Appendix A to Facility License No. R-56

Technical Specifications and Bases

University of Florida Training Reactor

Docket No. 50-083

March xx, 2017

TECHNICAL SPECIFICATIONS

1.0 Introduction

1.1 Scope

This document constitutes the Technical Specifications for Facility License No. R-56 as required by 10 CFR 50.36 and supersedes all prior UFTR Technical Specifications. This document includes the "bases" to support the selection and significance of the specifications. Each basis is included for information purposes only. They are not part of the Technical Specifications, and they do not constitute limitations or requirements to which the licensee must adhere.

1.2 Definitions

ACTIONS: Actions shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times. The Completion Time is the amount of time allowed for completing a Required Action referenced to the time of discovery of a situation.

CHANNEL: A channel is the combination of sensor, line, amplifier, and output devices that are connected for the purpose of measuring the value of a parameter.

CHANNEL CALIBRATION: Channel calibration shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel measures. The channel calibration shall encompass all devices in the channel required for channel OPERABILITY and the CHANNEL TEST.

CHANNEL CHECK: Channel check shall be the qualitative verification of acceptable performance by observation of channel behavior, or by comparison of the channel indication and status with other independent channels measuring the same parameter.

CHANNEL TEST: A channel test shall be:

a. Analog and bistable channels - the introduction of a signal into the channel for verification that it is OPERABLE.
b. Digital computer channels – the use of diagnostic programs to test digital computer hardware and the introduction of simulated process data into the channel for verification that it is OPERABLE.

CORE ALTERATION: Core alteration shall be the movement of any reactor fuel assemblies, graphite moderator elements, experimental facilities, or control blade assemblies within the reactor core region in MODE 5.

CORE CONFIGURATION: Core configuration shall include the number, type, or arrangement of fuel assemblies, graphite moderator elements, experimental locations, and control blades occupying the core region.

DAMAGED FUEL: A fuel assembly shall be identified as damaged if the cladding is breached resulting in fission product release or if visual inspection of the fuel indicates cladding blistering, excessive swelling, excessive bulging, excessive deformation, cladding holes, cladding tears, or cladding breaches of any kind.

EXCESS REACTIVITY: Excess reactivity shall be that amount of reactivity that would exist if all control blades were moved to the maximum reactive condition from the point where the reactor is exactly critical ($k_{eff} = 1$). When calculating excess reactivity, no credit shall be taken for negative experiment worth, temperature effects or xenon poisoning.

EXPERIMENT: Any evolution, hardware, or target (excluding devices such as detectors or foils) that is designed to investigate non-routine reactor characteristics or that is intended for irradiation within an irradiation facility. Hardware rigidly secured to the core or shield structure so as to be a part of its design to carry out experiments is not normally considered an experiment.

FUEL DEFECT: A fuel defect shall be any unintended change in the physical as-built condition of the fuel with the exception of normal effects of irradiation (e.g., elongation due to irradiation growth or assembly bow) that do not render the fuel inoperable. Examples include unusual pitting, unusual bulging, missing or broken bolts, missing or broken spacers, missing or broken combs, missing or broken welds, or unusual corrosion.

MOVABLE EXPERIMENT: A movable experiment is one where it is intended that all or part of the experiment may be moved into or adjoining the core or into and out of the core while the reactor is in MODES 1 or 2.

OPERABLE - OPERABILITY: A system or component shall be operable or have operability when it is capable of performing its intended function.

OPERATING: Operating means a component or system is performing its intended function.

RATED THERMAL POWER (RTP): RTP shall be a total reactor core heat transfer rate to the reactor coolant of 100 kWt.

REACTIVITY WORTH OF AN EXPERIMENT: The reactivity worth of an experiment is the value of the reactivity change that results from the experiment being inserted into or removed from its intended position.

REACTOR CELL: The Reactor Cell is the confinement enclosure around the reactor structure that is designed to limit the release of effluents between the enclosure and its external environment through defined pathways.

REACTOR OPERATING: The reactor is operating whenever it is not in MODES 3, 4, 5 or defueled. Reactor operation at greater than or equal to 1% RTP shall be called MODE 1. Reactor operation at less than 1% RTP shall be called MODE 2.

REACTOR SHUTDOWN: The reactor is shutdown if it is subcritical by at least 760 pcm with the core at ambient temperature with the reactivity worth of xenon equal to zero and with the reactivity worth of all installed experiments included. The reactor shutdown condition shall be called MODE 3.

REACTOR SECURED: The reactor is secured when with fuel present in the reactor there is insufficient water moderator available in the reactor to attain a k_{eff} greater than 0.8 or there is insufficient fuel present in the reactor under optimum available conditions of moderation and reflection to attain a k_{eff} greater than 0.8 or the reactor is shutdown with all control blades fully inserted; and the following conditions exist:

a. the console key switch is in the OFF position and the key is removed from the switch; and
b. no work is in progress involving fuel, core structure, installed control blades, or control blade drives unless they are physically decoupled from the control blades; and
c. no experiments are being moved or serviced that have, on movement, a reactivity worth exceeding 720 pcm.

The reactor secured condition shall be called MODE 4.

REACTOR OUTAGE: The reactor is in an outage condition anytime less than two layers of concrete block shielding are fully installed over the top of the core area with fuel in the core. The reactor outage condition shall be called MODE 5.

SHALL, SHOULD, and MAY: The word "shall" is used to denote a requirement; the word "should" is used to denote a recommendation; and the word "may" is used to denote permission, neither a requirement nor a recommendation.

SHUTDOWN MARGIN: Shutdown margin is the minimum shutdown reactivity necessary to ensure the reactor can be made subcritical by means of the reactor control and trip systems starting from any permissible operating condition with the most reactive blade in its most reactive position and that the reactor will remain subcritical without further operator action. When calculating shutdown margin, no credit shall be taken for negative experiment worth, temperature effects or xenon poisoning.

STRUCTURE, SYSTEM, OR COMPONENT (SSC): A structure is an element, or a collection of elements, to provide support or enclosure, such as a building, free-standing tanks, basins, dikes, or stacks. A system is a collection of components assembled to perform a function, such as piping, cable trays, conduits, or ventilation. A component is an item of mechanical or electrical equipment, such as a pump, valve, or relay, or an element of a larger array, such as a length of pipe, elbow, or reducer.

