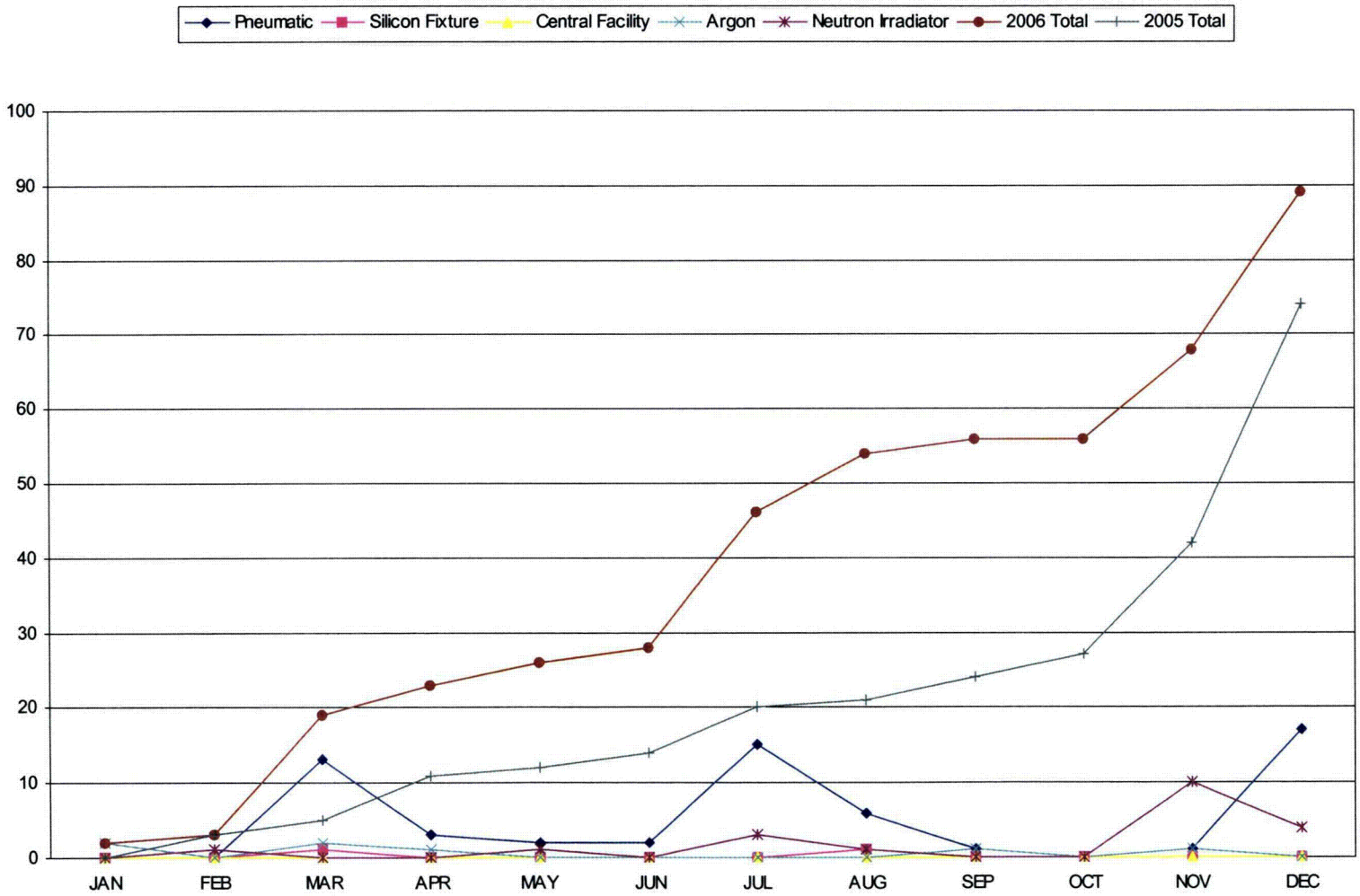


Reactor Hours (2006)

