16202

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD
Before Administrative Judges:

Charles Bechhoefer, Chairman
Dr. Jerry R. Kline
Dr. Peter S. Lam

In the Matter of	)	Docket No. 50-160-Ren
GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Georgia	)	ASLBP No. 95-704-01-Ren
Georgia Tech Research Reactor	)	
(Renewal of Facility License No. R-97)	)	January 25, 1995

GEORGIA INSTITUTE OF TECHNOLOGY'S OPPOSITION TO
PETITION FOR LEAVE TO INTERVENE
FILED BY GEORGIANS AGAINST NUCLEAR ENERGY

Procedural History

The Georgia Institute of Technology (Applicant or Georgia Tech) submits this Opposition to the Petition to Intervene originally filed by Georgians Against Nuclear Energy (GANE) on October 26, 1994.

This is a proceeding to renew Facility License No. R-97 for the Georgia Tech Research Reactor (GTRR or Reactor), which is located on the campus of Georgia Tech in Atlanta, Georgia. Georgia Tech timely filed its renewal application dated April 19, 1994, and the Commission published notice of the application at 59 Fed. Reg. 49088 (Sept. 26, 1994).

D503

On November 15, 1994, the Chief Administrative Judge established this Board pursuant to GANE's request for a hearing. The Board entered a Memorandum & Order on November 23, 1994, in which it found that GANE had failed to show standing and noted that a research reactor (such as GTRR) might be subject to different standing criteria than a power reactor. The Board allowed GANE until December 30, 1994 in which to amend its petition "to enhance its statement of standing, as well as file a supplement...setting forth the contentions it wishes to assert in this proceeding." Memorandum & Order at 6 (Nov. 23, 1994).

GANE timely filed an Amended Petition. Following a telephone conference on January 10, 1995, the Board entered a Memorandum & Order on January 11, 1995, in which the Board permitted GANE to once again attempt to show that it has standing, and allowed it until January 13 to do so. In response, GANE filed a supplemental affidavit of Mr. Robert Johnson.

Summary of Argument

GANE lacks standing in this proceeding because the Safety Analysis Report (SAR) demonstrates that even the worst credible accident in this small, heavy water research reactor would have no effects beyond a small radius on the campus of Georgia Tech. The SAR demonstrates that there would be no

health or safety effects off the Ceorgia Tech campus. GANE's single affidavit of membership, from Mr. Robert Johnson, shows that he resides several miles from the Georgia Tech campus, and his place of work is also outside the campus. Mr. Johnson's asserted interests in this proceeding are his health and safety; he asserts no other form of interest.

GANE has made no contention that Georgia Tech's assumptions in the SAR concerning the worst credible reactor accident are incorrect, and it has made no contention that the calculations of the radiation effects of that hypothetical accident -- all of which are carefully set out in the SAR -- are incorrect. Given the entire absence of such contentions, Mr. Johnson's health and safety interests are simply not implicated by this proceeding.

Georgia Tech will discuss each of GANE's contentions below in appropriate detail, but two features of those contentions stand out: First, GANE appears to be unaware that GTRR is a very small, heavy water reactor that operates at low temperatures and pressures. Although Georgia Tech has carefully analyzed the 'worst credible reactor accident' for the GTRR, the plain fact is that this type of heavy water research reactor is inherently safe. In particular, a steam bubble within the GTRR containment building, to which GANE repeatedly refers, is not possible with a small, heavy water reactor.

Second, GANE repeatedly refers to the lack of monitoring at the GTRR. Since the Commission obviously requires careful monitoring, and the results of that monitoring are matters of public record, GANE's contentions on this point can be explained only by a failure to consult the relevant public records before filing its petition.

Thus, Georgia Tech submits that GANE has failed to demonstrate that it has organizational standing in this proceeding. It also appears that GANE is not in a position to contribute in a meaningful way to the Board's consideration of the renewal application. For these reasons, Georgia Tech requests the Board to deny GANE intervention.

DISCUSSION

1. GANE's Petition and Amended Petition Should Be Denied for Lack of Standing.

The Applicant requests that GANE's Petition for Leave to Intervene and Amended Petition for Leave to Intervene be denied for lack of standing. Section 189a(1) of the Atomic Energy Act, 42 U.S.C. Section 2239(a) provides that a hearing shall be granted "upon the request of any person whose interest may be affected by the proceeding..." GANE has failed to establish that it has any interest that may be affected by the relicensing of the GTRR. Under 10 CFR 2.714(d)(1) the Board is to consider the following in ruling

on a petition for leave to intervene:

i) The nature of the petitioner's rights under the Act to be made a party to the proceeding.

ii) The nature and extent of the petitioner's property, financial or other interest in the proceeding.

iii) The possible effect of any order that may be entered in the proceeding on the petitioner's interest.