UNSCHEDULED SHUTDOWN: An unscheduled shutdown is any unplanned shutdown of the reactor caused by actuation of the reactor trip system, operator error, equipment malfunction, or a manual shutdown in response to conditions that could adversely affect safe operation, not including shutdowns that occur during testing or checkout operations.

1.3 Surveillance Intervals

Allowable intervals shall not exceed:

a. 10 years – interval not to exceed 12 years

b. 5 years – interval not to exceed 6 years

c. Biennial – interval not to exceed 30 months

d. Annual – interval not to exceed 15 months

e. Semiannual – interval not to exceed 7.5 months

f. Quarterly – interval not to exceed 4 months

g. Monthly – interval not to exceed 6 weeks

h. Weekly – interval not to exceed 10 days

i. Daily – prior to the first reactor startup of the day

2.0 Safety Limit and Limiting Safety System Settings

2.1 Safety Limit

Applicability: MODES 1 and 2.

Objective: To ensure fuel cladding integrity.

Specification: The fuel and cladding temperatures shall not exceed 986°F (530°C).

Basis: The safety limit is based on measurement of first fission product release from the fuel at or above the blister threshold temperature described in NUREG-1313.

2.2 Limiting Safety System Settings

Applicability: MODES 1 and 2.

Objective: To ensure automatic action terminates the abnormal situation before the safety limit is challenged.

Specification: According to Table 2.2-1.

Basis: Due to the inherently safe core design and low EXCESS REACTIVITY, postulated reactivity insertion event analyses indicate no automatic control or safety functions are needed to prevent reaching the Safety Limit (Ref. SAR Section 13.2). Therefore, to allow for generation of a reasonable set of Technical Specifications, and provide defense-in-depth, the fundamental reactor parameters of power, temperature, and flow were conservatively chosen for incorporation as LSSSs. These very conservative settings ensure normal reactor operation remains within the assumptions of the thermal hydraulic analysis for normal operation (ONBR > 1) as described in SAR Section 4.6.

Table 2.2-1
Limiting Safety System Settings

	FUNCTION	ALLOWABLE VALUE
1.	High Reactor Power Trip	≤ 110% RTP
2.	Low Reactor Coolant Flow Trip	≥ 41 gpm
3.	High Reactor Coolant Bulk Inlet Temperature Trip	≤ 102^{o}F

3.0 Limiting Conditions for Operation and Surveillance Requirements

3.0.1 LCO Applicability

Applicability: Any MODE or specified condition in which the applicable SSC or variable is required to be OPERABLE or within specified limits.

Objective: To provide general LCO requirements and guidance to ensure timely and appropriate operator action.

Specification:

1. LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.1.2.

2. Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.1.5. If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required.

3. When an LCO is not met and the associated ACTIONS are not met, or an associated ACTION is not provided, the reactor shall be placed in a MODE or other condition in which the LCO is not applicable. Action shall be initiated within 2 minutes of discovery of failure to meet the LCO. Exceptions to this Specification are stated in the individual Specifications.

4. Suspension of CORE ALTERATIONS, irradiated fuel movement, irradiated fueled EXPERIMENT movement, movement of experiments with significant potential for airborne releases, or movement of concrete block shielding over the top of the core in MODE 5, shall not preclude completion of movement of the component to a safe position.

5. When an LCO is not met solely due to interruption of recording function or indicating lamp function, the Conditions and Required Actions associated with this LCO are not required to be entered provided the recording function or indicating lamp function is restored within 15 minutes.

6. When in MODES 1 or 2, shutdown of the reactor should never be delayed when multiple unrelated LCOs are not being met simultaneously, except as provided in LCO 3.0.1.5.

Basis: LCOs 3.0.1.1, 3.0.1.2, 3.0.1.5, and 3.0.1.6 provide general LCO requirements and guidance. LCO 3.0.1.3 provides a 2-minute allowed action time upon discovery that an LCO is not met and the associated ACTIONS can't be met or an associated ACTION is not provided. LCO 3.0.1.4 provides the operator with prioritization guidance and an exception to allowed action completion time(s) to allow for safe completion of a component movement already in-progress.

3.0.2 Surveillance Requirement Applicability

Applicability: Any MODE or specified condition in which the applicable SSC or variable is required to be OPERABLE or within specified limits.

Objective: To confirm SSCs and variable properties required by Technical Specifications are OPERABLE and within specified limits.

Specification:

1. Failure to meet a surveillance, whether such failure is experienced during the performance of the surveillance or between performances of the surveillance, shall be failure to meet the associated LCO. Failure to perform a surveillance within the specified frequency shall be failure to meet the LCO except as provided in LCOs 3.0.2.2 and 3.0.2.3.

2. SRs may be deferred during MODES or other specified conditions in which a SSC or variable is not required to be OPERABLE or within specified limits; however, they shall be completed prior to entry into a MODE or other specified condition in which the SSC or variable is required to be OPERABLE or within specified limits unless entry into the MODE or other specified condition is required for performance of the surveillance as provided in LCO 3.0.2.3.

3. The following SRs require entry into the applicable MODE or other specified condition for performance of the surveillance. These SRs shall be performed as soon as practicable after entry into the MODE or other specified condition required for performance of the surveillance:
    a. SR 3.1.1
    b. SR 3.1.2
    c. SR 3.2.1.2
    d. SR 3.2.1.3
    e. SR 3.2.3.3 for LCO 3.2.3.1
    f. SR 3.7.2.2
    g. SR 3.7.2.3

4. Appropriate surveillance testing on any Technical Specification required SSC shall be conducted after replacement, repair, or modification before the SSC is considered OPERABLE except as provided in LCO 3.0.2.3.

Basis: These LCOs provide the operator with guidance and restrictions regarding missed SRs, deferred SRs, and post-maintenance testing of Technical Specification required SSCs.

3.1 Reactor Core Reactivity Parameters

Applicability: MODES 1 through 5.

Objective: To ensure the reactor can be made subcritical and to ensure the safety limit shall not be exceeded.

Specification: According to Table 3.1-1.

Basis: The value of SHUTDOWN MARGIN assures the reactor can be made subcritical from any operating condition. The value of EXCESS REACTIVITY allows flexibility to operate the reactor without the need to add fuel on a frequent basis while maintaining the installed core EXCESS REACTIVITY within the bounds of the analysis described in SAR Section 13.2.