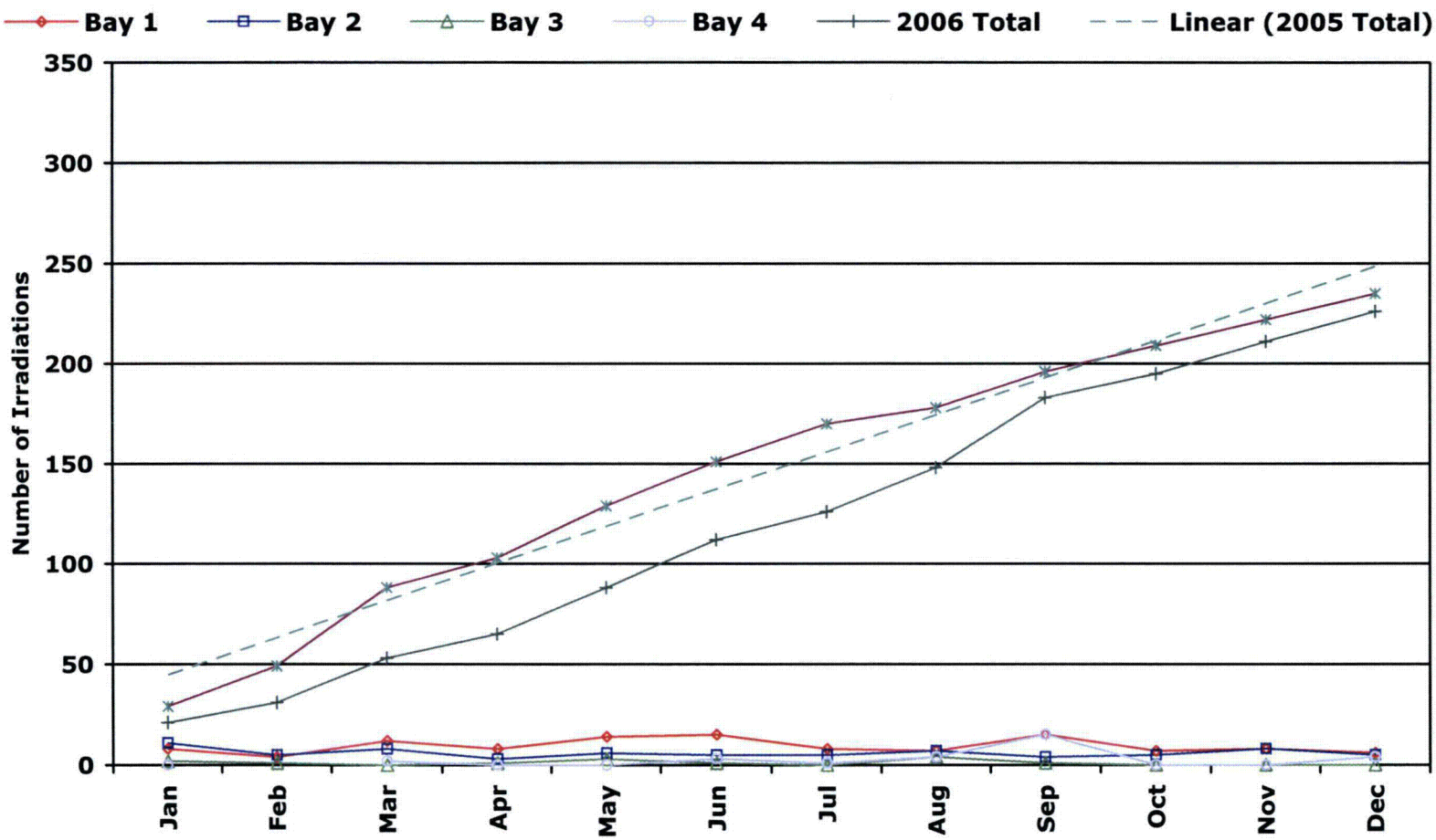
Unscheduled Shutdowns-- Total 2006



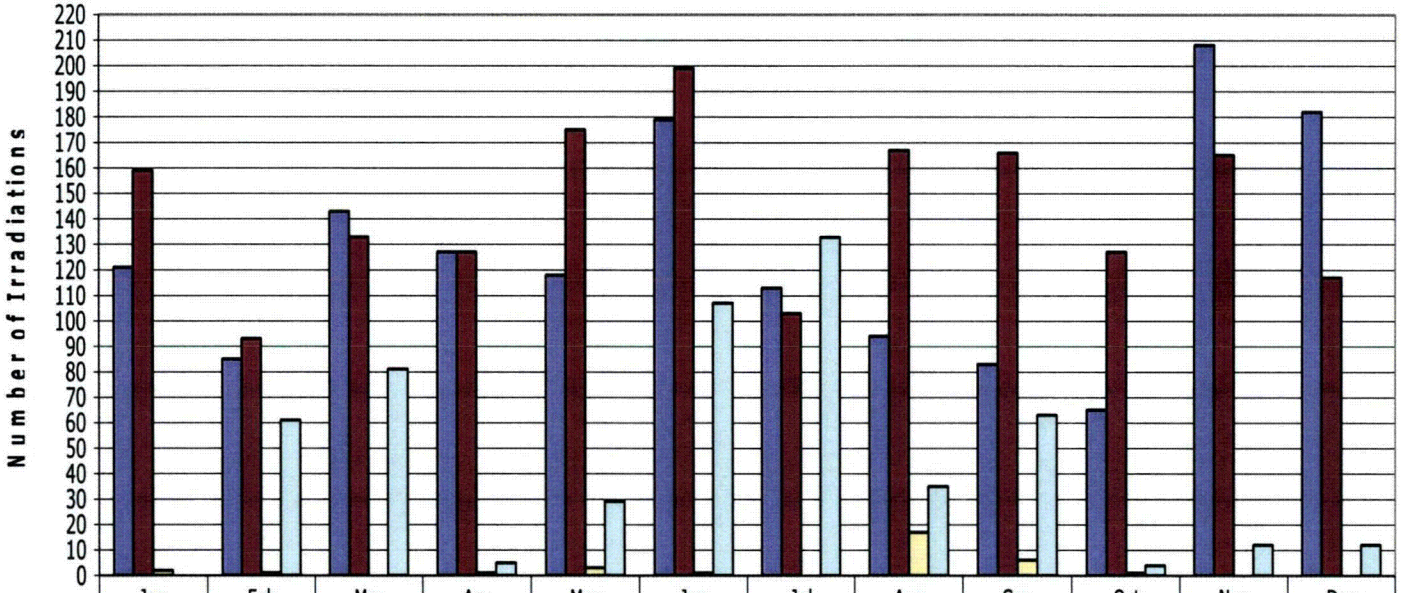
Reactor Tank Irradiation Facilities
Total Number of Irradiations Completed (2006)