GANE, in effect, relies on the affidavit of a single member, Robert Johnson, to establish its organizational standing. Mr. Johnson claims that he has a health and safety interest in this license renewal because of the location of his office, not his residence. While Mr. Johnson's office is approximately one half mile from the GTRR, his residence on Waddell Street (as shown on his GANE membership form) is more than four miles from the GTRR. Even if an office location could establish standing -- which Georgia Tech denies -- neither Mr. Johnson's home nor his residence is within the radius that could be affected by the worst credible reactor accident at the GTRR. Thus, GANE cannot have standing in this proceeding based on Mr. Johnson's affidavit, and it has produced no other member as a candidate.

The failure of Mr. Johnson's Affidavits to establish standing results in a failure of GANE to establish standing, since GANE has not met the requirement that a petitioner show that the proposed action will cause "injury-in-fact" to the

petitioner's interest. e.g. Georgia Power Co. (Vogtle Electric Generating Plant, Units 1 and 2), CLI-93-16, 38 NRC 25, 32 (1993). GANE has failed to meet either requirement under the injury-in-fact test because it has not shown that one of its members would suffer injury as a result of the re-licensing, so that GANE would have "representational" standing, nor has GANE stated in any of its filings any effect upon its organizational interests. Houston Lighting and Power Co. (South Texas Project Units 1 and 2), ALAB-549, 9 NRC 644, 646-47 (1979), *aff'g* LBP-79-10, 9 NRC 439, 447-48 (1979).

For these reasons, Applicant respectfully requests that GANE's Petitions be denied for lack of standing.

2. GANE'S Petition and Amended Petition Should Be Denied Because the Contentions Raised by GANE Fail to Meet the Requirements of 10 CFR 2.714(b)(2) and 10 CFR 2.714(d)(2)

The Applicant requests that GANE's Petition for Leave to Intervene and Amended Petition for Leave to Intervene, be denied for failure to meet NRC requirements relating to the contentions raised in the Petitions. GANE failed to provide, as required by 10 CFR 2.714(b)(2)(ii), "a concise statement of the alleged facts or expert opinion which support the contention and on which the petitioner intends to rely in proving the contention at the hearing, together with references to those specific sources and documents of which

the petitioner is aware and on which the petitioner intends to rely to establish those facts or expert opinion." Further, GANE failed to provide "sufficient information...to show that a genuine dispute exists with the applicant on a material issue of law or fact...", as required under 10 CFR 2.714(b)(2)(iii).

Each of the contentions raised by GANE is addressed by Applicant in more detail below.

a) GANE Contends that the GTRR is Generally Unsafe

Although Georgia Tech's application to renew License #R-97 contains exhaustive information about safety, GANE raises many questions, all of which are addressed in the SAR. Thus, the following summary highlights some of the points raised by GANE.

The GTRR is a small research facility licensed by the U.S. Nuclear Regulatory Commission (NRC) to operate at a maximum power level of five (5) megawatts. The GTRR is not a reactor for the generation of electricity. It operates at almost room temperature (maximum temperature at maximum power _ 135°F). Most of the time the reactor is operated at a power of one megawatt or less. At this power, the coolant temperature is approximately 80°F. In power reactors, the coolant temperature is greater than 500°F and the pressure in pressurized water reactors is 2200 pounds per square inch.

For comparison, the pressure in the GTRR is only 14.7 pounds per square inch. Operating conditions at the GTRR are such that wide margins exist between operating conditions and safety limit boundaries. Instabilities that could initiate transient conditions cannot occur unless the safety limit boundaries are approached.

In its SAR Applicant has analyzed all credible situations that could drive operating conditions toward safety limit boundaries and initiate instabilities resulting in transients. The analyses showed that the GTRR design is good enough to handle all credible scenarios with no danger to workers or the public. Applicant also performed an analysis beginning with the assumption that the reactor is critical and, without regard to the credibility of such an assumption, Applicant then added 1.5% k/k reactivity in one step. This is equivalent to making the reactor prompt critical by a wide margin in order to induce a good size transient. Again, Applicant's analysis showed that the GTRR can handle this transient with no danger to the workers or the public.

Finally, Applicant analyzed a situation that Applicant considers to be <u>incredible</u> and to have an extremely low probability of ever occurring: Applicant assumed that the entire core melted after continuous operation at maximum power for a long time; assumed maximum leak rate from the containment building under several adverse weather conditions;

further assumed that noble gas releases are 100% and iodine releases are 50% when releases from similar type fuel were measured to be 10% for noble gases and 2% for iodine (see SAR). The results of these analyses are summarized in Appendices B and C of the SAR.

Applicant was extremely conservative in methods used to calculate the results found in Appendices B and C of the SAR. It should be noted that these extremely conservative methods ignore the reality that the fission product inventory that is currently in the core is approximately 5000 Ci, rather than the more than 60,000 Ci assumed in the calculations. Despite the conservative methods used in the calculations, the consequences of such a scenario, while serious within the 100 meter Emergency Planning Zone (which is contained entirely on the Georgia Tech campus) is not catastrophic for the public nor for the City of Atlanta.