Table 3.1-1
Reactor Core Reactivity Parameters

	REACTIVITY PARAMETER	ALLOWABLE VALUE
1.	SHUTDOWN MARGIN	≥ 760 pcm
2.	EXCESS REACTIVITY	≤ 1480 pcm

ACTIONS

	CONDITION		REQUIRED ACTION	COMPLETION TIME
A.	SHUTDOWN MARGIN not within limit.	A.1	Dump water moderator	15 minutes
B.	EXCESS REACTIVITY not within limit.	B.1	Dump water moderator	15 minutes

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.1	Verify SHUTDOWN MARGIN within limits	Annual [(a)]
SR 3.1.2	Verify EXCESS REACTIVITY within limits	Annual [(a)]

(a) These reactivity parameters shall also be verified within limits following changes in CORE CONFIGURATION.

3.2 Reactor Control and Trip Systems

3.2.1 Control Blades

Applicability: MODES 1 and 2.

Objective: To ensure control blade drop times and reactivity insertion rate are within limits. To ensure control blade withdrawal inhibit operability.

Specification: According to Table 3.2.1-1.

Basis: The drop time specification ensures the reactor will be promptly shut down when a trip signal is initiated. The reactivity insertion analyses provided in SAR Section 13.2 demonstrate the acceptability of the control blade drop time and reactivity insertion rate limits. The control blade withdrawal inhibits assist the operator in ensuring proper monitoring and control of power changes and approaches to criticality.

Table 3.2.1-1
Control Blade Limitations

	LIMITING CONDITION OR FUNCTION	ALLOWABLE CONDITION OR VALUE	SURVEILLANCE REQUIREMENTS
1.	Individual control blade drop times from initiation of trip signal to full insertion as measured from the fully withdrawn position for each of the four control blades	$\leq$ 2.0 seconds	SR 3.2.1.1
2.	Reactivity insertion rate due to control blade withdrawal	$\leq$ 74 pcm/second	SR 3.2.1.2 SR 3.2.1.3
3.	Control blade withdrawal	Neutron count rate $\geq$ 2 counts/second	SR 3.2.1.4
4.	Control blade withdrawal	Reactor Period > 10 seconds	SR 3.2.1.5

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.2.1.1	Verify each control blade drop time is within limit	Annual
SR 3.2.1.2	Verify control blade reactivity worths	Annual [(a)]
SR 3.2.1.3	Verify reactivity insertion rate is within limit	Annual [(a)]
SR 3.2.1.4	Verify proper inhibit function when neutron count rate is less than 2 counts/second	Daily
SR 3.2.1.5	Verify proper inhibit function	Daily

(a) These reactivity parameters shall also be verified following changes in CORE CONFIGURATION.

3.2.2 Reactor Trips

Applicability: MODES 1 and 2.

Objective: To specify the minimum required OPERABLE reactor trips.

Specification: According to Table 3.2.2-1.

Basis: LCOs 3.2.2.1, 3.2.2.2, and 3.2.2.3 ensure reactor operation remains bounded by the thermal hydraulic analysis described in SAR Section 4.6. LCO 3.2.2.4 provides redundancy to LCOs 3.2.2.1, 3.2.2.2, and 3.2.2.3. LCO 3.2.2.5 ensures early termination of a reactivity insertion event originating from low power levels. LCO 3.2.2.6 provides redundancy to LCO 3.2.2.2 and acts as a blade withdrawal inhibit until the minimum core water level is reached. The Manual trip allows the operator to quickly shutdown the reactor if an unsafe or abnormal situation occurs.

Table 3.2.2-1
Specifications for Reactor System Trips

	FUNCTION	SURVEILLANCE REQUIREMENTS	ALLOWABLE CONDITION OR VALUE
1.	High Reactor Power	SR 3.2.2.1	$\leq$ 110% RTP
2.	Low Reactor Coolant Flow	SR 3.2.2.2	$\geq$ 41 gpm
3.	High Reactor Coolant Bulk Inlet Temperature	SR 3.2.2.1	$\leq 102^{o}$F
4.	High Reactor Coolant Bulk Outlet Temperature	SR 3.2.2.1	$\leq 120^{o}$F
5.	Fast Reactor Period	SR 3.2.2.1	$\geq$ 3 seconds
6.	Low Reactor Coolant Level	SR 3.2.2.2	$\geq$ 2 inches above the fuel
7.	Manual	SR 3.2.2.1	OPERABLE

ACTION

	CONDITION		REQUIRED ACTION	COMPLETION TIME
A.	One required trip inoperable.	A.1	Restore operability	15 minutes

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.2.2.1	Perform a CHANNEL CHECK	Daily
SR 3.2.2.2	Perform a CHANNEL TEST	Quarterly

3.2.3 Reactor Measuring Channels

Applicability: According to Table 3.2.3-1.

Objective: To specify the minimum measuring channels required to be OPERABLE.

Specification: According to Table 3.2.3-1.

Basis: To ensure indications of the specified parameters are provided to the operator for adequate monitoring of steady state and transient reactor conditions.

Table 3.2.3-1
Minimum Required Measuring Channels

	CHANNEL	APPLICABILITY	SURVEILLANCE REQUIREMENTS	NUMBER OPERABLE
1.	Reactor Power	MODES 1 and 2	SR 3.2.3.1 and SR 3.2.3.3	2
2.	Reactor Period	MODES 1 and 2	SR 3.2.3.1 and SR 3.2.3.3	1
3.	Control Blade Position	MODES 1 and 2	SR 3.2.3.1 and SR 3.2.3.2	4
4.	Reactor Coolant Flow	MODES 1 and 2	SR 3.2.3.1 and SR 3.2.3.3	1
5.	Reactor Coolant Bulk Inlet Temperature	MODES 1 and 2	SR 3.2.3.1 and SR 3.2.3.3	1
6.	Reactor Coolant Bulk Outlet Temperature	MODES 1 and 2	SR 3.2.3.1 and SR 3.2.3.3	1
7.	Reactor Coolant Fuel Box Outlet Temperature	MODE 1	SR 3.2.3.1 and SR 3.2.3.3	4

ACTION

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required channel inoperable.	A.1 Restore operability	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.3.1	Perform a CHANNEL CHECK	Daily
SR 3.2.3.2	Perform a CHANNEL TEST	Weekly
SR 3.2.3.3	Perform a CHANNEL CALIBRATION	Annual

3.3 Coolant Systems

3.3.1 Leak Detection

Applicability: MODES 1 and 2.

Objective: To ensure remote indication of water leakage into the equipment pit.

Specification: The equipment pit water level sensor shall provide an alarm if water level in the equipment pit is greater than 1 inch above equipment pit floor level.

