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WASHINGTON STATE UNIVERSITY

PULLMAN, WASHINGTON 99164

NUCLEAR RADIATION CENTER

April 26, 1982

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Mr. James R. Miller, Chief
Standardization and Special Projects Branch
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Miller:

Enclosed are WSU's responses to the formal Relicense Review Questions. We are also in the process of amending portions of the SAR and Technical Specifications and will send them to you as soon as possible.

Sincerely,

W. E. Wilson

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Associate Director

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W.S.U. RELICENSE REVIEW QUESTIONS RESPONSE

1. Describe the liquid reactor related radwaste handling and monitoring procedures, including retention volumes and sampling and measuring techniques.

   ANSWER: The retention tank system is shown in Figure 3.4-1 of the SAR. The two retention tanks have a volume of 3500 gallons and the sampling tank has a volume of 5000 gallons. The liquid radwaste from the facility flows into the 3500 gallon retention tank system until they are filled. When these tanks are full, they are automatically pumped up to the sampling tank to make room for more inflow. When the sampling tank becomes full, its contents are analyzed before being discharged to the sanitary sewer.

   The analysis procedure involves taking a 1000 ml aliquot from the sampling tank, evaporating the liquid to dryness on a 2 inch planchet, and counting the planchet. If the specific activity is less than 4×10^{-7} μCi/ml, the tank is discharged to the sanitary sewer system. If greater, further analysis is undertaken to identify the radionuclides present and appropriate dilution is made to conform to the 10 CFR 20 limits.

2. Is it possible to dump liquid radwaste inadvertently into the sanitary sewer system from the retention system by a single-point failure, or by personnel error?

   ANSWER: No, because: 1) of the dual tank system, in which the contents of the retention tanks is pumped to the sampling tank; 2) the contents of the sampling tank are determined before dumping, and 3) a number of operations must be performed before dumping takes place.

3. Describe the reactor room ventilation system, including filter types and efficiencies. Specify exhaust stack height and location with respect to the balance of the Nuclear Radiation Center Complex.

ANSWER: The reactor area ventilation system is shown in the attached drawings 3.2-1 and 3.2-1A from the SAR. A recent modification to the ventilation system increased the exhaust rate from the pool room from 2000 to 4500 CFM during normal operation.

The ventilation system operation modes are shown in Figure 3.2-1A. During normal operation 4500 CFM of air are exhausted from the pool room and discharged up the monitored stack. All the control dampers are spring loaded to shut in the event of a loss of control air pressure or AC power. In the event of a scram, the system automatically shifts to the isolation mode. Return to the normal mode requires the reactor operator to reset the vent system.

In the event of a CAM alarm the vent system shifts to the dilution mode. This mode may also be entered manually by operator intervention. In the dilute mode 300 CFM of air is exhausted from the pool room, passed through an absolute filter, mixed with 1700 CFM of outside air, and then discharged to the atmosphere.

The exhaust stack is located in the central part of the facility roof and extends about 36" above the roof. The absolute filter in the dilution mode line consists of two SGN C1 Caisson Filter boxes and standard C1 24" x 24" x 11-1/2" absolute filters. The Dop test on these filters yields a filter efficiency of 99.97 for .3 micron particles.

4. Is the flow rate in the effluent stack monitored? If not, how is the operational status verified?

ANSWER: The actual flow rate is not measured but each of the four fans shown in Figure 3.2-1, F1 to F4, have paddle type flow switches installed that give a positive indication of the presence or absence of air flow. The flow indicator lights are located in the reactor control room.

5. Does the ventilation system change operational modes automatically? If so, describe the automatic system.

ANSWER: A scram causes an automatic shift to the isolate mode and a CAM alarm causes an automatic shift to the dilute mode. See SAR Section 3.2 for a description of these modes of operation.