GANE addresses the population figures for the City of Atlanta in its Petitions. Although the SAR addresses the population figures on page 21 and 26, as taken from the 1990 Census, the actual population figure of the City of Atlanta is irrelevant to these contentions, since any criticality accident would only have implications within a 100 meter radius of the GTRR. Nevertheless, Applicant's statement that "Approximately 30,000 live within one mile of site", p.2 (SAR), is justified based on 1990 Census data.

The population of Atlanta that was reported in the SAR on page 17 was in error. A revised SAR, dated Jan. 10, 1995, corrected this and other typographical errors.

As an example of safety problems under this contention, GANE relates a 1972 incident related to the recontainerization of Co^{60}. The 1972 incident was not in any way connected with the reactor or its operation. The Co^{60} was brought in by a vendor for reincapsulation under state license. This incident occurred under the watch of staff members who no longer work at the Neely Nuclear Research Center. The discharges of pool water into the sewer system did not at any time exceed the limits set under NRC regulations. On the contrary, those discharges, although mistakes, were well within NRC limits by a factor of 100 or more. The table shown in Exhibit 1 to this Response shows some of the results.

There was no evidence whatsoever that a worker contaminated his home and a MARTA bus, as alleged by GANE. Testimony by fellow workers shows that the worker surveyed his home with a Geiger counter and found no contamination.

The charge that the director of the GTRR failed to report the incident to the NRC implies that the incident was of a nature that was required to be reported. The incident, in Applicant's opinion and in the opinion of Paul Fredrickson of the NRC, was not of a level that required reporting under the applicable regulations.

The reactor was shut down for eight months, not two years, by the then new president of Georgia Tech, not by the NRC, to allow enough time to sort out the issues. The NRC agreed with that decision. These are matters of public record, which GANE could have ascertained, had it attempted to do so.

The charge that there is insufficient monitoring of the GTRR is without merit. The monitoring program is reviewed by the NRC and by state agencies. All releases are well within regulations. The comprehensive radiation monitoring program, which is currently in place at the GTRR, is fully described in the SAR (pp.97-102) and covers air and liquid effluents, as well as personnel and environmental monitoring. The existence of and results of the monitoring are matters of public record, which GANE could have ascertained, had it attempted to do so.

GANE charges that the SAR is grossly deficient by stating that GTRR provides no data on the amount of radiation in curies that is contained within the facility. Applicant feels compelled to point out that the amount of fission products that exists in the core depends on the history of reactor operation. Currently, the fission product inventory in the core is approximately 5000 curies. This estimate is based on the total dose rate measured at one foot from each fuel element.

As for the remaining information extracted from the SAR,

which GANE contends is in error, Applicant states the following. The half life of I^{131} is indeed 193 hours and not the 1.93 hours reported on p. 204 of SAR. This and other typographical errors were corrected in the revised SAR. Xenon-137 decays into Cs^{137} and not Ce^{137}. The dose exposures were correctly calculated. Daughter products of volatile fission products are included in the calculation, e.g. Sr.90 (SAR, p.196).

b) GANE Contends That the GTRR is Unable to Contain Radiation From the Environment

All issues raised by GANE under this contention have been comprehensively addressed in the SAR. The only exceptions are the 700 mrem/year found near the site boundary and the scenario of a steam explosion. The scenario of a criticality accident was also analyzed (SAR, pp. 139-144). The probability of a core meltdown was analyzed in Appendices B and C of the SAR. The current fission product inventory is approximately 5000 Ci. The consequences from this fission product inventory are at least an order of magnitude less than the analysis reported in Appendices B and C.

A steam explosion is not considered credible. The GTRR is operated at low temperatures and pressure. The fuel cannot melt as long as it is covered with heavy water. If the heavy water is lost by some means, and emergency core cooling is not

available (although two independent redundant sources of emergency coolant are available), the fuel may melt, but it will not produce steam explosions.

The issue raised by GANE involving the 700 mrem/year present at the site boundary represents a campus-wide radioactive material storage "barn" under state license. It is not connected with GTRR or its operation in any way. The materials stored at this site are under the auspices of the State of Georgia Environmental Protection Division. The NRC has no regulatory authority over this storage arrangement, and thus, the storage of these materials are irrelevant to this proceeding. However, it should be noted that measures have been instituted such that radioactive waste in the storage "barn" near the fence is now frequently shipped out to Barnwell, S.C. for disposal. The yearly dose at this location is now normal background.