Basis: This specification is designed to alert the operator of water leakage into the equipment pit. The setpoint of one inch is based on the design of the equipment pit alarm level sensor.

ACTION

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Channel inoperable	A.1 Restore operability	15 minutes

SURVEILLANCE REQUIREMENT

SURVEILLANCE		FREQUENCY
SR 3.3.1	Perform a CHANNEL TEST	Weekly

3.3.2 Reactor Coolant System Water

Applicability: When reactor coolant system water is in contact with fuel assemblies.

Objective: To specify the electrical resistivity limit for reactor coolant system water in contact with in-core fuel assemblies.

Specification: The electrical resistivity of reactor coolant system water shall be no less than 0.5 MΩ-cm averaged over a period of four hours.

Basis: The resistivity limit is designed to minimize fuel assembly corrosion. Monitoring reactor coolant resistivity provides for early indication of any potential fission product release.

SURVEILLANCE REQUIREMENT

	SURVEILLANCE	FREQUENCY
SR 3.3.2	Verify resistivity is within the limit	Daily

3.4 Reactor Cell Evacuation Alarm Interlock

Applicability: MODES 1 and 2; during CORE ALTERATIONS, irradiated fuel movement, irradiated fueled EXPERIMENT movement, movement of experiments with significant potential for airborne releases, and during movement of concrete block shielding over the top of the core in MODE 5.

Objective: Specify requirements for this evacuation alarm system interlock.

Specification: Two area radiation monitors simultaneously alarming high shall cause an automatic actuation of the evacuation alarm.

Basis: As described in SAR Chapter 7, the evacuation alarm interlock with the area monitor high alarm function is designed to alert the staff and occupants of potential radiological emergencies in the REACTOR CELL.

ACTIONS

CONDITION	REQUIRED ACTIONS		COMPLETION TIME
A. Evacuation alarm interlock inoperable.	A.1	Restore operability	15 minutes
		AND	
	A.2	Suspend CORE ALTERATIONS, irradiated fuel movement, irradiated fueled EXPERIMENT movement, movement of experiments with significant potential for airborne releases, and movement of concrete block shielding over the top of the core in MODE 5	15 minutes

SURVEILLANCE REQUIREMENT

	SURVEILLANCE	FREQUENCY
SR 3.4	Verify proper interlock function	Weekly

3.5 Reactor Cell Ventilation Systems

Applicability: MODES 1 and 2; during CORE ALTERATIONS, irradiated fuel movement, irradiated fueled EXPERIMENT movement, movement of experiments with significant potential for airborne releases, and during movement of concrete block shielding over the top of the core in MODE 5.

Objective: To specify the minimum OPERABILITY requirement for the REACTOR CELL ventilation systems.

Specification:

1. The core vent and stack dilution systems shall be OPERATING.

2. REACTOR CELL pressure shall be negative with respect to the surrounding environment.

Basis: As described in SAR Chapters 9 and 11, operation of the core vent system ensures REACTOR CELL pressure is maintained negative relative to the surrounding environment and potential gaseous effluents are routed to the reactor stack. Operation of the stack dilution system ensures that gaseous effluents originating from the REACTOR CELL are diluted prior to release.

ACTIONS

	CONDITION		REQUIRED ACTIONS	COMPLETION TIME
A.	Core vent or stack dilution systems not OPERATING. OR REACTOR CELL pressure not within specification	A.1	Place or verify affected system(s) in operation AND	15 minutes
		A.2	Verify REACTOR CELL pressure within specification AND	15 minutes
		A.3	Suspend CORE ALTERATIONS, irradiated fuel movement, irradiated fueled EXPERIMENT movement, movement of experiments with significant potential for airborne releases, and movement of concrete block shielding over the top of the core in MODE 5	15 minutes

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.1	Verify core vent and stack dilution systems are OPERATING	Daily
SR 3.5.2	Verify REACTOR CELL pressure is negative with respect to the surrounding environment	Quarterly

3.6 Emergency Power – This section intentionally blank

3.7 Radiation Monitoring Systems and Radioactive Effluents

3.7.1 Radiation Monitoring Systems

Applicability: MODES 1 and 2; During CORE ALTERATIONS, irradiated fuel movement, irradiated fueled EXPERIMENT movement, movement of experiments with significant potential for airborne releases, and during movement of concrete block shielding over the top of the core in MODE 5.

Objective: To specify minimum OPERABILITY requirements for the area radiation monitors, air particulate detector, and stack radiation monitor.

Specification: According to Table 3.7.1-1.

Basis: As described in SAR Chapter 7, the radiation monitoring channels inform the operator about the radiological conditions present in the REACTOR CELL and reactor stack and provide early detection of any potential fission product release or radiological abnormality.

Table 3.7.1-1
Minimum Radiation System Requirements

	RADIATION MONITOR TYPE	ALARM SETPOINT	SURVEILLANCE REQUIREMENTS	NUMBER REQUIRED OPERABLE
1.	Area Radiation Monitor	≤ 25 mr/hr or equivalent	SR 3.7.1.1, SR 3.7.1.2, and SR 3.7.1.3	3
2.	Air Particulate Detector	≤ Five times background	SR 3.7.1.1, SR 3.7.1.2, and SR 3.7.1.3	1
3.	Stack Radiation Monitor	≤ Twice normal	SR 3.7.1.1, SR 3.7.1.2, and SR 3.7.1.3	1

ACTIONS

	CONDITION	REQUIRED ACTIONS		COMPLETION TIME
A.	One required radiation monitor inoperable.	A.1	Substitute portable instrument, survey, or analysis	60 minutes
			AND	
		A.2	Restore required radiation monitor operability	7 days

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.1.1	Perform a CHANNEL CHECK	Daily
SR 3.7.1.2	Perform a CHANNEL TEST	Weekly
SR 3.7.1.3	Perform a CHANNEL CALIBRATION	Semiannual

3.7.2 Argon-41 Discharge

Applicability: MODES 1 and 2.

Objective: To ensure Argon-41 emissions resulting from licensed UFTR operation remain below applicable limits.

Specification:

1. Ar-41 emissions resulting from licensed UFTR operation shall not exceed the total effective dose limit of 10 CFR 20.1101(d).

2. Energy generation (kW-hours) of the UFTR shall be limited to ensure TS 3.7.2.1 is not exceeded.

Basis: Regulation 10 CFR 20.1101(d) imposes an ALARA constraint of 10 mrem per year total effective dose equivalent on airborne emissions of radioactive material to the environment. To ensure compliance with this annual constraint, the UFTR limits Ar-41 produced by administratively limiting energy generation as described in SAR Chapter 11.