6. What functional tests are conducted on the ventilation isolation system? How is damper closure verified?

ANSWER: The auto-isolate and auto-dilute modes are checked daily before reactor startup. The startup checkoff sheets include a functional test of the ventilation system. The ventilation system control panel in the control room indicates the status of each fan and damper.

7. Outline the minimum qualifications (training and/or previous experience) for each of your Health Physics-related positions.

ANSWER: The Nuclear Radiation Center does not have a separate radiation protection staff for the reactor. All the members of the reactor operating staff must meet the training requirements of ANSI/ANS 15.4 and are qualified in health physics and perform the required H.P. activities. The Campus Radiation Safety Office is located in the Nuclear Radiation Center and may be called upon for assistance in the event of an emergency. Both the Director and the Associate Director of the facility may also be called upon for assistance in non-routine H.P. matters.

8. Describe any radiation protection training for non-Health Physics staff.

ANSWER: Non-reactor staff individuals who utilize the reactor (students) obtain their training in formal university classes and must pass a certification examination before being allowed to irradiate samples in the reactor.

9. Describe the program to ensure that personnel radiation exposure and releases of radioactive material are maintained at a level that is "as low as reasonably achievable" (ALARA).

ANSWER: In 1974 an environmental monitoring program was instituted that utilizes TLD type dosimeters. This program measures the background radiation level at the site and in the Pullman area and the effects of the operation of the facility on these background radiation levels on a quarterly basis. The results of these measurements are reported to the NRC annually. This program, the commitment of the University to ALARA principles, and the commitment given in Section 6.4-2 of the SAR constitute the ALARA commitment and program for the WSU reactor facility.

10. For the fixed-position radiation and effluent monitors, specify the generic types of detectors and their efficiencies and operable ranges. Also describe the methods and frequency of instrument calibrations and the routine operational checks.

ANSWER: The fixed effluent monitors are listed in the table below. The calibration of the units is checked monthly using a radioactive source and they are recalibrated annually in accordance with the preventative maintenance program using the procedure specified by the manufacturer of the instrument. The preventative maintenance program specifies the specific procedure for the calibration and maintenance of all important reactor system units.

Question 10 (ANSWER) - continued

Fixed Effluent Monitors

Unit	Detector	Efficiency
CAM	Pancake GM	β ≃ 30%
R.C. Stack	Thin Wall GM	β ≃ 10%
A-41	3" x 3" NaI(Tl)	1 CPM/10^{-8} μCi/ml

11. Describe the gaseous effluent sampling and equipment.

ANSWER: The A-41 monitor consists of a 3" x 3" NaI(Tl) detector situated in the center of a large volume shielded gaseous flow detector. The output of the NaI(Tl) detector is fed to a single channel pulse height analyzer and scaler system that accumulates the counts from the A-41 detected in the reactor exhaust.

The CAM is a standard fixed filter paper type CAM unit which is located on the bridge and takes a suction just above the pool surface. The CAM air flow rate is 1 CFM. The R. C. stack monitor is a thin window GM tube located in the center of the radiochemistry exhaust line. This unit monitors the discharge from the fume hoods in Room 101 where irradiated samples are uncanned. The pneumatic transfer system exhaust is also monitored by this unit.

12. For the radiation monitors that are alarmed, specify the alarm set-points and indicate the required staff response to each alarm.

ANSWER: Radiation Alarm Set Points and Required Staff Response

Unit	Alarm Set Point	Response
Bridge	100 mR/hr	(Automatically sounds evacuation alarm). Shut down reactor and evacuate
5 Area	10 mR/hr	Investigate cause
CAM	2000 CPM	Shut down reactor
R.C. Stack	500 CPM	Investigate cause
A-41	Release limit	Switch to isolation mode; if alarm persists, shut down reactor

13. Identify the generic type, number, and operable range of each of the portable Health Physics instruments routinely available at the reactor installation. Specify the frequency and methods of calibration.