The charge that a breach to the shielding pool for the Co^{60} would cause the 400,000 Ci of Co^{60} to yield 480 million Roentgen per hour is not correct. The amount of Co^{60} at the GTRR under state license is only 250,000 Ci. The dose rate from this quantity of Co^{60} at one foot and with no shield in between is 3.75 million Roentgen per hour. The dose rate at 20 feet, which is the distance to the top of the pool with no water in it, is 9375 Roentgen per hour or 156 Roentgen per minute. Emergency procedures are in place to allow complete

recovery without harm to personnel or the public. This cobalt-60 is stored at Georgia Tech under license from the State of Georgia and is not part of reactor operations.

c) GANE Contends That the GTRR is Contaminating the City of Atlanta Sewer System

Most of GANE's comments under this contention are directed at the NRC, not at the Applicant. The one comment directed at the Applicant is false. All releases from the GTRR are at least a factor of 100 lower than the limits established by NRC. Furthermore, all radioactive releases to the sewer by the GTRR are filtered to assure that only soluble radionuclides are released. GANE's remaining comments relating to sewer contamination in places outside of Atlanta are irrelevant to this proceeding.

d) GANE Contends That the GTRR Site is Unsafe Because It Suffers From Unstable Geologic Conditions

GANE makes the charge that twenty (20) years ago, a sinkhole swallowed a man adjacent to the GTRR, yet provides no information or facts to support such a charge. Without any indication of the basis of this charge, Applicant is compelled to state that such charge is false and without merit whatsoever, since Applicant is aware of no indication in the public record of any such incident. Applicant has been unable to locate anyone, who has been at Georgia Tech for more than

twenty (20) years, who claims to know anything about such an incident.

The June, 1993 collapse of the Orme Street sewer line, which is referred to by GANE in its Petition, was more than one-half (1/2) mile from the GTRR. The GTRR has been in place for more than thirty (30) years. No evidence of any kind has surfaced that the foundation is unstable or that the structure has moved or shifted in any direction. It is true that the collapse of the Orme Street sewer line caused the storm sewer to back up in the parking lot of the GTRR. The sewer collapse did not damage the reactor, its structure, or its foundation in any way, shape or form. Mr. Donald P. Alexander, P.E. and Manager, Facilities Engineering, at Georgia Tech recently inspected the GTRR for any cracks due to structural shifting over the last thirty (30) years. He concluded that the building does not have any visible exterior wall cracks or visible wall cracks due to the building shifting or settling. (See Exhibit 2 attached hereto).

e) GANE Contends That the GTRR is Unsafe to the Public Because of Inadequate Security Systems

The charge that reactor security is grossly inadequate is without merit. The security system in place is approved by the NRC. Preventing terrorism, during the 1996 Summer Olympic Games or at any other time, is the responsibility of the

United States Government, working with the appropriate local authorities. (Indeed, Congress has already appropriated substantial sums to provide for security during the Olympic Games, and security is a top priority for the 1996 Games.) Both the regulations, and the relevant case law, show that terrorism is not an admissible contention in a licensing proceeding. 10 C.F.R.§50.13; In re: Northern States Power Co., 5 N.R.C. 1177 (1977) (consideration need not be given in a licensing proceeding to protection of the facility against terrorism, because applicant may rely on government assistance); In re: Consolidated Edison Co. of New York, Inc., 7 A.E.C. 825 (1974)(same). Georgia Tech submits that no contention relating to security or terrorism should be considered in this proceeding. It would be grossly inappropriate to disclose the security plan for the GTRR to the public in this proceeding. Applicant contends that GANE should not be allowed to litigate the security issues and that this contention should not be admitted for any consideration by the Board.

f) GANE Contends that the GTRR is Unsafe to the Public Because It Has Not Been and Is Not Now Being Monitored Adequately

The monitoring program at the GTRR is in accordance with NRC's regulations and requirements under the terms of the GTRR

license. The monitoring program also meets all state regulations. All releases are well within the legal limits. The SAR describes fully the monitoring program. Annual reports to the NRC document that all releases are significantly below technical specifications limits. The charge that "no air monitoring has been performed around the facility" is false. The air that is exhausted through the stack is monitored continuously for any radioactivity before it is discharged. The monitoring covers any gas such as argon-41 or tritium, or vapor such as iodine or tritium oxide, or particulates such as powder or fine particles. All liquid releases are monitored before release.

Any concerns that GANE has with the state monitoring program should be addressed directly to the state and are not relevant to this proceeding. Notwithstanding their irrelevancy, Applicant feels compelled to point out that contrary to GANE's allegation, the Department of Natural Resources of the State of Georgia does not use the GTRR and, thus, there is no "hint of conflict of interest" in the State's monitoring of the GTRR.

g) GANE Contends That the GTRR is Not Safe Because It Does Not Have An Adequate Emergency Response Plan

The charge that the emergency response plan is uncoordinated and unknown to local and state authorities is

also without merit.

The emergency plan was approved by the NRC and state and local officials. Regular drills are performed annually with participation from state, local authorities and the NRC.

It is true that a campus wide evacuation drill has never been held. No need for such evacuation is envisioned. The total fission products inventory is low ~5000 Ci.

h) GANE Contends That a Major City of Atlanta Reservoir is Vulnerable to Extensive Contamination From the GTRR

No credible accident has been postulated that would jeopardize Atlanta's water supply. Furthermore, the reservoir is located upwind from the prevailing winds at the GTRR.

i) GANE Contends That Management Problems At the GTRR Are So Great That Safety for the Public Cannot Be Assured

The charge that safety concerns are the sole responsibility of R.A. Karam is without merit. There is an emergency organization in place and there is a Nuclear Safeguards Committee comprised of twelve independent safety experts who review and approve all safety matters. GANE makes reference to the 1987 incident relating to cadmium-115 and states that information relating to the incident was withheld from the NRC. The 1987 incident has been investigated by the

NRC, considered thoroughly in Federal Court, and is a closed matter. The current organizational structure for the GTRR has been approved by the NRC.

j) GANE Contends That the GTRR is a Financial Liability to Taxpayers of the State of Georgia and to Georgia Tech

Applicant finds no merit in this contention. The GTRR is being used for education, research and public service (See Exhibit 3).