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.2.1	Verify UFTR energy generation is within the limit	Quarterly
SR 3.7.2.2	Verify the expected total effective dose equivalent to the individual member of the public likely to receive the highest dose from Ar-41 emission is within the limit of 10 CFR 20.1101(d)	Semiannual
SR 3.7.2.3	Determine the UFTR energy generation limit based on measurement of the stack effluent discharge	Semiannual

3.8 Limitations on Experiments

3.8.1 Experiment Reactivity Limits

Applicability: MODES 1 through 5.

Objective: To minimize the likelihood of an inadvertent prompt reactivity excursion and to prevent damage to the fuel and cladding.

Specification:

1. The absolute value of the reactivity worth of any single MOVABLE EXPERIMENT shall be less than or equal to 720 pcm.

2. The sum of the absolute values of the reactivity worths of all EXPERIMENTS shall be less than or equal to l400 pcm.

Basis: The reactivity limit on MOVABLE EXPERIMENTS is less than the effective delayed neutron fraction to prevent an inadvertent prompt reactivity excursion. The total reactivity worth limit is established to prevent a reactivity insertion larger than the stipulated maximum step reactivity insertion in the accident analysis (Ref. SAR Sections 4.1 and 13.2).

3.8.2 Experiment Materials and Malfunctions

Applicability: MODES 1 through 5

Objective: To prevent damage to reactor components resulting from EXPERIMENT failure and minimize potential radiological hazards. To ensure fueled EXPERIMENT malfunctions are bounded by accident analyses.

Specification:

1. EXPERIMENTS known to contain explosive materials, such as gunpowder, TNT, nitroglycerin, or PETN, shall not be irradiated.

2. EXPERIMENTS known to contain corrosive materials shall be double encapsulated.

3. EXPERIMENTS shall be designed such that they will not contribute to the failure of other EXPERIMENTS, core components, or fuel cladding.

4. Each fueled EXPERIMENT shall be limited such that the total inventory of iodine isotopes 131 through 135 in the EXPERIMENT is not greater than 0.01 curies.

5. Credible failure of any EXPERIMENT shall not result in exposures in excess of the limits in 10 CFR Part 20.

Basis: This specification is intended to minimize potential radiological hazards and prevent damage to reactor components resulting from failure of an experiment (Ref. ANSI/ANS-15.1-2007). This specification also ensures that malfunction of a fueled experiment remains bounded by the accident analyses of SAR Section 13.2.

ACTIONS

	CONDITION		REQUIRED ACTIONS	COMPLETION TIME
A.	Release of EXPERIMENT material that could cause damage to other EXPERIMENTS, core components, or fuel cladding.	A.1	Verify the reactor is shutdown	5 minutes
			AND	
		A.2	Inspect the affected area	Prior to continued operations
			AND	
		A.3	Obtain RSRS approval	Prior to continued operations

3.9 Other Facility Specific Limitations

3.9.1 Shield Tank Level

Applicability: MODES 1 and 2.

Objective: To specify the minimum OPERABILITY requirement for the shield tank.

Specification: Shield tank water level shall be no lower than 18 inches below the top of the tank.

Basis: Maintaining shield tank water level ensures sufficient water to adequately shield the west side of the reactor core during full power reactor operation (Ref. SAR Chapters 4, 7, 9, 10 and 11).

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Level not within the limit.	A.1	Be in MODE 2	2 minutes
		AND	
	A.2	Restore level to within limit	15 minutes

SURVEILLANCE REQUIREMENT

	SURVEILLANCE	FREQUENCY
SR 3.9.1	Verify shield tank water level is within the limit	Daily

3.9.2 Fuel and Fuel Handling

Applicability: According to Table 3.9.2-1.

Objective: To establish fuel integrity and fuel handling operations remain bounded by the accident analyses.

Specification: According to Table 3.9.2-1.

Basis: Operation with damage free fuel ensures consequences of accidents involving a fission product release remain bounded by the analysis provided in SAR Section 13.2. Limiting entry into MODE 5 until at 30 days after shutdown ensures actual fuel fission product inventory remains bounded by the conservative calculated fission product inventory provided in SAR Section 13.2.

Table 3.9.2-1
Fuel and Fuel Handling Limitations

	LIMITING CONDITION	APPLICABLE MODES	SURVEILLANCE REQUIREMENTS
1.	The reactor shall not be operated with DAMAGED FUEL in the core except to locate the damaged in-core fuel	1, 2	SR 3.9.2.1 SR 3.9.2.2
2.	At least two layers of concrete block shielding shall remain fully installed over the core area until a minimum of 30 days have passed since the last operation in MODES 1 or 2	5	SR 3.9.2.3

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.9.2.1	Reactor coolant water shall be sampled and evaluated for indications of DAMAGED FUEL	Weekly
SR 3.9.2.2	Verify the integrity of all in-core reactor fuel assemblies by visual inspection. DAMAGED FUEL assemblies and assemblies with FUEL DEFECTS shall be removed from the core	10 years
SR 3.9.2.3	Verify a minimum of 30 days have passed since last operation in MODES 1 or 2	Prior to MODE 5 entry

4.0 This section intentionally left blank. Surveillances are included in Section 3.0

5.0 Design Features

5.1 Site Description

Applicability: At all times.

Objective: To identify the facility location. To specify REACTOR CELL features supporting radiological safety assumptions.

Specification:

1. The UFTR facility and Reactor Building shall be located on the main campus of the University of Florida at Gainesville, Florida, in the immediate vicinity of the buildings housing the College of Engineering and the College of Journalism.

2. The REACTOR CELL shall be located at the north end of the Reactor Building.

3. The REACTOR CELL shall be equipped with independent air conditioning and ventilation systems.

4. The REACTOR CELL core ventilation system effluents shall be discharged through a stack at a minimum of 25 feet above ground level.

5. The REACTOR CELL minimum free volume shall be 36,000 cubic feet.

6. Access to the REACTOR CELL shall be restricted in accordance with the facility security procedures.

Basis: To ensure changes to the specified location and REACTOR CELL features supporting radiological safety assumptions are not made without prior NRC approval.

5.2 Reactor Coolant System

Applicability: When reactor coolant system water is in contact with fuel assemblies loaded into the reactor core.