ANSWER: All instruments are calibrated quarterly using a calibration source. A Ra-226 source is used for the β/γ units and a Pu-Be neutron source for the neutron monitors.

Unit	Range
Snoopy Neutron Monitor (BF_3)	.1 to 2 x 10^3 MRem/hr
Tech Associates TB-3R (GM)	.5 to 1000 mR/hr
CP4 Cutie Pie (IC)	.02 mR/hr to 100 R/hr
Eberline E-120 (GM)	.02 to 50 mR/hr
Eberline E-120 with HP-210 Probe (GM)	.02 to 50 mR/hr
Eberline PRM-5 (NaI)	50 to 500 K CPM
Tech Assoc PUG-1E with Pancake Probe (GM)	10 to 50 K CPM
Tech Assoc PUG-1E with NaI Probe	10 to 50 K CPM
Harshaw Model 272 Alpha Monitor (SS Det)	Scale (.1 to 100,000 CPS)
DCA Digital Dosimeter (GM)	.1 to 99.9 mR

14. Describe your personnel Monitoring program.

ANSWER: The personnel monitoring program at WSU involves the use of commercial film badges changed on a monthly basis. Siemens Gammasonice of Desplaines, Illinois is the supplier of the film badge service. The WSU Radiation Safety Office manages the film badge personnel monitoring program for the entire campus including the reactor facility. In addition to the film badges assigned to personnel working at the Center, badges are placed in fixed locations in the facility to monitor the exposure in each major section of the facility. These room badges are also changed on a monthly basis.

15. Under what conditions is the core ^{16}N diffuser system operated?

ANSWER: The diffuser is operated at power levels of 100 KW or above.

16. What provisions are made to ensure that the beam plugs are in place before reactor operation?

ANSWER: Each beam port has a microswitch which controls an indicator light on the reactor control panel. The reactor operator checks the status of the beam status lights during startup and any changes made during operation will be immediately made known to the operator.

17. List all reactor and HVAC parameters that are alarmed in the control room and specify alarm trip settings. (It is not necessary to repeat the radiation monitors discussed in answer to Question 12).

ANSWER: See next page

Question 17 (continued)

ANSWER: Control Console Alarms

Unit	Set Point	Visual	Audible
Seismograph		X	X
Short Period	5 sec	X	X
HV Failure	590 V	X	X
High Power	122%	X	X
Fule Temperature	500°C	X	X
High Radiation	100 mR/hr	X	X
CAM	2000 CPM	X	X
A-41 Level	6707 CPM	X	X
Stack	2000 CPM	X	X
Neutron Flux	110%	X	X
Pool Level	6" drop	X	X
Pool Conductivity	1 mho	X	X
Low Air Pressure	70 psi	X	X
Blade Disengage		X	X
Sample Monitor	100 mR/hr	X	X
Beam Port Plugs		X	
Building Evacuation	100 mR/hr	X	X

*For pedagogical purposes only - not required

18. Identify any automatic scram conditions other than the safety system channels listed in Technical Specification 3.5.3.

ANSWER: In addition to the scrams specified in the facility technical specifications, the WSU TRIGA reactor has a short period scram as listed in the table above. This is an extra (not required) scram installed for training power plant operators.

19. How does a monitored thermocouple failure during operations affect the temperature scram logic?

ANSWER: An open thermocouple produces a high temperature scram and a shorted thermocouple produces a low temperature scram.

20. Describe the heat exchanger system providing details of design temperatures, flow rates, pressure drops, and pressure differential between primary and secondary loops.

