RADIATION CENTER

OREGON
STATE
UNIVERSITY

Radiation Center A100
Corvallis, Oregon
97331-5903

Telephone
503-737-2341

Fax
503-737-0480

November 22, 1995

50-243

Mr. Al Adams, Jr.
Senior Project Manager
Non-Power Reactors and Decommissioning
Projects Directorate
U. S. Nuclear Regulatory Commission
M. S. 0-11-B-20
Washington, DC 20555

Dear Al:

Please find enclosed three copies of the briefing information for your visit next week. I would be grateful if you could pass two copies on to the AEOD staff coming.

If you see any problems with the agenda, please give me a call. Otherwise, we will see you on Wednesday.

Have a good Thanksgiving.

Sincerely,

Brian Dodd, Ph.D.
Director

dd

Enclosure

280016

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Oregon State University
Radiation Center

Briefing Information For the

U. S. Nuclear Regulatory Commission

Office for Analysis and Evaluation of Operational Data

November 29-30, 1995

Contents

Agenda

Wednesday November 29, 1995

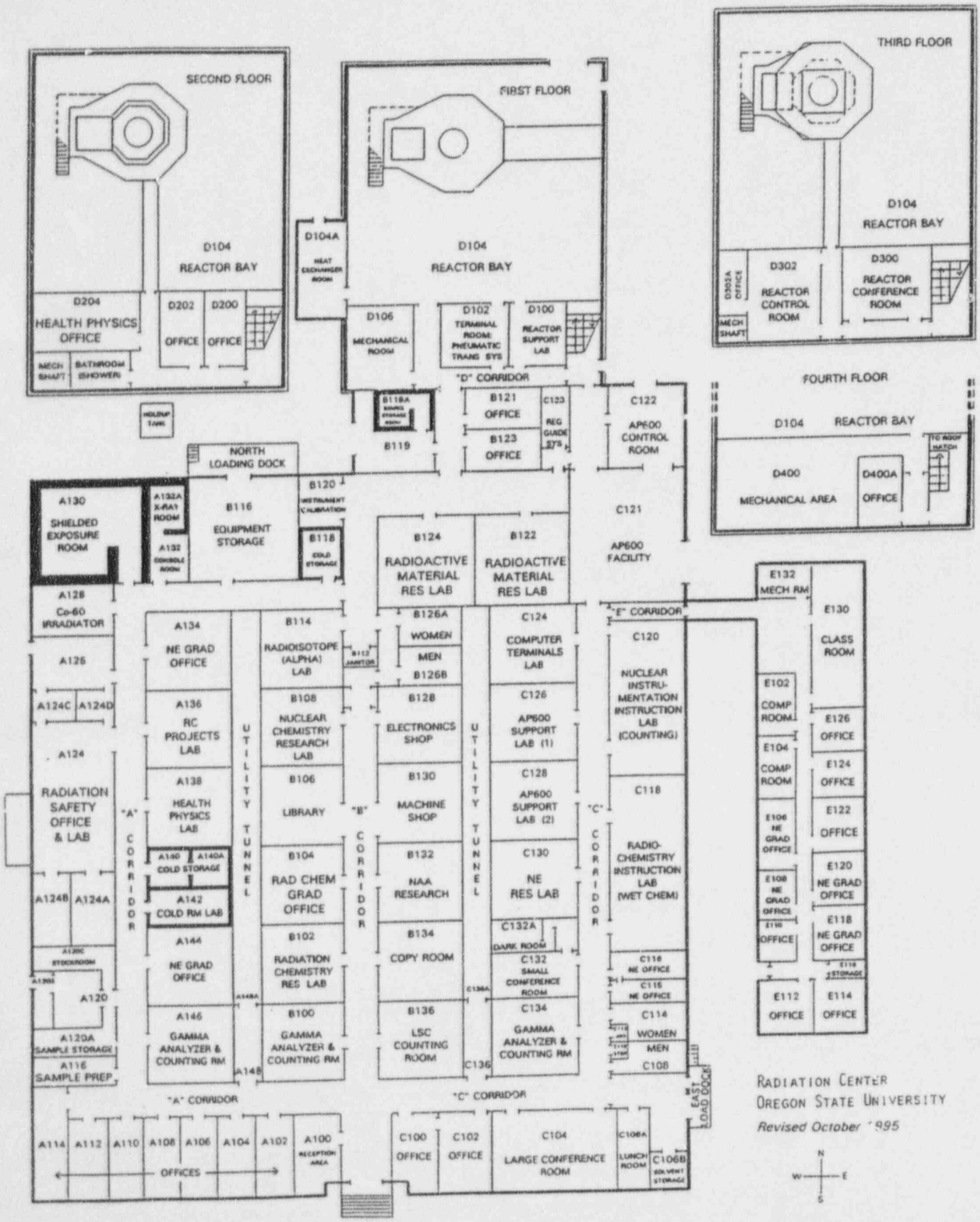
1500	NRC arrive at the Oregon State University Radiation Center
1500-1530	Initial meeting and briefing - Brian Dodd.
1530-1700	Tour of the Radiation Center and the Oregon State University TRIGA Reactor (OSTR) - Brian Dodd.

Thursday November 30, 1995

0800 - 0830	Visit with the Vice-Provost for Research and International Programs - George Keller.
0900 - 0930	Discussions with the Chairman of the Reactor Operations Committee - Steve Binney
0930 - 1230	Discussion and review of reactor operations - Brian Dodd/Jack Higginbotham
1230 - 1400	Lunch at Sadies with Brian Dodd, Jack Higginbotham and Dave Pratt
1400 - 1600	Discussion and review of radiation health physics - Brian Dodd/Dave Pratt
1600 - 1700	Debriefing and exit interview - Brian Dodd/Jack Higginbotham/Dave Pratt

Radiation Center Overview

- The Radiation Center is a unique facility which serves the Oregon State University campus, other Oregon universities, and institutions of higher education throughout the nation and the world.
- The Center has its own operating staff and also provides office, laboratory and classroom space for the campus Radiation Safety Office, and the Department of Nuclear Engineering.
- Faculty from other academic departments who perform research involving radiation and radioactive materials are also housed in the Radiation Center.
- Facilities and equipment include:
  - A 1.1 MW TRIGA reactor (OSTR)
  - Two ^{60}Co irradiators and a large number of smaller isotopic sealed sources
  - Several radioactive material laboratories for teaching and research
  - Specialized laboratories devoted to individual research projects, such as the AP-600 thermal hydraulic test facility.
  - Many instruments for radiation detection and analysis, such as multichannel analyzers and associated detectors, liquid scintillation detectors, proportional counting systems, thermoluminescent dosimeter systems and many portable survey meters.
  - Radiological instrument calibration and repair facilities
  - Classrooms and libraries
- The reactor is licensed and regulated by the Nuclear Regulatory Commission (NRC)
- All other Radiation Center facilities, radioactive materials and activities are licensed and regulated by the State of Oregon under the NRC agreement state program.

