UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	Docket No. 50-170
ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE	)	(Renewal of Facility License No. R-84)
	)	
(TRIGA-Type Research Reactor)	)	

STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE TO BE HEARD

The following is a statement of those material facts as to which there is no genuine issue in this proceeding.

Contention 1

1. For the purposes of computation, the SAR assumes that ". . . the theoretical limit of 0.1 percent gap activity for fission product noble gases and iodines, as stated in reference 2, will be used in the consequence analysis for the Design Basis Accidents (Section 6.3.4)" SAR, Section 6.3.2.2, page 6-12, 13 and Section 6.3.4.2, pages 6-17 & 6-18.

2. Figure 5-1 of reference 2 of the SAR indicates that a theoretical maximum release of 0.1% (10^{-3}) of the total inventory of gaseous fission products in a standard fuel rod corresponds to an infinite irradiation time at more than 600°C.

3. The Licensee's assumption of 0.1% release following clad failure is related to the long-term history of operation, and the actual temperature of the cladding at the instant of assumed failure is irrelevant in determining this release.

4. The Licensee has assumed, for the purposes of computation, that the cladding of a fuel element has certainly failed: "Another Design Basis Accident for the AFRRI reactor is postulated to be the cladding failure of a fuel element during a pulse operation or inadvertent transient following steady state operation at 1 MW." Section 6.3.4.2 SAR, page 6-17, June 1981.

5. The probability (or likelihood) of clad failure is assumed to be 100% for the purposes of the ensuing computations.

6. H. H. Hausner and F. Schumar, "Nuclear Fuel Elements", page 84 discusses test samples of unclad zirconium hydride fuel meat, and is not relevant to fuel claddings.

Contention 2

7. The Licensee has written and distributed and referenced a memorandum on the calculations from which it concludes that a contact configuration of the twelve fuel elements stored in the reactor pool would not result in a critical mass. Reference #2, page 4-32, SAR, June 1981.

8. CO Report No. 179/65-2, Docket No. 50-170 shows explicitly that fewer than 69 stainless steel clad fuel elements would not form a criticality condition in the AFRRI core configuration.

9. A "confinement" must be a system or a device that could intercept radioactive material which may be somewhere or a route from where it is intended to be retained towards points where it is not intended to be.

10. Based on the wording of Contention 2, only the possible transport of radioactivity in the air need be considered.

11. The lead doors in the pool serve no confinement function; they are used to decrease the level of direct radiation in one of the exposure rooms when the reactor core is positioned at the far end of the pool.

12. The primary purpose of the lead doors is to decrease radiation exposure to operations personnel while they are working in the exposure room.

13. The reactor core position interlock is simply a device to prevent the operator from inadvertently attempting to operate the reactor while the core dolly is in motion, or move the dolly across the pool while the lead doors are closed. This interlock has no confinement function.

14. The two systems related to confinement of radioactivity are the reactor room ventilation dampers and the rubber gaskets on the double doors between the reactor room and the hallway on the control room level.

15. The annual reports and event reports from the Licensee, and the inspection reports from the AEC/NRC inspectors, demonstrate that the room dampers malfunctioned once, and the rubber gaskets were not in place at one time between 1962 and 1982.

16. In order to be in a location that could be influenced by the two confinement safeguards, the experiment would have to be in the pool, the in-pool experiment tube, or possibly in one of the pneumatic transport tubes.

17. An experiment in one of the two exposure rooms could not lead to airborne radioactivity in the reactor room itself, or in the hallway behind the control room.

18. The types of experiments authorized at AFRRI by the Technical Specifications (Section D, Experiments, currently applicable; and section II, 3.9 Experiments, proposed revision) would preclude the release of radioactivity to unrestricted areas that would exceed 10 C.F.R. Part 20 Appendix B guidelines, even if total failure of an experiment were to occur and all contained radioactive gases and aerosols were released.

19. The experience record at AFRRI indicates that no potentially hazardous experiment has failed, between initial licensing in 1962, and 1982.

20. There are redundant systems on all of the important safety channels (SER § 4.8.4).

21. A transient induced by the instantaneous insertion of all available excess reactivity does not exceed the safety limits of the fuel (SER § 4.7.1).