None of the contentions raised by GANE in its Petitions provide " sufficient information...to show that a genuine dispute exists with the applicant on a material issue of law or fact...", nor has GANE provided any reference to "specific sources and documents of which the petitioner is aware and on which the petitioner intends to rely to establish those facts or expert opinion," as required under 10 CFR 2.714(b)(2). GANE's Petitions consist almost entirely of stated disagreement with Applicant's SAR, but contains practically no reference to any expert opinions or documentary sources to support those statements of disagreement. Applicant requests that GANE's Petition for Leave to Intervene and Amended Petition for Leave to Intervene, be denied for failure to meet NRC requirements relating to the contentions raised in the Petitions.

Under 10 CFR 2.714(d)(2) the Board shall refuse to admit a contention for the following reasons:

> (i) the contention and supporting material fail to satisfy the requirements of paragraph (b)(2) of this section; or
>
> (ii) the contention, if proven, would be of no consequence in the proceeding because it would not entitle petitioner to relief.

Applicant contends that GANE has failed to meet the requirements of (b)(2), as outlined more specifically above. Additionally, GANE has failed to show that any of the contentions raised by GANE would entitle GANE to relief, if proven, thus requiring the Board to refuse to admit GANE's contentions under 10 CFR 2.714(d)(2).

CONCLUSION

For all the above reasons, Georgia Tech believes that GANE does not qualify for intervener's status and that its Petitions should be denied.

Respectfully Submitted,

Randy A. Nordin
Chief Legal Advisor
Georgia Institute of Technology

E. Gail Gunnells

E. Gail Gunnells
Deputy Chief Legal Advisor
Georgia Institute of Technology

Dated at Atlanta, Georgia
this 25th day of January, 1995

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD
Before Administrative Judges:

Charles Bechhoefer, Chairman
Dr. Jerry R. Kline
Dr. Peter S. Lam

In the Matter of	)	Docket No. 50-160-Ren
	)	
GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Georgia	)	ASLBP No. 95-704-01-Ren
	)	
Georgia Tech Research Reactor	)	
	)	
(Renewal of Facility License No. R-97)	)	January 25, 1995

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing Response has been served upon the following persons by U.S. mail, first class, except as otherwise noted and in accordance with the requirements of 10 CFR Sec. 2.712.

Office of Commission
Appellate Adjudication
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Administrative Judge
Jerry R. Kline
Atomic Safety and Licensing
Board
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Sherwin E. Turk, Esq.
Susan S. Chidakel, Esq.
Office of the General
Counsel
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Glenn Carroll
Georgians Against Nuclear
Energy
P.O. Box 8574
Atlanta, Georgia 30306

Administrative Judge
Charles Bechhoefer, Chairman
Atomic Safety and Licensing
Board
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Administrative Judge
Peter S. Lam
Atomic Safety and Licensing
Board
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Dated at Atlanta, GA this
25th day of January, 1995

Respectfully Submitted,

Randy M. Nordin
Chief Legal Advisor
Georgia Institute of Technology

E. Gail Gunnells

E. Gail Gunnells
Deputy Chief Legal Advisor
Georgia Institute of Technology

Exhibit 1

Typical Storage Pool Water Analysis
Co-60

Date	Activity µCi/cc
12-1-94	$<3.985*10^{-7}$
11-4-94	$<4.415*10^{-7}$
10-4-94	$<3.77*10^{-7}$
9-6-94	$3.01*10^{-7}$
8-12-94	$2.31*10^{-7}$
6-28-94	$2.63*10^{-7}$
5-31-94	$2.31*10^{-7}$
5-4-94	$2.69*10^{-7}$
3-31-94	$3.915*10^{-7}$
3-2-94	$4.045*10^{-7}$
2-2-94	$<3.81*10^{-7}$
1-7-94	$<3.875*10^{-7}$
12-3-93	$2.05*10^{-7}$
11-9-93	$2.34*10^{-7}$
10-6-93	$2.34*10^{-7}$
9-7-93	$2.26*10^{-7}$
8-16-93	$1.81*10^{-7}$
7-7-93	$<4.24*10^{-7}$
6-9-93	$<4.39*10^{-7}$
5-7-93	$3.28*10^{-7}$
4-7-93	$2.82*10^{-7}$
3-8-93	$2.44*10^{-7}$
2-8-93	$<5.45*10^{-7}$
1-6-93	$<4.43*10^{-7}$