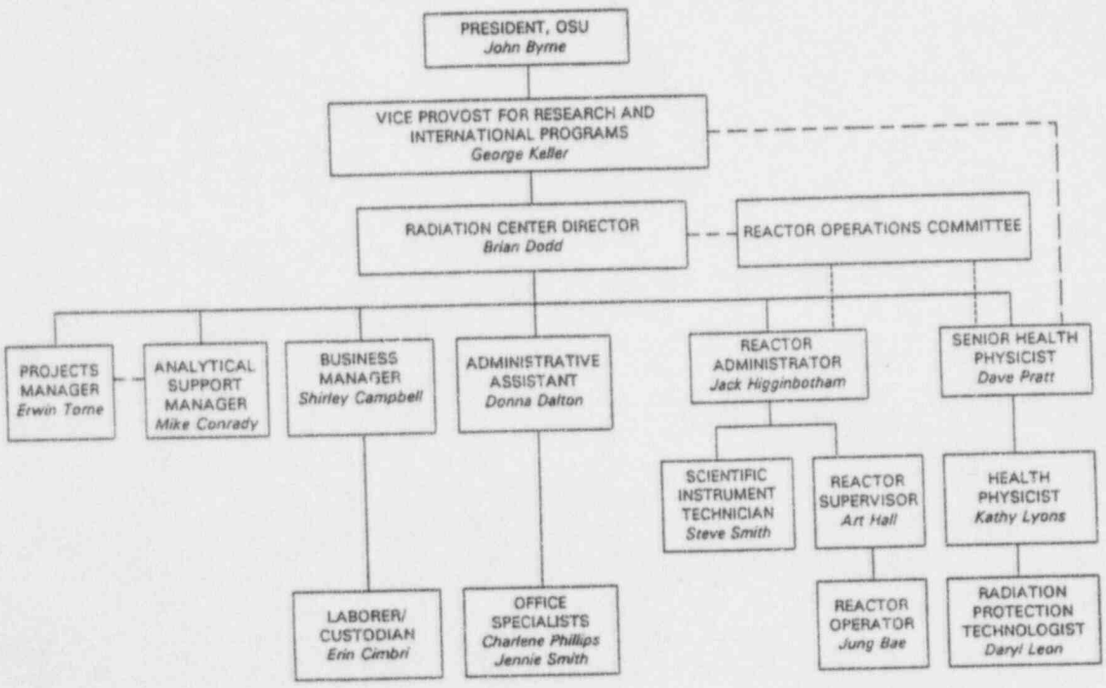


RADIATION CENTER
OREGON STATE UNIVERSITY
Revised October '995

Administration

- There is full support of the Radiation Center and the OSTR from top-level OSU Administration.
- The Radiation Center and OSTR have a clearly defined organization (shown below).
- Known and regularly implemented lines of succession exist for key positions:
  Director/Principle Security Officer: Brian Dodd-Jack Higginbotham-Dave Pratt
  Reactor Administrator: Jack Higginbotham-Art Hall-Steve Smith
  Senior Health Physicist: Dave Pratt-Kathy Lyons-Jack Higginbotham
  Chairman, ROC: Steve Binney-John Ringle-Alan Robinson
  Reactor Supervisor: Art Hall-Jack Higginbotham-Steve Smith-Brian Dodd
- Position descriptions and responsibilities for the key reactor and health physics positions are written and used by the employees.
- The reporting line for radiation protection is separate from reactor operations.
- Management philosophy has been communicated to staff. Key elements include commitments to safety, quality, people, customer service, and good public relations.
- Clear personnel accountability exists at the Radiation Center.
- Monthly staff meetings are held to keep people informed and to discuss issues.
- Staffing is stable and at a sufficient level for current levels of operation.

Radiation Center Organization Chart



KEY:

——— Administrative reporting channels

- - - - - - Technical review, communications and/or assistance

Reactor Operations Committee (ROC)

- The ROC has a Charter which defines the membership and their responsibilities. Duties focus primarily on oversight and auditing of the OSTR program.
- Membership (currently 10 persons) includes Radiation Center staff and outside people from a variety of disciplines.
- The ROC meets quarterly.
- Quarterly reactor audits are performed to meet Technical Specification requirements. These are:
  - Housekeeping inspection
  - Reportable occurrences
  - Console log book
  - Reactor Supervisor's log
  - Irradiation requests
  - Startup and shutdown checklists
  - Surveillance and maintenance checklists
  - Fuel inventory and transfers
  - Facility drawings.
  - Operating procedures (OSTROPs)
- Additional quarterly reactor audits are also conducted by the ROC. These are:
  - Radioactive effluents released to unrestricted areas
  - Personnel radiation doses
  - Radioactive material shipments
  - Radiation surveys (Special, daily, weekly, monthly, receipt & environmental).
  - Offsite environmental surveys
  - Radiation center health physics procedures (RCHPPs)
- Annual reactor audits performed by the ROC include:
  - Active OSTR experiments
  - Emergency response plan
  - Physical security plan
  - Annual report
  - Reactor operator requalification program
  - ROC charter.
- The ROC reviews and approves the following as they relate to the OSTR:
  - Audits
  - Abnormal occurrences
  - Submissions to the NRC
  - Other events related to the reactor
  - Corrective actions
  - New experiments
  - Facility changes
  - Procedural changes
  - Changes, tests or experiments submitted under 10 CFR 50.59.
  - Reactor operators.
- Audits typically find minor errors, typos, items not up-to-date and the like.
- ROC independent review and approval of safety evaluations is considered essential and of great value.

Oregon State University
TRIGA Reactor Operations Committee
Quarterly and/or Annual Audit Report Form

Operating Quarter Being Audited: Year 19___

[ ] First Quarter (January 1 through March 31)
[ ] Second " (April 1 through June 30)
[ ] Third " (July 1 through September 30)
[ ] Fourth " (October 1 through December 31)

Required Audits

[ ] Physical Inspection of Operating Areas
[ ] Reportable Occurrences
[ ] Console Log Book
[ ] Supervisor's Log
[ ] Irradiation Requests
[ ] Startup and Shutdown Checklists
[ ] Surveillance and Maintenance Checklists
[ ] Fuel inventory and transfers
[ ] Facility drawings
[ ] OSTROPs # _____

Other Audits

[ ] Radioactive Effluents Released to Unrestricted Areas
[ ] Personnel Radiation Doses
[ ] Radioactive Materials Shipment Log
[ ] Radiation Surveys
[ ] Offsite environmental surveys
[ ] Health Physics Procedures #_____
[ ] Other: _____