Objective: To specify reactor coolant system design features that support gravity draining of the core water moderator and pressure surge protection.

Specification:

1. The reactor coolant water flow path shall be from the storage tank located in the equipment pit to the reactor coolant pump then through the heat exchanger up to the bottom of the fuel boxes, upward past the fuel assemblies to overflow pipes and into a header for gravity-driven return to the storage tank.

2. The reactor coolant system shall contain a rupture disc designed to break at approximately 2 psi above normal operating system pressure. Breakage of the rupture disc shall cause water from the core to be drained into the equipment storage pit.

Basis: Fuel boxes are elevated above other major reactor coolant system components to ensure any event causing a loss of primary coolant flow results in the water moderator gravity draining from the fuel boxes thereby shutting down the reactor. The rupture disc is designed to break during a pressure surge causing the water moderator to be drained from the core thereby shutting down the reactor (Ref. SAR Section 5.2).

5.3 Reactor Core and Fuel

5.3.1 Reactor Core Design

Applicability: MODES 1 through 5.

Objective: To specify reactor core design features which if altered could affect safety.

Specification:

1. The reactor core shall contain six aluminum fuel boxes, containing up to four fuel assemblies each, arranged in two parallel rows of three boxes each, and separated by about 30 cm of graphite.

2. The reactor core shall contain four scrammable control blades of swing-arm type consisting of aluminum vanes tipped with cadmium, protected by magnesium shrouds.

3. The reactor core shall contain the surrounding graphite assembly that measures about 5’ x 5’ x 5’.

4. The reactor core shall contain experimental locations to include three vertical columns and one horizontal throughport.

Basis: This ensures specified reactor core design features remain as analyzed in SAR Chapters 4 and 13.

5.3.2 Reactor Core Fuel Loading

Applicability: According to Table 5.3.2-1.

Objective: To ensure the operational reactor core is loaded as intended and contains no fewer full fuel assemblies than the limiting CORE CONFIGURATION.

Specification: According to Table 5.3.2-1.

Basis: This ensures the reactor core is loaded as intended and that the operational fuel loading remains bounded by the limiting CORE CONFIGURATION described in SAR Chapters 4 and 13.

Table 5.3.2-1
Fuel Loading Limitations

	FUEL LOADING LIMIT	APPLICABILITY
1.	The reactor core shall contain no less than 22 full fuel assemblies and shall be loaded so that all fuel assembly positions are occupied	MODES 1 and 2
2.	The reactor core shall contain up to 24 full fuel assemblies of 14 plates each	MODES 1 through 5
3.	Full assemblies in the reactor core may be replaced with pairs of partial assemblies	MODES 1 through 5
4.	A partial assembly in the reactor core shall be composed of either all dummy or all fueled plates	MODES 1 through 5
5.	A pair of partial assemblies in the reactor core shall contain 13 plates	MODES 1 through 5

5.3.3 Reactor Fuel Design

Applicability: MODES 1 through 5.

Objective: To specify the proper reactor fuel type and burnup limit.

Specification:

1. Fuel assemblies installed in the core shall be of the general MTR type, with thin fuel plates clad with aluminum 6061 and containing uranium silicide-aluminum (U_3Si_2-Al) fuel meat enriched to no more than about 19.75% U-235.

2. Fuel assembly burnup shall not exceed 50% of its initial U-235 content.

Basis: This ensures the reactor core is loaded with the proper type fuel as analyzed in SAR Chapters 4 and 13 and that fuel burnup is limited to within the evaluation limits of NUREG-1313.

5.4 Fuel Storage

Applicability: At all times for fuel in storage.

Objective: To ensure fuel in storage remains subcritical and adequately cooled.

Specification:

1. The k_{eff} of all fuel, including fueled EXPERIMENTS and fueled devices, in storage shall be no greater than 0.90.

2. Irradiated fuel, including irradiated fueled EXPERIMENTS and irradiated fueled devices, in storage shall be stored in a manner that permits sufficient natural cooling.

Basis: This ensures fuel in storage remains subcritical and adequately cooled (Ref. SAR Section 9.2).

6.0 Administrative Controls

6.1 Organization

6.1.1 Structure

The organization for the management and operation of the reactor facility shall include the structure indicated in Figure 6-1. Four levels of authority are provided.

Level 1 - Individuals responsible for the reactor facility's licenses, charter, and site administration.

Level 2 - Individual responsible for reactor facility management.

Level 3 - Individual responsible for reactor operations, and supervision of day-to-day facility activities.

Level 4 - Reactor operations staff.

6.1.2 Responsibility

Responsibility for the safe operation of the reactor facility shall be with the chain of command established in Figure 6-1. In addition to having responsibility for the policies and operation of the reactor facility, individuals at various management levels shall be responsible for safeguarding the public and facility personnel from undue radiation exposures, and for adhering to all requirements of the operating license and Technical Specifications. In all instances, responsibilities of one level may be assumed by designated alternates or by higher levels, conditional upon appropriate qualifications.

6.1.3 Staffing

1. The minimum staffing when the reactor is in MODES 1, 2, or 3 shall be:

    a. An operator in the control room,

    b. A designated second person, physically located on the grounds of the University of Florida campus and capable of getting to the control room within 10 minutes under normal conditions, able to carry out prescribed written instructions, and

    c. A designated senior operator shall be readily available on call. "Readily Available on Call" means an individual who:

        i. has been specifically designated and the designation known to the operator on duty,

        ii. can be rapidly contacted by phone or other means of communication available to the operator on duty, and

        iii. is capable of getting to the reactor facility within 30 minutes under normal conditions.

2. A list of reactor facility personnel by name and telephone number shall be readily available in the control room for use by the operator. The list shall include:

    a. Management personnel,

    b. Radiation control personnel, and

    c. Other operations personnel.

3. Events requiring the presence at the facility of a senior operator are:

    a. All CORE ALTERATIONS,

    b. Initial startup and approach to power,

    c. Relocation of any EXPERIMENT with reactivity worth greater than 720 pcm,

    d. Recovery from an UNSCHEDULED SHUTDOWN or unplanned reduction in power of 10 kWth or more, and

    e. During movement of concrete block shielding over top of the core in MODE 5.

6.1.4 Selection and Training of Operations Personnel

The selection and training of licensed operations personnel should be in accordance with the American National Standard, ANSI/ANS-15.4-2016, Selection and Training of Personnel for Research Reactors.