ANSWER: Design Data for Cooling System

Primary flow rate, gpm	350
Primary inlet temperature, °F	110
Primary outlet temperature, °F	90
Secondary flow rate, gpm	700
Secondary inlet temperature, °F	80
Secondary outlet temperature, °F	90
System heat load, BTU/hr (nominal)	3,500,000
Design wet bulb temperature, °F	65
Primary pressure drop, psi	10
Secondary pressure drop, psi	6
Cooling tower water consumption, evaporation, gph	430
Cooling tower water consumption, blow down, gph	100
Maximum pool temperature, °F	120
Primary pump, horsepower	10
Secondary pump, horsepower	15
Cooling tower fan, horsepower	20
Primary pipe size, inches	6
Secondary pipe size, inches	8

21. Describe your preventative maintenance program, including its relation to aging of your instrumentation and equipment.

ANSWER: The preventative maintenance program is described in detail in facility SOP #5 consisting of 21 pages of detailed instructions. The preamble of this procedure is given on the following page.

Question 21 (Answer) - continued

All license-required daily and weekly tests are conducted in the performance of the Reactor Pre-Startup Checkoff which contains a record thereof. A Preventative Maintenance Check List, consisting of two log sheets, is the record of other required tests and measurements along with information taken from the daily Reactor Pre-Startup Checkoff.

This procedure outlies the methods to be utilized in the conduct of tests, measurements, and maintenance scheduled on the Preventative Maintenance Check List. References to other standard operating procedures are made where specific procedures have been prepared for particular items. A licensed Reactor Operator shall be present during all tests, measurements, or maintenance operations and shall date and sign the appropriate space in the Check List upon completion.

SOP #5 along with additional SOP's describing the specific calibration procedure for a number of systems insures that all portions of the WSU reactor are maintained such that they perform their intended function irrespective of the age of the equipment.

22. Describe the WSU Nuclear Radiation Center fire protection program. Compare with proposed ANS 15.17.

ANSWER: The WSU Nuclear Radiation Center fire protection plan was drawn up to meet the requirements of ANS 15.17. The first paragraph of this plan is given below.

1.0 SCOPE: The purpose of the Washington State University Nuclear Radiation Center Fire Protection Plan is to assure that an adequate fire protection program is maintained at the Center. The primary objective of the fire protection program must be that of minimizing any danger to the health and safety of the general public resulting from a fire at the facility. Secondaly, the program should minimize: a) deleterious fire induced effects on facility safety-related systems, b) the release of radioactive materials to the environment, c) facility property damage, and d) assure personnel protection. The fire protection program necessary to achieve the overall objective can be described in terms of its three program components: passive fire protection, active fire protection, and fire prevention.

23. Describe the techniques used to insure facility instrumentation/control system configuration integrity.

<u>ANSWER</u>: Prior to startup a Reactor Startup Checkout is performed using a 10 page checkoff sheet. All systems are checked to insure that they perform their intended functions and all safety circuits are checked to insure that they alarm and/or scram at the prescribed setting.

24. Specify the maximum excess reactivity available in the WSU reactor.

<u>ANSWER</u>: The safety of a TRIGA reactor is not determined by the magnitude of the excess reactivity but by the shutdown margin. The SDM is designed to insure that the reactor will be shut down in the event of a scram even with the highest worth rod stuck in the fully withdrawn position.

The maximum excess reactivity available in the WSU reactor is core specific and not generic and depends on the core arrangement, fuel loading in each rod, and the control rod worths. The present SDM limit and control rod worths would permit the installation of approximately a $10.00 excess in the reactor.

Questions 25 to 26 are addressed by modifications in the appropriate sections of the WSU TRIGA Reactor Safety Analysis Report.