Annual Audits

[ ] All Currently Active TRIGA Reactor Experiments
[ ] Emergency Response Plan
[ ] Physical Security Plan
[ ] TRIGA Reactor Annual Report
[ ] Results of Annual Reactor Operator Requalification
[ ] ROC Charter
[ ] Other: _____

Report *(Attach sheets as needed)*

Auditor's Signature _____ Date of Audit _____

Rev. 10/90

ROC Disk AUDIT.FRM

Reactor Operators

- There are currently four NRC Licensed Senior Reactor Operators:
  - Director - supervises and operates on a fill-in basis when needed.
  - Reactor Administrator - supervises and operates when needed.
  - Reactor Supervisor - supervises full time, operates frequently.
  - Scientific Instrument Technician - supervises and operates fairly frequently.
- The OSTR has one Reactor Operator - operates full time.
- One person is under training as a Reactor Operator.
- Clear procedures exist for:
  - Operator changes
  - Supervisor changes
  - Supervisor's absence from building
  - Minimum number of people in the facility while operating
- Operators are kept informed of changes via 10 CFR 50.59 safety evaluations and OSTR information bulletins.
- Clear fitness for duty criteria and procedures for handling such issues are included in the administrative procedures.
- The OSTR has a 100% NRC examination pass rate for operators and senior operators.
- Each year the operator requalification program includes lectures on four separate topics followed by a performance-based exam over each topic, plus required quarterly supervisor/operator duties, and an annual operating examination.
- Operator time logs are organized to provide information necessary for license renewal.
- A procedure has been established to ensure timely renewal of licenses and timely medical examinations.

Oregon State TRIGA Reactor Operating Procedures (OSTROPs)

- OSTROPs are reviewed annually by the ROC at a rate of about 25% per quarter.
- The procedure for approval of changes ensures any necessary 10 CFR 50.59 safety evaluations are performed.
- OSTROPs have a standard, consistent format.
- OSTROPs are updated as needed.
- A fixed number of control copies of OSTROPs are kept updated.
- Computer disk controls and backups ensure the "originals" are kept uncorrupted.
- Old OSTROP pages are archived.
- OSTROPs cover all needed areas:

OSTROP 1	Emergency Operating Procedures (ERIP 3)
OSTROP 2	Reactor Startup Checklist Procedures
OSTROP 3	Reactor Shutdown Checklist Procedures
OSTROP 4	Reactor Operation Procedures
OSTROP 5	Procedures for Maintaining Reactor Operational Records
OSTROP 6	Administrative and Personnel Procedures
OSTROP 7	Operating Procedures for Reactor Water Systems
OSTROP 8	Reactor Power Calibration Procedures
OSTROP 9	Control Rod Calibration Procedures
OSTROP 10	Operating Procedures for Reactor Irradiation Facilities
OSTROP 11	Fuel Element Handling Procedures
OSTROP 12	Control Rod Maintenance , Removal and Replacement Procedures
OSTROP 13	Monthly Surveillance and Maintenance Procedures
OSTROP 14	Quarterly Surveillance and Maintenance Procedures
OSTROP 15	Semi-Annual Surveillance and Maintenance Procedures
OSTROP 16	Annual Surveillance and Maintenance Procedures
OSTROP 17	Reactor Room Ventilation System Procedures
OSTROP 18	Procedures for the Approval and Use of Reactor Experiments
OSTROP 19	Equipment Maintenance and Calibration Procedures
OSTROP 20	Special Nuclear Material Control and Accounting Procedures
OSTROP 21	Procedures for Reporting of Defects and Non-Compliance
OSTROP 22	Emergency Power System
OSTROP 23	Crane Operation Procedures
OSTROP 24	Physical Security System Functional Checks and Control Room Exit Procedures
OSTROP 25	Reporting Requirements
OSTROP 26	Procedures for the Use of External Monitoring and Recording Devices
OSTROP 27	Procedures to Follow in the Event of a Commercial Electrical Power Failure.

- Changes to OSTROPs are reviewed as part of the operator requalification program.

Changes Made Under the Provisions of 10 CFR 50.59

- A review and approval procedure exists for making changes to the facility, to procedures, and to the emergency response plan, and for changing or introducing new tests or experiments, any of which might constitute an unreviewed safety question or a reduced level of emergency preparedness, as appropriate. (Figure 6.8.1).

  Draft safety evaluation written by Reactor Administrator.
  Reviewed by R.C. Director.
  Final proposed changes and safety evaluation reviewed and approved by ROC and circulated through operators for information.
  ROC Chairman signs last, assuming there is no unreviewed safety questions.
  If required, based on the safety evaluation, an ROC approved license or technical specification change will be submitted to the NRC.

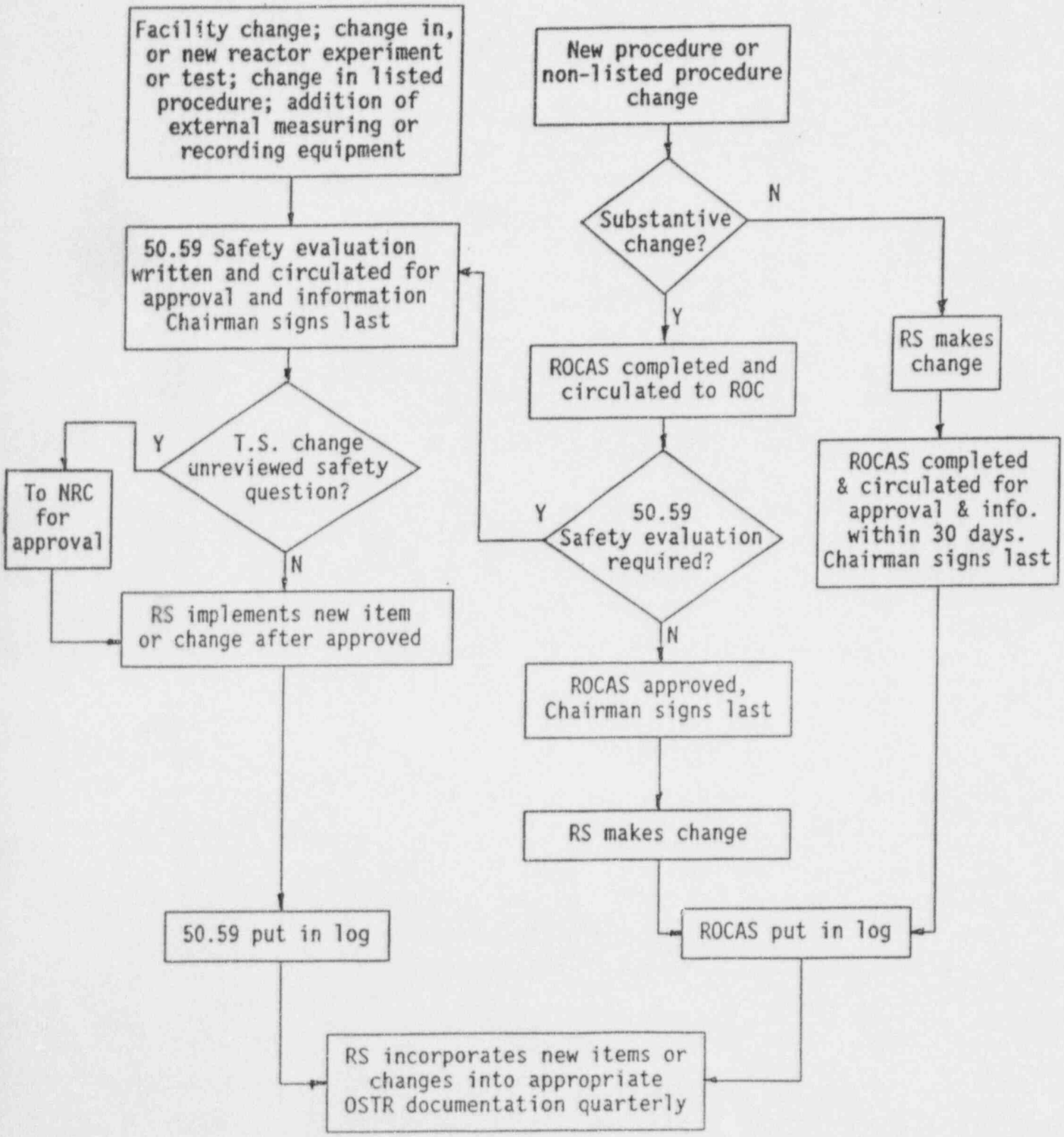
- Not just the required items are reviewed but:

  Any proposed facility change.
  Any newly proposed reactor test
  Any proposed change to an existing reactor test
  Any newly proposed reactor experiment
  Any proposed change to an existing reactor experiment
  Any proposed addition of external measuring or recording equipment to measuring or safety channels
  Any change to OSTROPs mentioned in the SAR, including OSTROPs 6, 11, 12, 17, 18, and 26.
  Any change to the emergency response plan.

- A 10 CFR 50.59 report is submitted annually to the NRC and the information is included in the Radiation Center and OSTR Annual Report.

Figure 6.8.1

Flow Chart for Procedural and Facility Changes, and Changes in Reactor Experiments or Tests



Surveillance and Maintenance Activities (S & Ms)

- Procedures are written for performing monthly, quarterly, semi-annual, annual and biennial surveillance and maintenance items.
- Not just Technical Specification required items are included, but a large number of additional maintenance items are incorporated.
- S & M checklists are also used as a mechanism to ensure that other non-maintenance requirements are not forgotten or missed.
- S & Ms have a method to ensure that items are checked at the required frequency, but without creeping of dates over a long time period.
- S & Ms also have a mechanism to ensure Technical Specification items do not exceed maximum allowed intervals.
- All Technical Specification requirements are in the S & Ms.
- A fault tree analysis has been performed for the OSTR and a comprehensive inventory of spare parts is maintained to ensure that the facility can be made operable again within a maximum period of about 10 days following a component failure.
- OSU Facilities Services performs preventive maintenance on the physical plant and provides prompt response to any problems.
- The Radiation Center and Reactor Building have just undergone a complete re-roofing, repainting and refurbishment project which included a new parking lot, landscaping and security-related lighting.
- OSU contracts with the Corvallis Fire Department to perform routine fire safety and hazard inspections of all university buildings, including the Radiation Center and Reactor Buildings.
- Readily combustible material is not normally stored in the reactor bay.
- Standard extension cords have been replaced with fused power strips throughout the Radiation Center.

Monthly Surveillance and Maintenance (Sample Form)

OSTROP 13 SURVEILLANCE & MAINTENANCE FOR THE MONTH OF _____

SURVEILLANCE & MAINTENANCE TO BE PERFORMED	LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
* 1 FUNCTIONAL CHECK OF REACTOR WATER LEVEL ALARMS AND GREEN LIGHT ALARM	MAXIMUM MOVEMENT ±3 INCHES	UP: _____ Inches DN: _____ Inches ANN: _____ GREEN LIGHT: ____				
2 MEASUREMENT OF THE REACTOR PRIMARY WATER pH	MIN: 5 MAX: 8.5					
3 MEASUREMENT OF THE BULK SHIELD TANK WATER pH	MIN: 5 MAX: 8.5					
4 EMERGENCY POWER SYSTEM BATTERY CHECKS	LIQUID: ~1" DN					
INVERTER	S.G.: >1.250					
	FUNCTIONAL CHECK					
GENERATOR	S.G.: >1.250					
	VOLTS ≥ 12.6V DC					
5 EVACUATION HORN & P.A. EMERGENCY SYSTEM BATTERY CHECKS	LIQUID: FULL					
	S.G.: >1.250					
	VOLTS ≥ 12.6V DC					
	CORR: NONE					
6 INSPECTION OF THE BRUSHES ON THE PNEUMATIC TRANSFER SYSTEM BLOWER MOTOR	CHANGE WHEN 1/4" LEFT					
7 GREEN LIGHT BULB REPLACEMENT	75 WATT					
8 CHANGE LAZY SUSAN FILTER	FILTER CHANGED					
9 LUBRICATE THE TRIGA TUBE LOADING TOOL (REEL)	USE GUN OIL	NEED OIL? ____				
10 REACTOR TOP CAM OIL LEVEL CHECK	OSTROP 13.10	NEED OIL? ____				
11 PROPANE TANK LIQUID LEVEL CHECK (% FULL)	>50%					
*12 BULK WATER TEMPERATURE ALARM CHECK	FUNCTIONAL					
13 PRIMARY PUMP BEARINGS OIL LEVEL CHECK	OSTROP 13.13	NEED OIL? ____				

* License Requirement.

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date completed last month plus six weeks.