6.2 Review and Audit

6.2.1 RSRS Composition and Qualifications

1. The RSRS shall be composed of a minimum of three members with expertise in reactor technology and/or radiological safety.

2. Members of the RSRS shall be appointed by and report to the Chair of the Radiation Control Committee (RCC).

3. Qualified and approved alternates may serve in the absence of regular members.

6.2.2 RSRS Rules

RSRS functions shall be conducted in accordance with the following charter:

1. At least one meeting shall be held annually. Meetings may be held more frequently as circumstances warrant, consistent with the effective monitoring of facility operations as determined by the RSRS Chair;

2. The RSRS Chair shall ensure meeting minutes are submitted, reviewed, and approved, no later than the next RSRS meeting; and

3. A quorum shall consist of not less than one-half of the voting members where the operating staff does not constitute a majority.

6.2.3 RSRS Review Function

The following items shall be reviewed:

1. Determinations that proposed changes or experiments or tests do not require prior NRC authorization, pursuant to 10 CFR 50.59;

2. New procedures and major revisions of existing procedures having safety significance;

3. Proposed changes to a SSC having safety significance;

4. Proposed changes in Technical Specifications or license;

5. All new tests;

6. Violations of Technical Specifications or license;

7. Violations of procedures having safety significance;

8. Operating abnormalities having safety significance;

9. Reportable occurrences listed in Section 6.7.2; and

10. Audit reports required by Technical Specifications.

6.2.4 Audit Function

The audit function shall include selective but comprehensive examination of operating records, logs, and other documents. Discussions with cognizant personnel and observation of operations should be used also as appropriate. In no case shall the individual immediately responsible for the area perform an audit in that area. The following items shall be audited:

1. Facility operations for conformance to the Technical Specifications and applicable license conditions, annually;

2. The retraining and requalification program for the operating staff, biennially;

3. The results of action taken to correct deficiencies in reactor SSCs or methods of operations that affect reactor safety, annually; and

4. The emergency plan, security procedures, and emergency implementing procedures, biennially.

A written report of audit findings shall be submitted to the Dean of the College of Engineering and RSRS members within three months after the audit has been completed. Deficiencies uncovered that affect reactor safety shall immediately be reported to Dean of the College of Engineering.

6.3 Radiation Safety

The Radiation Control Officer shall be responsible for implementation of the radiation protection program and shall report to the Director, Environmental Health and Safety.

6.4 Procedures

The UFTR facility shall be operated and maintained in accordance with approved written procedures. All procedures and major revisions thereto shall be reviewed and approved by the Facility Director before going into effect. Operating procedures shall be in effect for the following items:

1. Startup, operation and shutdown of the reactor;

2. Fuel loading, unloading, and movement within the reactor;

3. Maintenance of major components of systems that could have an effect on reactor safety;

4. Surveillances and inspections required by the Technical Specifications or those that may have an effect on reactor safety;

5. Personnel radiation protection, consistent with applicable regulations. The procedures shall include management commitment to maintain exposures as low as reasonably achievable (ALARA);

6. Administrative controls for operations and maintenance and for the conduct of irradiations and EXPERIMENTS that could affect reactor safety or core reactivity;

7. Implementation of the Emergency Plan and security procedures; and

8. Use, receipt, and transfer of by-product material, if appropriate.

6.5 Experiment Review and Approval

Approved EXPERIMENTS shall be carried out in accordance with established and approved procedures. In addition:

1. All new EXPERIMENTS or class of EXPERIMENTS shall be reviewed by the RSRS and approved in writing by the Facility Director or designated alternates prior to initiation;

2. Substantive changes to previously approved EXPERIMENTS shall be made only after review by the RSRS and approval in writing by the Facility Director or designated alternates. Minor changes that do not significantly alter the EXPERIMENT may be approved by Reactor Manager or higher; and

3. EXPERIMENT review and approval shall include verification that the limitations imposed under Section 3.8 are met, as appropriate.

6.6 Required Actions

6.6.1 Actions to be Taken in the Event of a Safety Limit Violation

1. The reactor shall be shut down, the Facility Director shall be notified, and reactor operations shall not resume until authorized by the NRC;

2. The NRC shall be notified in accordance with Section 6.7.2; and

3. A safety limit violation report shall be prepared. The report shall describe the following:

    a. Applicable circumstances leading to the violation including, when known, the cause and contributing factors;

    b. Effect of the violation upon reactor facility components, systems, or structures and on the health and safety of personnel and the public; and

    c. Corrective action to be taken to prevent recurrence.

The report shall be reviewed by the RSRS and any follow-up report shall be submitted to the NRC when authorization is sought to resume operation of the reactor.

6.6.2 Actions to be Taken in the Event of a Reportable Occurrence of the Type Identified in Section 6.7.2.a Other Than a Safety Limit Violation

1. Reactor conditions shall be returned to normal, or the reactor shall be shut down;

2. If it is necessary to shut down the reactor to correct the occurrence, operations shall not be resumed unless authorized by the Facility Director or designated alternates;

3. Occurrence shall be reported to the Facility Director or designated alternates and to the NRC as required in Section 6.7.2; and

4. Occurrence shall be reviewed by the RSRS at its next scheduled meeting.

6.7 Reports

6.7.1 Annual Operating Report

An annual report covering the previous calendar year shall be submitted to the NRC Document Control Desk by June 30 of each year consisting of:

1. A narrative summary of reactor operating experience including the energy produced by the reactor or the hours the reactor was critical, or both;

2. The UNSCHEDULED SHUTDOWNS including, where applicable, corrective action taken to preclude recurrence;

3. Tabulation of major preventive and corrective maintenance operations having safety significance;

4. A brief description, including a summary of the change evaluation, of changes, tests, and EXPERIMENTS implemented under 10 CFR 50.59;

5. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the facility licensee as determined at, or before, the point of such release or discharge. The summary shall include to the extent practicable an estimate of individual radionuclides present in the effluent. If the estimated average release after dilution or diffusion is less than 25% of the concentration allowed, a statement to this effect is sufficient;

6. A summarized result of environmental surveys performed outside the facility; and

7. A summary of exposure received by facility personnel and visitors where such exposures are greater than 25% of that allowed in 10 CFR Part 20.