22. A loss of all coolant in a reasonable time interval, including the rate of loss of coolant proposed by the intervenor, even following a very long steady-state run and pulse, will not lead to fuel-clad failure (SER § 14.2.2).

23. Loss of electrical power causes control rods to be released for gravity-fall into the core, leading to benign reactor shutdown (SER § 4.8).

24. There are no high pressures or high temperatures during normal operation that can lead to disruptive disassembly of the reactor or dispersion of contained radioactivity (SER §§ 5.2, 14.2.1, 14.2.7).

25. The Licensee submitted a report to NRC dated March 25, 1980 reporting one malfunction of safety channel one; there was no NRC inspector or inspection involved.

26. The malfunction of safety channel one was discovered by the Licensee during a routine check-out of instruments following an inadvertent electrical power outage over a week-end while the reactor was not operating. The reactor was not brought to power while the safety channel was inoperable.

27. The reactor was not in operation at the time of the reactor exhaust system malfunction on August 9, 1979 and the malfunction was discovered during the next routine pre-start check-out.

28. The Licensee discovered the malfunction of the fuel element temperature sensing circuit by observing the instruments on the control console prior to bringing the reactor to power. and reported it to NRC by letter dated August 1, 1979.

29. The malfunction of the pool water level sensing float switch stemmed from degraded insulation on a signal wire and was reported to NRC by letter dated July 31, 1979.

30. While a loss of a large fraction of the water from the pool is considered to be significant enough to warrant a shut down of the

reactor, the potential impact is primarily one of direct radiation exposure to the AFRRI staff.

31. The pool level switch is wired in to cause a reactor scram.

32. The open pool top is observable from the reactor control room (through a window) so the operator does not rely solely on the pool water level switch to be functional to provide evidence that sufficient pool water is present.

33. The Licensee discovered the radiation monitoring system malfunction while performing a routine, required pre-start-up check-out of the reactor; the reactor was not operated with the malfunction condition.

34. The malfunction of the fuel temperature-automatic scram system on January 29. 1974, was discovered by the Licensee during a routine pre-start-up- check-out of the reactor instrumentation.

35. The reactor core position safety interlock system does not qualify as a safety-related item.

36. Under normal steady state operating conditions, it is not necessary that the negative temperature coefficient be large enough to cause reactor shutdown.

37. It is conservatively sufficient that the coefficient be negative so that a reactor transient is mitigated rather than amplified by increasing temperature.

38. Under all normal operating conditions and most accident conditions in research reactors, it is expected that the control elements will be operable or already inserted, so these will serve to shut down the reactor.

39. For a reactor designed and loaded to operate on thermal neutrons, most of the material in the core that thermalizes, or moderates the neutron energy, is necessary for the chain reaction to continue.

40. If a significant fraction of the hydrogen is removed from the core region of a TRIGA reactor, either by loss of coolant water or from the fuel meat itself, the fission chain reaction will most likely no longer be self sustaining, that is, the reactor will shut down.

41. There have been no instances of multiple clad failures of TRIGA fuel in a single operational reactor caused by defects in material integrity.

Contention 4

42. The Staff's SER (§ 11.3.3) and the Licensee's various reports (Docket No. 50-170) including annual reports and a special report dated 12/14/71 conclude that there are no measurable quantities of

airborne radioactive particulates routinely released from the AFRRI reactor building.

43. The only airborne reactor-related radioactive material released from AFRRI in measurable quantity is ^{41}AR, which is a typical emitter of beta rays accompanied by a gamma ray.

44. ^{41}AR is a noble gas, exhibiting the chemical inertness of a noble gas.

45. Committee II of ICRP (International Commission on Radiological Protection) has published recommendations related to the control of radiation exposures, and these recommendations, on the whole, have been codified in 10 C.F.R. Part 20.

46. The ICRP recommendations include the one that personnel exposures from immersion in a large cloud of a radioactive noble gas be based on the external whole body exposure, and exposure due to internal betas be considered relatively insignificant.

47. The Licensee has evaluated the particulate radioactivity detector system, and concluded that it meets the established criteria for being isokinetic. Licensee's Answers for Intervenor's Interrogatories dated October 30, 1981, Question No. 28(b).