Date	Activity µCi/cc
12-7-92	$<5.54*10^{-7}$
11-5-92	$<5.21*10^{-7}$
10-8-92	$<5.85*10^{-7}$
9-3-92	$<5.27*10^{-7}$
8-10-92	$2.41*10^{-7}$
7-8-92	$<5.37*10^{-7}$
6-4-92	$5.60*10^{-7}$
5-5-92	$<5.79*10^{-7}$
4-6-92	$<5.57*10^{-7}$
3-9-92	$3.21*10^{-7}$
2-6-92	$3.91*10^{-7}$
1-6-92	$4.01*10^{-7}$
12-11-91	$3.53*10^{-7}$
11-11-91	$2.93*10^{-7}$
10-3-91	$4.10*10^{-7}$
9-6-91	$3.31*10^{-7}$
8-2-91	$3.74*10^{-7}$
7-9-91	$4.27*10^{-7}$
6-6-91	$4.13*10^{-7}$
5-1-91	$2.98*10^{-7}$
4-5-91	$3.09*10^{-7}$
3-7-91	$3.09*10^{-7}$
2-5-91	$2.55*10^{-7}$
1-7-91	$2.54*10^{-7}$

Allowed (10CFR20, App.B)Co-60 release to the sewer, monthly average concentration is $3*10^{-5}$ µCi/cc. (Note 1)

NOTES:

1. If sewer water were the only source of water ingested by man during a year this concentration would give a dose of 500 mrem.
2. Above data is pool water, <u>per se</u>, and does not show NNRC water use dilution, ($2x10^{11}$ ml/qtr)
3. Our analysis above is often at Lower Limits of Detection (LLO) thus actual Co-60 is less than (<) that indicated.

Exhibit 2

Georgia Tech

Plant Operations

Georgia Institute of Technology
915 Atlantic Drive, N.W.
Atlanta, Georgia 30318-0350
USA
FAX 404•853•9028
404•894•

March 4, 1994

MEMORANDUM

TO: Dr. R.A. Karam
Director, NNRC

FROM: Donald P. Alexander, P.E.
Manager, Facilities Engineering

RE: NNRC Building Stability

At your request, we have reviewed the available data concerning the possibility that the office building would shift should a washout of the earth occur.

We have examined the following construction documents and records: earth bore testing reports, foundation details, construction specifications, and visited the building to inspect for any cracks due to structural shifting over the last 30 years of life. The building does not have any visible exterior wall cracks or visible interior wall cracks due to the building shifting or settling. The bore testing reports (site B-5, B-6, B-7, B-8, B-9) indicate a mean weathered rock elevation of 888 ft. elv. The foundation drawings and specifications direct the contractor to construct the foundation footings on firm undisturbed soil with a measured bearing pressure of 10,000 lbs. per sq. ft. at an elevation as noted on the drawings which also have a mean elevation of 888 ft. elv. This indicates the building footings were placed on the weathered rock. The west structural/foundation elevations illustrate that the building foundations are to be placed below the existing sewer line. The boring test reports and the site survey indicate that the sewer line is supported by weathered rock, therefore the footings would be sitting on the same rock shelf to support the building. The foundation structure forms a bridge to support the building over the existing sewer line.

Based on the above information, we conclude that if the earth was eroded from under the building, it would be supported by the weathered rock formations.

c: James L. Priest

Exhibit 3

Georgia Institute of Technology
NEELY NUCLEAR RESEARCH CENTER
900 ATLANTIC DRIVE
ATLANTA, GEORGIA 30332-0425
USA
(404) 894-3600

October 12, 1993

SECRETARY
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention; Docketing and Service Branch

Gentlemen:

The Georgia Institute of Technology appreciates the opportunity to comment on externalized benefits of research reactors at U. S. universities. At Georgia Tech, the mission of the Neely Nuclear Research Center (NNRC), where the Georgia Tech Research Reactor (GTRR) is located, is to contribute to the fulfillment of the scientific and technical nuclear needs of the State of Georgia and the United States of America through:

- the education of those who will pioneer the advancement of knowledge in the nuclear field and be future leaders;
- the conduct of research of basic and applied nature in nuclear engineering and health physics;
- service to the profession, to the State of Georgia, to the U.S., and to the further development of nuclear applications for the benefit of mankind and the environment.

Records obtained from the Office of the Registrar show that to date the Georgia Institute of Technology granted 92 PhD's, 646 MS degrees, and 288 Bachelor degrees in Nuclear Engineering and Health Physics.

Nuclear Engineering and Health Physics graduates from Georgia Tech have found productive and rewarding careers in a range of areas including:

Transport of neutrons and photons; Dosimetry; Fission energy systems; Application of radioisotopes in medicine, Radiation protection; Risk management; Safety analyses; Fusion energy systems/plasma research; Energy needs; Material science, Thermal hydraulics and multiphase fluid flow, Computer applications; Environmental control; Ecology; Transport of radionuclides in the environment; Atmospheric science; Instrumentation; Sensors and detectors.