Rev. 11/92

Quarterly Surveillance and Maintenance (Sample Form)

OSTROP 14 — SURVEILLANCE & MAINTENANCE FOR THE QUARTER OF ____/____/____

SURVEILLANCE & MAINTENANCE TO BE PERFORMED	LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
* 1 REACTOR OPERATION COMMITTEE (ROC) AUDIT OF REACTOR OPERATIONS FOR ____/____/____ QUARTER	QUARTERLY					
* 2 QUARTERLY ROC MEETING	QUARTERLY					
‡ 3 FUEL ELEMENT RADIATION LEVEL MEASUREMENTS IN WATER	≥23 R/hr @ 2' IN WATER					
4 INSPECTION OF THE SOLENOID VALVES IN THE PNEUMATIC TRANSFER SYSTEM	FUNCTIONAL					
5 PNEUMATIC TRANSFER SYSTEM INSERTION TIME CHECK	≤6 SECONDS					
6 ROTATING RACK CHECK FOR UNKNOWN SAMPLES	RACK SHOULD BE EMPTY					
7 FUNCTIONAL CHECK OF EMERGENCY LIGHTS (SEE CHECKSHEET)	FUNCTIONAL					
8 WATER MONITOR ALARM CHECK	FUNCTIONAL					
9 STACK MONITOR CHECKS (OIL DRIVE MOTORS, H.V. READINGS)	MOTORS OILED					
	PART: 1150 V ±50	VOLTS				
	GAS: 900 V ±50	VOLTS				
10						
11 ARM SYSTEM ALARM CHECKS	FUNCTIONAL					

CHAN	1	2	3	4	5	6	7	8	9	10	11	12
AUD												
LIGHT												
PANEL												
ANN												

12 OPERATOR LOG

NAME	a) ≥4 hours: at console (RO) or as Rx. Sup. (SRO) b) Complete Operating Exercise	a) TIME	b) OPERATING EXERCISE			

* License Requirement ‡ Physical Security Plan Requirement

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date completed last quarter plus four months.

Rev. 1/93

Quarterly Surveillance and Maintenance (Sample Form)

OSTROP 14 (CONTINUED)

SURVEILLANCE & MAINTENANCE FOR THE QUARTER OF _____/_____/_____ 19____

SURVEILLANCE & MAINTENANCE TO BE PERFORMED	LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
13 CHECK FILTER TAPE SPEED ON STACK MONITOR	1"/HR ± 0.2					
14 INCORPORATE 50.59 & ROCAS INTO DOCUMENTATION	QUARTERLY					
15						
16 FUNCTIONAL CHECK OF EVACUATION ALARMS	ALL FUNCTIONAL					
*17 SUBMISSION OF SAFEGUARDS LOG BY P.S.O. FOR ____/____/____ QUARTER	SUBMIT IF NEW ENTRIES					
18 STACK MONITOR ALARM CIRCUIT CHECKS	ALARM ON CONTACT					
19 ALARM TESTING OF VITAL AREA DOUBLE DOORS	FUNCTIONAL					

* License Requirement.

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date completed last quarter plus four months.

Semi-Annual Surveillance and Maintenance (Sample Form)

OSTROP 15

SEMI-ANNUAL SURVEILLANCE AND MAINTENANCE FOR _____

SURVEILLANCE & MAINTENANCE TO BE PERFORMED							LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
*1	FUNCTIONAL CHECKS OF REACTOR INTERLOCKS	a) NEUTRON SOURCE COUNT RATE INTERLOCK					NO WITHDRAW	a1				
							≥5 cps	a2				
		b) TRANSIENT ROD AIR INTERLOCK					NO PULSE	b				
		c) PULSE PROHIBIT ABOVE 1 kW					≥1 kW	c				
		d) TWO ROD WITHDRAWAL PROHIBIT					1 only	d				
		e) PULSE MODE ROD MOVEMENT INTERLOCK					NO MOVEMENT	e				
		f) MAXIMUM PULSE REACTIVITY INSERTION LIMIT					≤ $2.50	f				
		g) PULSE INTERLOCK ON RANGE SWITCH					NO PULSE	g				
*2	SAFETY CIRCUIT TEST	PERIOD SCRAM					≥3 sec					
*3	CONTROL ROD WITHDRAWAL, INSERTION & SCRAM TIMES		TRANS	SAFE	SHIM	REG						
		a) SCRAM					≤2 sec	a				
		b) WITHDRAWAL					≤50 sec	b				
		c) INSERTION					≤50 sec	c				
*4	PULSE COMPARISON (PREVIOUS PULSE): PULSE # _____ $_____ _____MW _____°C						≤20% CHANGE	PULSE #_____ $_____ _____MW _____°C				
*5	REACTOR BAY VENTILATION SYSTEM SHUTDOWN TEST						DAMPERS CLOSE IN ≤5 SECONDS	4TH FLOOR ____ 1ST FLOOR ____				
*6	CALIBRATION OF THE FUEL ELEMENT TEMPERATURE CHANNEL						±2°C					
*7	MATERIALS BALANCE REPORT/FUEL MANAGEMENT						REPORTS DONE/ - EVEN BURNUP		APRIL 15 OCTOBER 15	APRIL 30 OCTOBER 30		
*8	CLEANING & LUBRICATION OF TRANSIENT ROD CARRIER INTERNAL BARREL						3-IN-1 or GUN OIL	CLEANED ____ OILED _____				
*9	LUBRICATION OF BALL-NUT DRIVE ON TRANSIENT ROD CARRIER						3-IN-1 or GUN OIL	MOLY KOTE ____ OILED _____				
10	LUBRICATION OF THE ROTATING RACK BEARINGS						10 W OIL	OILED _____				
11	CONSOLE CHECK LIST (OSTROP 15.11)						OSTROP 15.11					
12	CONSTANT AIR MONITOR RECORDER MAINTENANCE											

* License Requirements.

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date last time plus 7½ months.

Rev. 11/92

Semi-Annual Surveillance and Maintenance (Sample Form)

OSTROP 15 (continued)

SEMI-ANNUAL SURVEILLANCE AND MAINTENANCE FOR _____

SURVEILLANCE & MAINTENANCE TO BE PERFORMED			LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
12	CONSTANT AIR MONITOR RECORDER MAINTENANCE							
13	Deleted							
14	STANDARD CONTROL ROD MOTOR CHECKS			OILED _____				
15	Deleted							
16	ION CHAMBER RESISTANCE MEASUREMENTS WITH MEGGAR INDUCED VOLTAGE	A. SAFETY CHANNEL	NONE (Info Only)					
		B. % POWER CHANNEL	NONE (Info Only)					
17	FISSION CHAMBER RESISTANCE CALCULATION $R = \frac{800V}{\Delta I}$	@ 100 V. I = _____AMPS @ 900 V. I = _____AMPS ΔI = _____AMPS R = _____Ω	NONE (Info Only)					
18	FUNCTIONAL CHECK OF HOLDUP TANK WATER LEVEL ALARMS		OSTROP 15.18	HIGH _____ FULL _____ GREEN LIGHT _____				

* License Requirements.

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date last time plus 7½ months.