Bay Irradiations Completed (2006)



Bay Utilization (Shutter Operations) 2006



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bay 1	121	85	143	127	118	179	113	94	83	65	208	182
Bay 2	159	93	133	127	175	199	103	167	166	127	165	117
Bay 3	2	1	0	1	3	1	0	17	6	1	0	0
Bay 4	0	61	81	5	29	107	133	35	63	4	12	12

Months

8.0 Radioactive Effluents

A summary of the nature and amount of radioactive effluents released or discharged to the environment beyond the effective control of the MNRC, as measured at or prior to the point of such release or discharge, include the following:

8.1 Liquid Effluents

Liquid effluents released during 2006 are summarized on a monthly basis in Table 1 below.

TABLE 1

2006 SUMMARY OF LIQUID EFFLUENTS

ONTH	TOTAL ACT. RELEASED (Ci)	DETECTABLE RADIO-NUCLIDE(S)	SPECIFIC ACT. OF EACH DETECT-ABLE RADIO-NUCLIDE (uCi/ml)	TOTAL ACT. OF EACH DETECT-ABLE RADIO-NUCLIDE (Ci)	AVG. CONC. OF RAD. MATL. AT POINT OF RELEASE (uCi/ml)	FRACTION OF 10CFR20 LIMIT	TOTAL VOL. OF EFFLUENT WATER (INCLUDING DILUENT) RELEASED (gal)
JAN	0	NONE					
FEB	0	NONE					
MAR	0	NONE					
APR	0	NONE					
MAY	0	NONE					
JUN	0	NONE					
JUL	0	NONE					
AUG	0	NONE					
SEP	0	NONE					
OCT	0	NONE					
NOV	0	NONE					
DEC	0	NONE					

8.2 Airborne Effluents

Airborne radioactivity discharged during 2006 is tabulated in Table 2 below.

TABLE 2
2006 SUMMARY OF AIRBORNE EFFLUENTS

MONTH	TOTAL EST. QUAN. Ar-41 RELEASED (Ci)	EST.MAX AVG. CONC. OF Ar-41 IN UNRESTRICTED AREA (1) (uCi/ml)	FRACTION OF APPLI 10CFR20 Ar-41 CONC. LIMIT FOR UNRESTRICTED AREA (1) (%)	EST. DOSE (2) FROM Ar-41 FOR UNRESTRICTED AREA (1) (mrem)	FRACTION OF APPLICABLE 10CFR20 DOSE LIMIT FOR UNRESTRICTED AREA (1) (%)	TOT. EST. QUANTITY OF ACT. IN PART. FORM WITH HALF-LIFE >8 DAYS (Ci)	AVERAGE CONC. OF PART. ACT. RELEASED WITH HALF-LIFE > 8 DAYS (uCi/ml)
JAN	4.25	5.37E-07	2.4%	1.20E-01	0.12	NONE	NONE
FEB	3.61	5.04E-07	2.2%	1.13E-01	0.11	NONE	NONE
MAR	4.16	5.26E-07	2.3%	1.17E-01	0.12	NONE	NONE
APR	3.91	4.94E-07	2.2%	1.10E-01	0.11	NONE	NONE
MAY	4.22	5.32E-07	2.3%	1.19E-01	0.12	NONE	NONE
JUN	2.75	3.47E-07	1.5%	7.74E-02	0.08	NONE	NONE
JUL	2.44	3.07E-07	1.4%	6.86E-02	0.07	NONE	NONE
AUG	2.68	3.38E-07	1.5%	7.54E-02	0.08	NONE	NONE
SEP	2.48	3.12E-07	1.4%	6.97E-02	0.07	NONE	NONE
OCT	1.87	2.36E-07	1.0%	5.28E-02	0.05	NONE	NONE
NOV	2.49	3.14E-07	1.4%	7.01E-02	0.07	NONE	NONE
DEC	1.68	2.12E-07	0.9%	4.74E-02	0.05	NONE	NONE
TOT	36.54	4.66E-06		1.04	1.04	NONE	NONE
AVG	3.05	3.88E-07	1.7	1.04	.09		