48. The unresolved status of the effluent monitor systems listed in Intervenor's reference: Inspection Report No. 50-170/77-01-03 was resolved in a subsequent inspection and is discussed in Inspection Report No. 50-170/78-01.

49. There is no evidence that the Licensee uses a concentric cylinder set model "... to derive its dose assessments to the environment...", based on Licensee letter to AEC, with enclosure, 12/14/71; recent I&E inspection reports 50-170/70-1; 50-170/77-01; 50-170/78-01; 50-170/79-01.

50. Upon discovery of a leak in the ventilation exhaust stack drain line (see NRC Inspection Report No. 50-170/79-01), the drain line was removed and the exit from the stack capped and sealed.

51. I&E inspection reports 50-170/66-1 and 50-170/66-2 review the environmental monitoring program, including monitor data from 1962 and 1963. The conclusion is reached that "The environmental monitoring to date shows the average yearly ambient radiation levels to be less tha 0.5 rem per year for unrestricted areas."

Contention 5

52. A research reactor is not among the actions specifically listed in 10 C.F.R. 51.5(a)(1)-(9) as requiring an EIS.

Contention 8

53. To achieve metal-steam and metal-air explosive chemical interactions, very special conditions of metal droplet size, rate of formation, mixture ratio of metal and water molecules, and temperatures are necessary.

54. It is very unlikely that an uncontrolled heating and dispersion of the components of a reactor core would lead to both the necessary and sufficient conditions to support an explosive chemical reaction.

55. Among the detailed considerations are the following:

a) It is necessary that the metal be finely divided, and hot.

b) It appears that this is not sufficient. The metal must be in the form of molten droplets of optimum sizes.

c) A nearly stoichiometric mixture of a significant fraction of the metal and water vapor molecules is necessary.

d) The rate of formation and dispersion of the metal droplets is important. If that rate is too slow, the rate of reaction of the mixture would be limited, and it would not explode.

e) The high temperature of the molten metal is necessary to initiate the rapid chemical reaction, because zirconium hydride is relatively inactive in water at temperatures below approximately 1000°C.

56. Not only must energy be supplied rapidly to raise the temperature of the solid metal to its melting point, but the latent heat of fusion must be supplied to cause melting. For zirconium hydride, this is equivalent to raising the temperature approximately an additional 500°C. Thus, to just cause melting requires the energy equivalent to raise the solid fuel temperature to (500 + 1800 =) 2300°C. No credible reactivity insertion in the AFRRI reactor could produce that much energy in a pulse.

Contention 9

57. Because the AFRRI reactor is designed and loaded to operate on thermal neutrons, loss of most of the coolant water from the core would reduce reactivity sufficiently that the reactor becomes subcritical, and any operation, either pulsing or steady state, is impossible.

58. Either the reactor can be pulsable with water in and around the core, or the core can be devoid of water and lacking the excess reactivity required for pulsing.

59. Given the size of the AFRRI reactor pool, a leak of 250 gallons per minute would cause the surface of the water to fall at the rate of approximately 1 foot in 3 minutes. Thus, from the time the reactor would be pulsable to the time the surface of the pool would be below fuel level would require no less than 4 minutes. This is sufficient time to allow the water to remove a large fraction of the energy

generated by the fissions during a large pulse, and, therefore, to lower the fuel temperature by several hundred degrees celsius. Thus, by the time all of the water had left the core, the fuel temperatures would be approximately as assumed for the LOCA analyses.

Contention 10

60. The highest integrated exposure for one year measured in an unrestricted area was 76 mrem, accumulated during calendar year 1970. This environmental station was close to and influenced by the itron 250 x-ray facility. The highest short term exposure rate at this location, measured by the Licensee with ionization chambers, is quoted by the licensee as approximately 5.0 mrem/hr during maxitron operation. Both the Licensee's reports, and AEC/NRC inspections have confirmed the source of this high exposure rate (see I&E report No. 50-170/70-1, dated 2/27/70, especially page 6, item (3)).

Respectfully submitted,

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Dated at Bethesda, Maryland
this 25th day of February, 1983