Rev. 11/94

Annual Surveillance and Maintenance (Sample Form)

OSTROP 16.0 — ANNUAL Surveillance and Maintenance for the Year _____ — Page 1

SURVEILLANCE AND MAINTENANCE TO BE PERFORMED			LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
*1	BIENNIAL INSPECTION OF CONTROL RODS:	a) FFCRS	OSTROP 12.0					
		b) TRANS						
*2	ANNUAL REPORT (DUE JUNE 30 + 75 DAYS)		NOV 1		OCT 1	NOV 1		
*3	CONTROL ROD CALIBRATION:	a) SAFE	OSTROP 9.0					
		b) SHIM						
		c) REG						
		d) TRANS						
*4	REACTOR POWER CALIBRATION		OSTROP 8.0					
*5	CALIBRATION OF REACTOR TANK WATER TEMPERATURE METERS		OSTROP 16.5					
*6	CONTINUOUS AIR MONITOR CALIBRATION:	a) Particulate Monitor	RCHPP 18.0					
		b) Gas Monitor						
*7	STACK MONITOR CALIBRATION:	a) Particulate Monitor	RCHPP 18 & 26					
		b) Gas Monitor						
*8	AREA RADIATION MONITOR CALIBRATION		RCHPP 18.0					
*9	WATER MONITOR CALIBRATION		RCHPP 18.0					
10	REACTOR TANK AND CORE COMPONENT INSPECTION		NO POWDERY WHITE SPOTS					
*11	SNM PHYSICAL INVENTORY		OSTROP 20.0					
*12	EMERGENCY RESPONSE PLAN DRILL							
*13	STANDARD CONTROL ROD DRIVE INSPECTION		OSTROP 16.13					
*14	OSU POLICE AND SECURITY RETRAINING							
*15	50.59 REPORT		NOV 15		OCT 15	NOV 15		
*16	INTRUSION ALARM RESPONSE DRILL (OSU POLICE AND SECURITY)		RESPONSE ≤5 MIN					

* License Requirements.

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date completed last year plus 15 months. For biennial license requirements, it is equal to the date completed last time plus 2½ years.

Rev. 11/92

Annual Surveillance and Maintenance (Sample Form)

ANNUAL Surveillance and Maintenance for the Year _____

	SURVEILLANCE AND MAINTENANCE TO BE PERFORMED	LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
17	EMERGENCY POWER INVERTER TEST	OSTROP 22.0					
18	REPLACE P.A. & EVAC SYSTEM LEAD-ACID BATTERIES	EVERY 4 YEARS					

		ANNUAL				BIENNIAL		EVERY 6 YEARS				
		REQUALIFICATION				MEDICAL		NRC REQUAL EXAM		LICENSE		
		WRITTEN EXAMINATIONS		OPERATING TEST						APPLICATION		EXPIRATION DATE
*19	REACTOR OPERATOR LICENSE CONDITIONS NAME	DUE DATE	DATE PASSED	DUE DATE	DATE PASSED	DUE DATE	DATE COMPLETED	DUE DATE	DATE PASSED	DUE DATE	DATE MAILED	

	SURVEILLANCE AND MAINTENANCE TO BE PERFORMED	LIMITS	AS FOUND	TARGET DATE	DATE NOT TO BE EXCEEDED**	DATE COMPLETED	REMARKS & INITIALS
20	FUEL ELEMENT INSPECTION FOR SELECTED ELEMENTS (B1, B2, B3, B5, B6, C3, C5, D5, D6)	PASS GO/NO GO TEST		Pulse # _____ Date _____	Pulse # _____ Date _____		
*21	DECOMMISSIONING COST UPDATE	N/A	N/A				
22	FUNCTIONAL TEST OF THE REACTOR WATER LOW LEVEL ALARM	MAXIMUM MOVEMENT ~3 INCHES	___INS ___ANN				

		ANNUAL - CPR		EVERY 3 YEARS - FIRST AID	
23	NAME	REMINDER DATE	EXPIRY DATE	REMINDER DATE	EXPIRY DATE

* License Requirements.

** Date not to be exceeded is only applicable to marked (*) items. It is equal to the date completed last year plus 15 months. For biennial license requirements, it is equal to the date completed last time plus 2½ years.

Logs and Records

- All logs and records required by the Technical Specifications are maintained:
  - Operating logbook
  - Startup and shutdown checklists
  - Surveillance and maintenance records
  - Facility drawings
  - Approved experiments
  - Radioactive material transfer records
  - Changes to operating procedures
  - Fuel inventories and transfers
  - 10 CFR 50.59 reviews
  - ROC reviews, approvals, audits and minutes
  - Facility radiation and contamination surveys
  - Gaseous and liquid effluent surveys
  - Off-site environmental surveys
  - Radiation exposure records for personnel
- All logs and records required by the Requalification Plan are maintained:
  - Training outlines
  - Examinations
  - Training sign-up sheets
  - Operator's licenses
  - Operator's medical examination records
- All logs and records required by the Emergency Response Plan are maintained:
  - Support agency written agreements
  - Outlines for facility and local support personnel training
  - Training sign up sheets
  - Emergency equipment inventory checks
  - Exercise and drill scenarios
  - Observer critiques of exercises
  - Annual plan review
- All logs and records required by the Physical Security Plan are maintained:
  - Outlines for facility personnel and law enforcement agency training
  - Training sign up sheets
  - Security maintenance log
  - Security event log
  - Quarterly and annual key inventories
  - Security response time drills
  - Annual plan review
- All logs and records required for Special Nuclear Material Accountability are maintained:
  - Book and physical SNM inventories
  - Book and physical source material inventories
  - Fuel element histories

Fuel element movements
Material balance reports (742s)
Material transfer reports (741s)

- The following additional logs and records are maintained:
  - Reactor irradiation requests
  - Operator console time log
  - Reactor Supervisor's maintenance log
  - Orientation records
  - Approved operators for each experimental facility
  - Defects and non-compliance log
- The following OSTR-related health physics records are maintained:
  - Routine daily, weekly, and monthly area radiation and contamination surveys
  - Weekly gamma spectroscopy of the continuous air monitor particulate filter
  - Monthly instrument response checks
  - Monthly radiation levels at the environmental monitoring stations
  - Monthly OSTR primary, secondary and make-up water analysis
  - Monthly area and personnel dosimeter results
  - Monthly emergency safety equipment checks
  - Monthly gaseous effluent releases
  - Solid and liquid waste effluent discharges
  - Radioactive material shipments
  - Receipt surveys of radioactive material shipments
  - Special radiation and contamination surveys
  - Urinalysis bioassays
  - Orientations and training
  - Radiation work permits
  - Quarterly environmental soil, water, vegetation, and TLD results
  - Quarterly stack effluent sample analysis
  - Quarterly area and personnel dosimetry results
  - Semi-annual leak tests of sealed sources
  - Semi-annual sealed source inventories
  - Semi-annual floor surveys
  - Semi-annual portable instrument and pocket ion chamber calibrations
  - Semi-annual inventory of off-site emergency equipment
  - Annual calibrations of stack effluent monitor, air monitor, remote area radiation monitors, water monitor and air samplers.
  - Annual hood flow measurements
  - Annual emergency equipment inventory and inspection
  - Annual dosimeter training
  - Annual smear survey of ventilation stacks
  - Decommissioning logbook
  - Licenses of users who are shipped radioactive material
  - Shipping container certification tests
- Records and logs are archived and kept for at least the minimum required time periods.