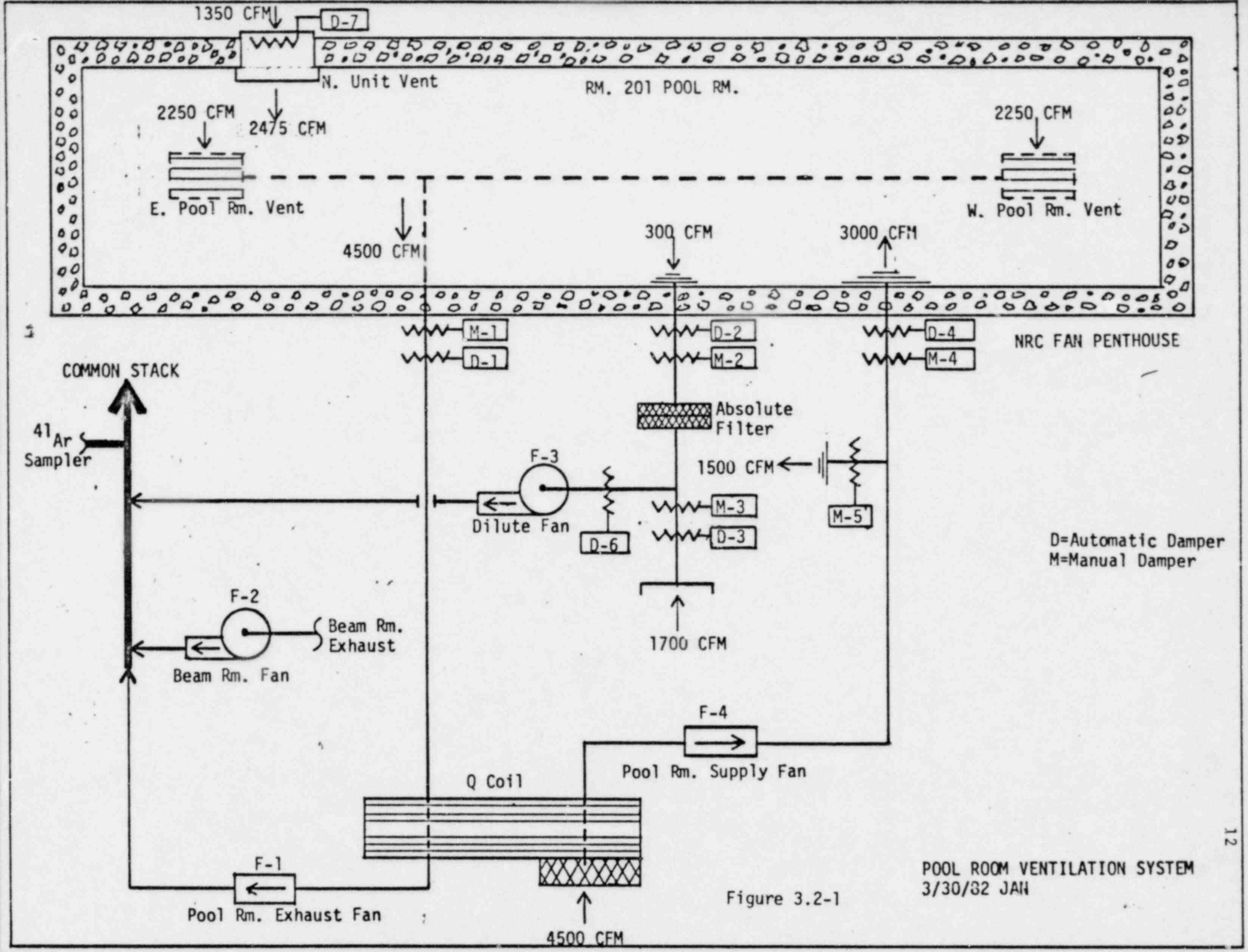

Figure 3.2-1

POOL ROOM VENTILATION SYSTEM
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Reactor Ventilation System Operating Modes

CONTROL MODE	FAN STATUS			AUTO-DAMPER STATUS			
	F1	F3	F4	D1	D2	D3	D4
AUTO	ON	OFF	ON	OPEN	CLOSED	CLOSED	OPEN
DILUTE	OFF	ON	OFF	CLOSED	OPEN	OPEN	CLOSED
ISOLATE	OFF	OFF	OFF	CLOSED	CLOSED	CLOSED	CLOSED

Figure 3.2-1A