6.7.2 Special Reports

a. There shall be a report not later than the following working day by telephone and confirmed in writing by facsimile or similar conveyance to the NRC Headquarters Operations Center, to be followed by a written report that describes the circumstances of the event within 14 days of any of the following:

1. Violation of safety limit;

2. Release of radioactivity from the site above allowed limits;

3. MODE 1 or MODE 2 operation with actual trip system settings for required systems less conservative than the limiting safety system settings;

4. MODE 1 or MODE 2 operation in violation of limiting conditions for operation unless prompt remedial action is taken as permitted in Section 3;

5. A reactor safety system component malfunction that renders or could render the reactor safety system incapable of performing its intended safety function. If the malfunction or condition occurs during MODES or conditions in which the LCO is not applicable then no report is required;

   Note: Where components or systems are provided in addition to the minimum required by the Technical Specifications, the failure of the extra components or systems is not considered reportable provided that the minimum number of components or systems specified or required are capable of performing their intended function.

6. An unanticipated or uncontrolled change in reactivity greater than 720 pcm. Reactor trips resulting from a known cause are excluded;

7. Abnormal and significant degradation in reactor fuel or cladding, or both, coolant boundary (excluding minor leaks), or REACTOR CELL boundary (excluding minor leaks) where applicable; or

8. An observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or could have caused the existence or development of an unsafe condition with regard to reactor operations.

b. There shall be a written report within 30 days to the NRC of the following:

1. Permanent changes in the facility organization of Level 1 or 2 personnel, and

2. Significant changes in the transient or accident analyses as described in the Safety Analysis Report.

6.8 Records

6.8.1 Records Shall be Retained for a Period of at Least Five Years or for the Life of the Component Involved if Less Than Five Years

1. Normal reactor operation (but not including supporting documents such as checklists, log sheets, etc., which shall be maintained for a period of at least one year),

2. Principal maintenance operations,

3. Reportable occurrences,

4. Surveillance activities required by the Technical Specifications,

5. Reactor facility radiation and contamination surveys where required by applicable regulations,

6. EXPERIMENTS performed with the reactor,

7. Fuel inventories, receipts, and shipments,

8. Approved changes in operating procedures, and

9. Records of meetings and audit reports of the RSRS.

6.8.2 Records Shall be Retained for at Least One Training Cycle

Record of retraining and requalification of operators shall be maintained at all times the individual is employed or until the operator's license is renewed.

6.8.3 Records Shall be Retained for the Lifetime of the Facility

1. Gaseous and liquid radioactive effluents released to the environs,

2. Offsite environmental monitoring surveys,

3. Radiation exposures for all personnel monitored,

4. Drawings of the reactor facility, and

5. Reviews and reports pertaining to a violation of a safety limit, limiting safety system setting, or limiting conditions for operations.

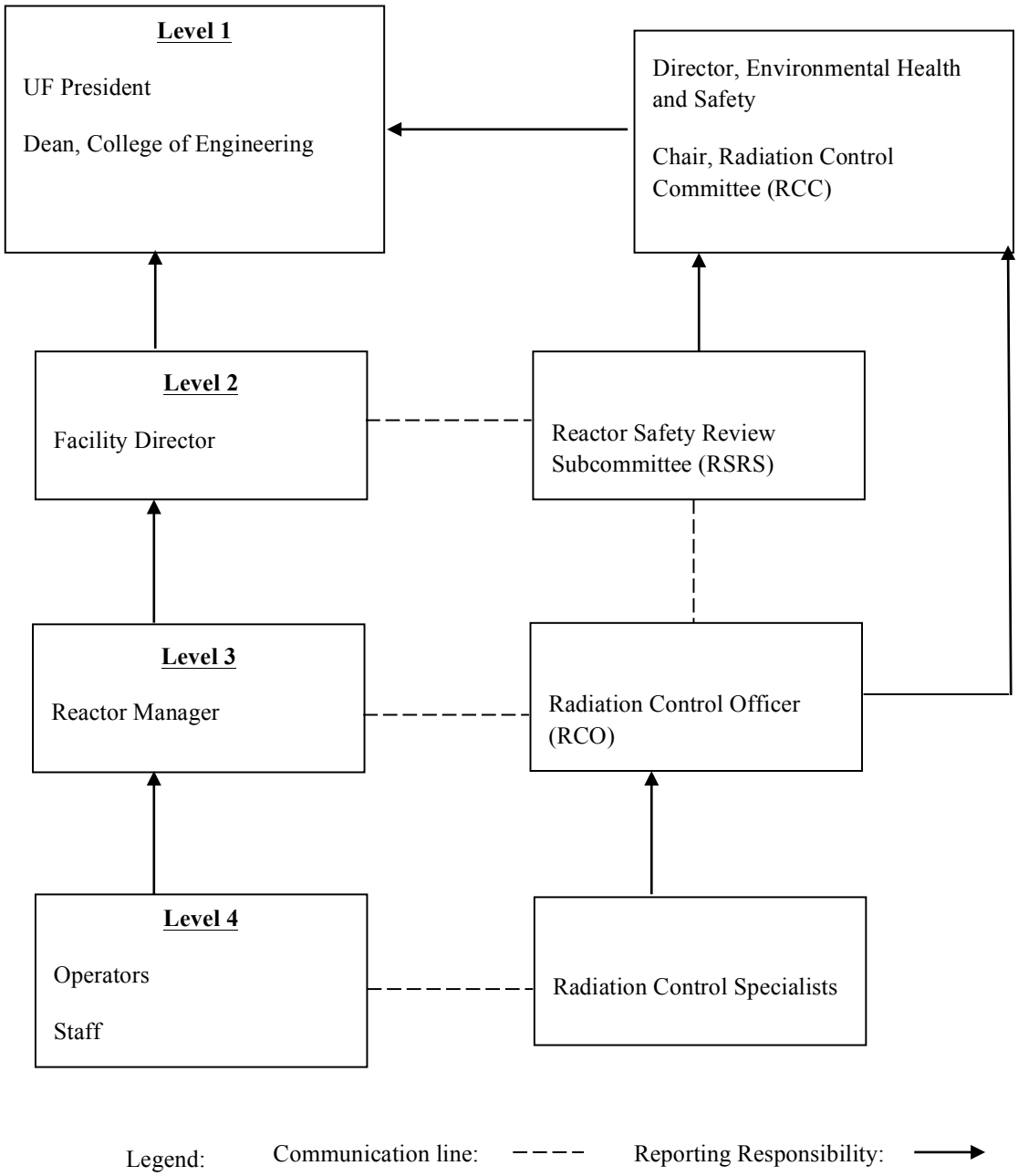

Figure 6-1 UFTR Organizational Chart