- Records and logs are kept reasonably secure from theft, flood and fire.
- Records and logs are legible, accessible, dated and corrected appropriately.
- Records and logs are sufficiently detailed to enable events to be accurately recounted.

Reactor Experiments and Irradiations

- A clear procedure exists for reviewing and approving new or substantially changed experiments.
- Reactor experiments are classified A, B, or C according to the nature of the experiment and the level of approvals required.
  - Class A experiments just involve routine reactor operation; no sample irradiation.
  - Class B experiments typically involve use of the reactor facilities for sample irradiation.
  - Class C experiments are unusual and non-routine.
- There is one active Class A experiment and seven active Class B experiments.
- All irradiation requests are reviewed and approved by the Reactor Supervisor.
- In addition, each irradiation request which produces byproduct material is approved by the Senior Health Physicist.
- Class C experiments are rarely performed, but require significant additional controls.
- Each experiment type has defined limits.
- Irradiation request approval methods ensure:
  - Experiments are performed according to procedures
  - Compliance with the limitations on experiments
  - Experimenters are aware of limits on experiments
  - Isotope production is within applicable authorizations and licenses
  - Clear transfer of byproduct material from the NRC to the State or other user's license
  - Only approved encapsulation methods are used
  - Experimenter receives radioactive material only after it has decayed to safe levels.

Reactivity Controls

- The Technical Specifications include a number of limits on reactivity:
  - Cold, clean shutdown margin with most reactive rod withdrawn - 57 cents
  - Maximum pulse reactivity insertion - $2.55
  - Maximum worth of an unsecured experiment - $1
  - Worth of any single experiment must be less than $2.55
  - Total worth of all experiments must not exceed $3.00.
- Core excess measurements are taken at the beginning of each day's operation to ensure that there has been no unexpected changes to the core and to ensure that the minimum shutdown margin is not exceeded.
- Control rods are calibrated annually and after any core changes.
- Three sets of control rod worth curves are maintained for the three standard core configurations:
  - Normal
  - Sample-holding dummy fuel element in the B-1 position
  - Cadmium-lined in-core irradiation tube (CLICIT) in the B-1 position.
- Core excess reactivity is plotted each day to observe the trends. The OSTR is currently at a point where reactivity is increasing with fuel burn up.
- A fuel element was recently removed from the core to ensure that the minimum shutdown margin was significantly away from the Technical Specification limit.
- Part of the ROC's review of new experiments is an assessment of the reactivity effects of the proposed experiment.
- The reactivity effects of putting samples in the standard irradiation facilities are well known from measurements and experience. For example, the effect of putting samples with cadmium cups in the rotating rack and the pneumatic transfer system have been measured and shown to be small.
- Experimenters are required to read and sign a statement that they have read and understood the "General Limitations on Experiments".
- The micro switch stop on the transient rod has been set to $2.50 which is below the Technical Specification limit.
- The Reactor Supervisor may move fuel elements without specific ROC approval only under the following conditions:
  - Removal of a single element out of the core to insert an experiment or be left vacant (max. power 1kW if not on periphery). Element is returned to the same location.
  - Movement of a single inner ring element to the core periphery to accommodate the dummy element or the CLICIT.
  - Any movement within the facility of elements not in the core.
  - Removal of elements from the core for maintenance purposes and their replacement in the same locations provided the reactor remains shutdown.
  - Exchange of the fuel element in B-1 with an element elsewhere in the core. If the core excess difference before and after this movement is greater than 8 cents, then the control rods must be recalibrated.

- All other core changes and fuel element movements require ROC approval. The Reactor Administrator must submit a proposed sequence of movement and perform an assessment of the reactivity effects at each stage of the sequence.
- The Senior Health Physicist is notified prior to any fuel element movement.
- A licensed operator is at the console whenever core movements take place.
- All fuel movements are supervised by the Reactor Supervisor.
- Particular care is taken in fuel handling procedures to minimize the potential for dropping an element and to ensure it is placed in the correct grid position.
- The reactivity worth of each fuel element is reasonably well known from a variety of measurements and calculations performed over the years.
- OSTR staff have been working in close cooperation with a person developing a modern, MCNP-based core analysis code. One of the potential uses of the code is to enable good predictions of reactivity effects of various core configurations, even allowing for burn up.

Emergency Response Plan

- A clear, practical emergency organization has been as established.
- Staff are aware of their roles in the emergency organization.
- The emergency activation system is realistic with the call list posted as well as distributed to the Oregon State Police dispatch office on campus and Radiation Center emergency response staff.
- Written support agreements with local agencies have been made and kept current.
- The following Emergency Response Implementing Procedures (ERIPs) exist:

ERIP 0	Emergency Procedures for Emergency Response Personnel - Class 0 Emergency, Personnel and Operational Events
ERIP 1	Emergency Procedures for Emergency Response Personnel - Class 1 Emergency, Notification of Unusual Events
ERIP 2	Emergency Procedures for Emergency Response Personnel - Class 2 Emergency, Alert
ERIP 3	OSTR Emergency Operation Procedures (OSTROP 1)
ERIP 4	Emergency Procedures for Laboratories and Areas where Radioactive Materials are Used
ERIP 5	Radiation Center Complex Evacuation Procedures
ERIP 6	Emergency Procedures to Follow on Receipt of a Bomb Threat
ERIP 7	Emergency Activation and Notification Procedures
ERIP 8	News Release Policy and Guidelines.

- Annual training is conducted for facility and emergency support personnel.
- Annual drills are performed each year with alternate years involving outside support agencies.
- Drills involving outside agencies are independently evaluated and critiqued.
- Drills use a variety of realistic and topical scenarios, as well as making a variety of assumptions about who is available.
- Media kits have been preplanned with press releases, photos and videotape.
- Emergency cabinets are maintained in appropriate locations, and are routinely inventoried.
- The Emergency Response Plan and ERIPs are reviewed and updated each year, with a known number of controlled copies of each in existence.
- Telephone numbers in the ERIPs are tested and updated each year.
- A cadre of first aid responders is kept qualified.
- Emergency evacuations are conducted each fall, these are often unannounced, and the building is still emptied in 2-3 minutes.

Physical Security Plan

- All requirements of the Physical Security Plan are being met.
- The OSTR Physical Security Plan exceeds regulatory requirements.
- There is a branch of the Oregon State Police with an office on campus.
- Close cooperation exists between the Oregon State Police, OSU Security Services, the City of Corvallis Police, Benton County Sheriff and the Radiation Center security staff.
- The Radiation Center receives very good security support from the response agencies.
- Annual training is conducted for facility and emergency support personnel.
- Annual security response drills are performed each year.
- Security keys are inventoried quarterly and all Radiation Center keys are inventoried annually.
- A relational database is maintained for all keys issued.
- The Security Plan is reviewed and updated each year with only a very few number of controlled copies in existence.
- False alarms have been minimized by the careful purchase of suitable equipment.
- Further details are not included here because of safeguards considerations.