No attempt will be made here to trace the careers of all of our graduates. We do know, however, that they occupy important positions in the nuclear industry, in academic institutions, in federal and local government agencies, and in business.

In the greater Atlanta area, we made a survey of those who either graduated from or worked at Georgia Tech in endeavors related to nuclear science and engineering and who later started businesses "spawned" in many cases, at the Neely Nuclear Research Center. The following is a partial list:

Company Name	Address	Annual Sales
Digital Communication Associates	1000 Alderman Drive Alpharetta, GA 30302	$292,900,000
Applied Radiological Control	500 Chastain Cntr.Blvd. Kennesaw, GA 30144-5559	25,000,000
Analytics	1380 Seaboard Ind. Blvd. Atlanta, GA 30318	2,500,000
Theragenics	5325 Oakbrook Pkwy. NW Norcross, GA 30093	5,000,000
Consort Technologies, Inc.	6201 Powers Ferry Rd.NW Atlanta, GA 30339	9,000,000
Phoenix Corp.	1431-A McLendon Dr. Decatur, GA 30030	1,000,000
Nuclear Assurance	6251 Crooked Crk.Rd.NW Norcross, GA 30092	10,000,000
Total Direct Sales Contribution to Atlanta's Economy		$345,400,000

Additionally, Georgia Tech graduates in Nuclear Engineering and Health Physics make a substantial contribution to personnel operating Region II of NRC, operating nuclear power plants Vogtle, Hatch, and Farley; operating nuclear fuel services, the Savannah River site, and Oak Ridge National Laboratory.

Twenty-five Doctorial dissertations (out of a total of 92) in Nuclear Engineering and Health Physics were based on research conducted at the GTRR. Faculty/Graduate students at Georgia Tech over the years produced numerous scientific publications based on work conducted at the GTRR. A partial list of publications is available upon request.

The Georgia Tech Research Reactor is used, free of charge, in support of faculty and student investigations covering a wide spectrum of scientific research by more than 20 universities spread all over the U.S. These universities include the following:

Arizona State University; University of Arizona; Oklahoma State University; University of Oklahoma; Southern Methodist University; University of Texas, El Paso; Mississippi State University; University of Alabama; Tuskegee Institute; Medical College of Georgia; University of Georgia; Emory University; Georgia State University; Armstrong College; University of Tennessee; University of Miami; University of Wisconsin; Clemson University; University of South Carolina; University of California at Berkeley; Georgia Southern University.

The type of research conducted by these universities include:

1.	Neutron Activation Analysis	Georgia Tech; University of Georgia; Emory University; Mississippi State University;
2.	Atmospheric and Earth Sciences	Georgia Tech; University of Georgia; University of Miami;
3.	Food Preservation	University of Georgia; Tuskegee Institute; Clemson University;
4.	Geologic Formation	University of Oklahoma; Oklahoma State University; Arizona State University; University of Arizona; University of Texas-El Paso; Southern Methodist University; University of Miami; University of Alabama; University of Georgia; Georgia Southern; University of California-Berkeley;
5.	Archeology	University of Wisconsin; University of Alabama; Georgia Tech; University of Georgia;

6.	Boron Capture Therapy	Georgia Tech; Emory; University of Georgia; Medical College of Georgia; Medical University of South Carolina; other universities in the BNCT University Consortium;
7.	Agricultural Research	University of Georgia; Clemson University; Tuskegee Institute;
8.	NE/HP Student Training	Georgia Tech; SMU; University of Tennessee;
9.	Neutron Radiography	Georgia Tech; University of Florida.
10.	Neutron Diffractometry	Georgia Tech;

The above areas of research are described in the nuclear industry literature at length. In this letter, we briefly describe our activities in the Boron Neutron Capture Therapy application, training, and tours for High School students and Boy/Girl Scouts.

1. Boron Neutron Capture Therapy

Our objective is to establish a BNCT Test and Measurements Laboratory which would be capable of both basic and applied preclinical and clinical research in support of BNCT Technology. The BNCT project will be interuniversity, interdisciplinary in scope with active participation by the Georgia Institute of Technology, the Emory University School of Medicine and the BNCT University Consortium comprising nine other universities.

The boron neutron capture reaction in radiotherapy, $^{10}B(n,\alpha)^{7}Li$, has recently received renewed attention due to the clinical studies in Japan by Dr. Hatanaka. In these studies patients with tumors of the brain who had been administered a boronated compound, which had some degree of preference for the tumor tissue, were treated with a thermal neutron beam. These treatments resulted in a median survival rate for these patients that was higher than that obtained with conventional radiotherapy techniques or chemotherapy.

These brain tumors, i.e., glioblastomas, are nearly always fatal. The extreme malignancy of glioblastomas is attributable to the numerous tiny unencapsulated "fingerlets" of actively growing cells that protrude from a central tumor mass into the surrounding healthy brain tissue. These "fingerlets" severely limit the success of surgical removal. Because of these factors, conventional radiotherapy has been the treatment of choice, its effectiveness being limited by the amount of radiation dose that can be delivered to normal tissue surrounding the tumor. This limitation can be minimized with BNCT. If tumor cells can be loaded with boron while maintaining the concentrations of boron in surrounding healthy tissue at a minimum, the boron neutron capture reaction will deliver an intense radiation dose to the tumor cell thus sparing the normal tissue. The result is that cells in which the reaction occurs are killed, i.e., tumor cells, while other cells, i.e., normal tissue, will survive.