(1) This location is 240 meters downwind which is the point of maximum expected concentration based on the worst case atmospheric conditions (see MNRC SAR Chapter 11).
(2) Based on continuous occupancy and the calculation techniques used in Appendix A of the MNRC SAR (Ar-41 at 2.3E-10 uCi/ml continuous for one year equals 1.4 mrem).

8.3 Solid Waste

No waste shipments were made in 2006

TABLE 3
2006 SUMMARY OF SOLID WASTE

TOTAL VOL. (cu. ft.)	TOTAL ACTIVITY (mCi)	DATE OF SHIPMENT	DISPOSITION
0	0	N/A	N/A

9.0 Radiation Exposure

Radiation exposure received by facility operations personnel, facility users, and visitors during 2006 is summarized in Table 4 below.

TABLE 4
2006 SUMMARY OF PERSONNEL RADIATION EXPOSURES

	NUMBER OF INDIVIDUALS	AVERAGE TEDE PER INDIVIDUAL (mrem)	GREATEST INDIVIDUAL TEDE (mrem)	AVERAGE EXTREMITY (mrem)	GREATEST EXTREMITY (mrem)
FACILITY PERSONNEL	14	90	390	126	772
FACILITY USERS	3	0.5	3	*	*
VISITORS	851 (515[1])	0.6	10	*	*

* Extremity monitoring was not required.
1 = Total number that were monitored for exposure

10.0 Radiation Levels and Levels of Contamination

Radiation levels and levels of contamination observed during routine surveys performed at the MNRC during 2006 are summarized in Table 5 below.

TABLE 5
2006 SUMMARY OF RADIATION LEVELS AND CONTAMINATION LEVELS DURING ROUTINE SURVEYS

	AVERAGE (mrem/hr)	HIGHEST (mrem/hr)	AVERAGE (dpm/100cm^2)	HIGHEST (dpm/100cm^2)
OFFICE SPACES	<0.1	<0.1	<800(1)	<800(1)
REACTOR CONTROL RM	<0.1	<0.1	<800(1)	<800(1)
RADIOGRAPHY CONTROL RM	<0.1	<0.1	<800(1)	<800(1)
COUNTING LAB	<0.1	<0.1	<800(1)	<800(1)
STAGING AREA	<0.1	<0.1	<800(1)	<800(1)
COMPOUND	<0.1	<0.1	<800(1)	<800(1)
EQUIPMENT RM	3.4	10.2	<800(1)	<800(1)
DEMINERALIZER AREA	390	228	<800(1)	<800(1)
REACTOR RM	13.5	90	<800(1)	<800(1)
SILICON STORAGE SHED	<0.1	<0.1	<800(1)	<800(1)
RADIOGRAPHY BAYS	*2.0	*1500	<800(1)	<800(1)

(1) <800 dpm/100 cm^2 = Less than the lower limit of detection for a swipe survey.
* Due to Bay 1 Storage Areas; most other areas and other bays are significantly lower

11.0 Environmental Surveys

Environmental surveys performed outside of the MNRC during 2006 are summarized in Tables 6-9 below. The environmental survey program is described in the MNRC Facility Safety Analysis Report.

TABLE 6
2006 SUMMARY OF ENVIRONMENTAL TLD RESULTS
(WITH NATURAL BACKGROUND(1) SUBTRACTED)

	AVERAGE (mrem)	HIGHEST (mrem)
ON BASE (OFF SITE 1-20 & 64)	5	22
ON SITE (SITES 50 – 62 & 65-71)	11	27

(1) Natural background assumed to be the off base (Sites 27-42) average of 27mrem.

TABLE 7
2006 SUMMARY OF RADIOACTIVITY IN WELL WATER

	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)	Cs-137 (pCi/l)
AVERAGE	<MDA	<MDA	<MDA	<MDA
HIGHEST				

MDA is the minimum detectable activity at the 95% confidence level.
The MDA range for the analyzed radionuclides (pCi/L).

	MIN	MAX
Alpha	1.40	3.18
Beta	2.53	3.23
Tritium	208	346
Cs-137	4.21	9.46