Radiation Health Physics Support

- The health physics support for reactor operations is comprehensive and of high quality.
- A good listing of the work performed by the health physics group is found in Table V.A.1 of the annual report (attached).
- Health physics procedures have been written covering the following:

RCHHP 1	Guidelines for the Radiation Protection Program at the OSU Radiation Center
RCHHP 4	Emergency Procedures and Actions to be Taken After Accidental Radiation Exposure
RCHHP 5	Procedures for Receipt Radiation Surveys and Unpacking of Packages Containing Radioactive Materials
RCHHP 6	OSU Procedures for Transfer, Packaging and Transport of Radioactive Materials Other than Radioactive Wastes
RCHHP 7	Absorption of Liquid Radioactive Waste
RCHHP 8	Water Analysis
RCHHP 9	Standard Quality Assurance Procedures for Laboratory Radiation Detectors
RCHHP 10	Procedures for Hood Air Flow Surveys and Hood Filter Changes
RCHHP 11	Procedures for Testing and Certification of OSU Radioactive Materials Shipping Containers
RCHHP 12	Procedures for Performing the Neutron Generator Monthly Contamination Survey
RCHHP 13	Procedures for Collection and Radiological Analysis of Environmental Soil, Water and Vegetation Samples
RCHHP 14	Tritium Urinalysis Bioassay Procedures
RCHHP 15	Operating Procedures for the Environmental Thermoluminescent Dosimetry (TLD) Program
RCHHP 16	General Leak Testing Procedures for Sealed Radiation Sources
RCHHP 18	Maintenance and Calibration Procedures for Radiation Protection Instrumentation (Including Operator Training Manual and Operating Procedures for the Radiation Center Gamma Instrument Calibration Facility)
RCHHP 20	Radiation Survey Procedures for the Gamma Irradiation Facility
RCHHP 21	Operating Procedures for the Gamma Irradiation Facility
RCHHP 22	Operating and Emergency Procedures for the GE Maxitron 300 X-Ray Machine
RCHHP 23	Personnel Decontamination Procedures
RCHHP 24	Procedures for Performing Daily, Weekly and Monthly Routine and Non-Routine (Special) Radiation Surveys
RCHHP 27	Procedure for Performing the Routine Semi-Annual Floor Survey for Fixed and Removable Radioactive Contamination
RCHHP 28	Background Radiation Measurements Using the Trout 16.5 Liter Shonka Chamber and Shonka Model 104 Electrometer

RCHHP 30 Transfer and Control of Activated Cadmium Cups
RCHHP 31 Procedure for Sampling and Pumping the Liquid Waste Hold-up Tank
RCHHP 32 Stack Gas Effluent Analysis
RCHHP 33 TRIGA Tube Wash System Procedures
RCHHP 34 Orientation and Training Program for the OSU Radiation Center

- Health physics staff are involved and perform surveys when samples are removed from the reactor core region, the reactor tank or experimental facilities, and during all fuel element movements.
- There is a close, cooperative relationship between the health physics and the reactor operations groups.
- Reactor operators do not hesitate to request health physics assistance when needed.
- The health physics staff provides timely response to reactor operators' requests for health physics coverage.
- Health physics staff know that they have the authority to stop any operation, if in their judgement there is a radiological or safety concern.
- OSU has a policy of zero release of liquid radioactive effluents.
- The ALARA philosophy at the Radiation Center has successfully reduced effluents from the facility.
- A summary of significant numbers from the radiological information in the latest annual report is given below:

  Liquid releases - zero
  Gaseous releases - 3.4 Ci of ^{41}Ar at 0.6% of applicable effluent concentration limit
  Particulate releases - zero
  Solid waste - 9×10^{-4} Ci in 20 ft^3
  Average annual whole body dose to facility operating personnel - 5 mrem
  Maximum annual whole body dose to facility operating personnel - 75 mrem
  Average annual whole body dose to everyone else - 0 mrem
  Offsite environmental monitoring measurements all showed background levels
  Radioactive material shipments world-wide - 37 Limited Quantity, 43 Yellow II.

- Radiological instruments of state institutions and agencies are repaired and calibrated at the Radiation Center.
- Radioactive material shipments are only performed by qualified persons. Qualification involves initial training and annual retraining (with an examination) as well as the approval of the Senior Health Physicist.
- Radioactive material shipping papers are reviewed for completeness and accuracy by a second qualified person prior to shipment.
- The Radiation Center performs all of its own Type A shipping container testing.
- Gamma spectroscopy is performed on radioactive material shipments at the time of shipment to ensure that all significant radioisotopes are identified.

Radiation Protection Program Requirements and Frequencies

FREQUENCY	RADIATION PROTECTION REQUIREMENT
Daily/Weekly/Monthly	Perform routine area radiation/contamination monitoring.
Weekly	Perform gamma spectroscopy of the (OSTR) continuous air monitor particulate filter.
Monthly	Perform routine response checks of radiation monitoring instruments. Monitor radiation levels (μrem/hr) at the environmental monitoring stations. Collect and analyze TRIGA primary, secondary, and make-up water. Exchange personnel dosimeters and inside area monitoring dosimeters, and review exposure reports. Inspect laboratories. Check emergency safety equipment. Perform neutron generator contamination survey. Calculate previous month's gaseous effluent discharge.
As Required	Process and record solid waste and liquid effluent discharges. Prepare and record radioactive material shipments. Survey and record incoming radioactive materials receipts. Perform and record special radiation surveys. Perform thyroid and urinalysis bioassays. Conduct orientations and training. Issue radiation work permits and provide health physics coverage for maintenance operations.
Quarterly	Prepare, exchange and process environmental TLD packs. Collect and process environmental soil, water and vegetation samples. Conduct orientations for classes using radioactive materials. Collect and analyze sample from reactor stack effluent line. Exchange personnel dosimeters and inside area monitoring dosimeters, and review exposure reports.
Semi-Annual	Leak test and inventory sealed sources. Conduct floor survey of corridors and reactor bay. Calibrate portable radiation monitoring instruments and personnel pocket ion chambers. Inventory and inspect Radiation Center equipment located in the Corvallis Fire Department Haz/Mat van and at Good Samaritan Hospital.
Annual	Calibrate reactor stack effluent monitor, continuous air monitors, remote area radiation monitors, water monitor, and air samplers. Measure face air velocity in laboratory hoods and exchange dust-stop filters and HEPA filters as necessary. Inventory and inspect Radiation Center emergency equipment. Conduct facility radiation survey of the ^{60}Co irradiators and X-ray machine. Conduct personnel dosimeter training. Perform contamination smear survey of Radiation Center ventilation stacks. Update decommissioning logbook.