Because of the characteristics of this reaction, identification of boronated compounds, which preferentially accumulate in tumor cells, will provide a powerful tool for treatment of these tumors which historically have been intractable. Prime tumor candidates for BNCT are glioblastomas, ocular and cutaneous melanomas.

For BNCT therapy to achieve the status as a recognized treatment option for gliomas or other tumor types, considerable work in the areas of dosimetry, neutron beam characterization, and compound development and testing are needed.

The goal is to produce a thermal neutron beam and an epithermal neutron beam of adequate flux which contain minimal contaminating radiations, e.g., gamma rays and fast neutrons. This requires that the physical parameters of the beam(s) be characterized. The physical parameters that are being evaluated are described in the following paragraphs.

The design and construction of the idealized neutron beam will be utilized using filtration to eliminate unwanted radiation components from the beam. Various beam filters are being evaluated. Emphasis is placed on the epithermal neutron beam since the use of higher energy neutrons offers the features of greater depth of penetration into brain tissue than with thermal neutron beams and the advantage of sparing the skin. Current work includes (1) measurement of the neutron spectrum; (2) determination of the fast and thermal neutron contaminants; (3) mapping the dimensions

and accompanying fall off of the beam and accompanying gamma rays and (4) optimization of the beam configuration and shielding to achieve a maximum epithermal flux-to-gamma-ray ratio.

It is necessary to perform measurements of dose from the tailored beam(s). Calculations based on reactor core configuration, fuel enrichment, attenuation, relative biological effectiveness, etc. have been performed. These calculations will be verified by measurements utilizing a humanoid phantom. Simultaneously, studies with animal and cell culture models will be initiated so that the effects of the neutron beam(s) on biological systems can be ascertained.

It is our goal to establish a credible and sustained basic research effort in BNCT therapy involving Georgia Tech, Emory, and other universities. The end result of this collaboration will be to bring healing to thousands suffering from incurable brain and other cancers.

2. Training

NNRC is very active in training students at Georgia Tech in reactor engineering and radiation detection and protection. The reactor experiments involve the following: approach to criticality, checkouts and operation of the GTRR, control rod calibration by various methods, flux mapping, material reactivity coefficients, temperature coefficient, power calibration, activation analysis, and cross section measurement using a single energy neutrons from a neutron diffractometer. Radiation detection experiments involve scintillation, semiconductor, and gas-filled detectors.

In addition to student training in nuclear science and engineering, NNRC sponsors short courses for training reactor operators and health physicists for nuclear power plants. More than 200 trainees from Georgia Power and TVA have taken such short courses.

NNRC also sponsors short courses in health physics. The topics covered include the following: basic radiation technology; radiation safety officer duties; federal, state and local regulations; licenses; biological effects of ionizing radiation; portable instruments frequently used to detect and measure radiation; fixed laboratory instruments used to detect and measure radiation; laboratory techniques to control radiation; radioactive material shipment; practical radiation safety practices; and hands-on control and actual startup of the 5 MW Georgia Tech Research Reactor.

3. High School/Scout Tours and Projects

More than 100 tours for high school students and scouts ranging in size from 10-30 students per tour are conducted by the Neely Nuclear Research Center staff per year. One institution, the Fernbank Science Center, an arm of the DeKalb County School Board, brings on a regular basis, groups of bright ninth grade students to visit the center as part of its scientific tools and techniques program.

The Neely Nuclear Research Center also helps many high school/ scouts students with science projects. One example is that of young Jenni Rausch. She studied the effects of Co^{60} radiation on Escherichia Coli, Micrococcus Luteus, and Rhodospirillum Rubrum bacteria. Miss Rausch received the first place award in the microbiology classification in Fulton County and third on a statewide competition involving more than 500 entries. Boy and Girl Scouts earn their nuclear merit badge with NNRC projects.

In summary, the Neely Nuclear Research Center and its facilities are widely used to strengthen nuclear science instruction in the curricula of non-reactor owning colleges and universities as well as research opportunities and application of nuclear analytical techniques for faculty and students in the sciences. We also have a significant program for high school students' tours which is very valuable for scientific education, career choices and public information.

In short, the Nuclear Research Center is vigorously involving other universities as well as Georgia Tech faculty in research utilizing the GTRR and associated facilities.

Finally, the externalized benefits of the GTRR are significant and emcompass a wide spectrum of human endeavors. We appreciate the willingness of NRC to reconsider the license fees issue and trust that the exemption of university research reactor will be reinstituted.

Sincerely,

R.A. Karam, Ph.D., Director
Neely Nuclear Research Center

RAK/ccg
Enclosures: Attachments A & B