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MIT Nuclear Reactor Laboratory

Safety & Security Questions

Questions submitted to MIT (MIT's answers appear below)	Commentary on MIT's answers
1. How does MIT's 6 kW reactor compare in size to other research reactors in the US? The MIT reactor is 6 MW. There are about 25 research reactors located on university campuses across the United States and another few at the various National Laboratories. These range in power from a few Watts to 250 MW.	*MIT's comparison suggests that their unit is of less than average size. In fact, the 250 MW reactor they cite is not located on a university campus, and is not even a civilian facility, but is located in a remote Idaho desert, miles from the nearest settlement. In fact, the MIT reactor (MITR) is the second largest university-based research reactor in the U.S. (after the Missouri University Research Reactor (MURR).* *Source:* NRC Information Digest, 2011–2012 (NUREG-1350, Volume 23), Appendix F *http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1350/* *The average size of a university research reactor in the United States is 1.7 MW. The MIT reactor is 6 MW and may be increased to 7 M, making it nearly 4 times the average size. It is also one of only two reactors in the nation to use Highly Enriched Uranium fuel (HEU), which has a half-life of 700 million years, and can be used to make nuclear weapons.* *MIT's reactor is also the oldest academic reactor still in service, and is located in the densest urban location, with an unusually small security buffer separating it from public streets and rail lines. For all these reasons, it is risk profile is well above average.*
2. How many research reactors the size of MIT's are located in an urban area in the US? Most research reactors are located on university campuses hence are in highly populated settings.	*While most research reactors are in populated settings, few are in an area as densely developed as Cambridge and Boston. Many, including the reactor closest in size and fuel type to the MITR (the MURR reactor in Columbia Missouri) are in suburban settings, with large buffer areas that can be evacuated without catastrophic consequences should the need arise.* *According to MITR's own filings to the NRC,* "A ring 2 km (1.2 mi) from the reactor site includes one-third of Cambridge and some residential areas of Boston and Somerville. The population within this ring is estimated at 73,000. The estimated population within rings of 4 km (2.5 mi), 6 km (3.7 mi), and 8 km (5.0 mi) is 264,000, 570,000, and **850,000**, respectively." (Source:NRC Safety Evaluation Report, Oct. 2010, p.2-1) http://pbadupws.nrc.gov/docs/ML1023/ML102320082.pdf By contrast, here is the filing for the MURR reactor in Columbia Missouri, the only other unit in the U.S. fueled with HEU-235:

"The MURR Facility is situated on a 7.5-acre lot in the central portion of the University Research Park, an 84 acre tract of land one mile southwest of the MU main campus. The campus is situated in the southern portion of Columbia; a city with a current population of approximately **91,885** people. The University Research Park consists of low occupancy research buildings."

http://pbadupws.nrc.gov/docs/ML0921/ML092110573.pdf

The population within 5 miles of the MIT reactor is 850,000, approximately 9 times the total population of Columbia MO.

3. Are there any other nuclear facilities in the US located within 50' of both an active railroad line and a public street?

   The MIT reactor is located 80' from the railroad and 100' from Albany Street. We do not have such information for other reactors.

Whether the distance is 50', 80' or 100' should not obscure the larger point that the security buffer around MIT's reactor falls far short of normal reactor siting practices. The NRC mandates specific buffer zones to protect both the reactor and public safety, including a "Protected Area", "Exclusion Zone" and "Low Population Zone".

Regarding the specific dimensions MIT cites, these are at odds with those they provided to the NRC in October 201, when they stated that:

"the nearest point of normal public occupancy is on Albany Street, approximately 68 feet northwest of the reactor building....Railroad tracks run along the south side of the reactor site approximately 16 ft from the site boundary."

http://pbadupws.nrc.gov/docs/ML1023/ML102320082.pdf
(see page 2-1)

The 50' distance from the containment building to the railroad tracks, can be confirmed with reasonable accuracy in Google Earth, and calibrated using the gridlines on an adjacent football field.

Regarding MIT's statement that they do not have information about buffer distances at other reactors, these can be obtained from public filings submitted to the NRC (as MIT has noted elsewhere). It seems reasonable that MIT would want to understand how their own security vulnerabilities compare to those of peer facilities, and be willing to make the effort to find out.

MIT's licensing documents state that the adjacent freight trains carry "cargo that is not hazardous to the MITR-II" although inspection of freight cargo in the U..S. is far from complete.

(ibid, *page 2-2)*

There has been periodic discussion of providing passenger service on the Grand Junction Line, which would make the rail line a public way, closer to the reactor than Albany Street is.

4. How many safety violations have occurred at the MIT NRL since it began operation, and what has been their severity?

A "reportable occurrence" is a lawyerly term for a safety violation.

Dismissing exposures in excess of legal limits as having "no radiological consequence is not appropriate.

The MIT reactor has operated safely since 1958 without a release that affected the general public. There have been some reportable occurences, mostly procedural. These are rare (about one per year) and have had no radiological consequences.

The statement that the reactor has operated "without a release that affected the public" is misleading. The reactor discharges large volumes of low-level radioactive materials through its vent stack and sewer connections on a daily basis. In 2010 these included almost 1 kilogram of radioactive Argon-41 and 1.5 million gallons of slightly contaminated liquid waste discharged into sewers.

While these discharges are permitted by the NRC, it is not possible to state with certainty that they have had no consequences. Like many environmental toxins, it is almost impossible to connect an individual illness with a particular source.

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5. What changes were made following the discovery of an operator asleep and unreachable while on duty at the MIT NRP on June 30, 2003?

The changes that were made are those that were provided to the Nuclear Regulatory Commission in our report on this event. Our training program was revised to include a module on operator alertness and how to prepare physically for night shifts; routine activities such as data logging were split up so that the operator is required to do some physical activity every thirty minutes; and management reviewed research done on human factors to improve methods for assigning operators to the night shifts.

The fact that an operator was unreachable inside the control room of an operating nuclear reactor for 30 minutes raises questions beyond the issue of operator alertness, and suggest a significant vulnerability to sabotage.

http://pbadupws.nrc.gov/docs/ML0319/ML031970382.pdf

While small size of the MITR is often cited as a reason for confidence, the smaller staff also means a single person has more power than they would as one of many workers at a larger facility.

Maintaining a video log of all plant operations, which could be periodically reviewed for internal safety assurance, might be a useful supplement to current training efforts.

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6. What changes were made following the exposure of a worker to excessive levels of radiation in 2007, when the NRC cited MIT for Severity Level IV safety violations?

No one was exposed to "excessive" radiation levels. The event involved a badge exposure that was above normal but still below the safe limit. Both MIT and the Nuclear Regulatory Commission (NRC) carefully review all such exposures even when legal limits are not reached. The changes made included: improved training on the work in question, new radiation monitoring **equipment with both local and remote alarms, and electronic dosimetry that allows real-time monitoring of one's dose. The NRC citation was not for the radiation exposure, but rather for procedural errors.**

The concept that there is a "safe" limit for radiation exposure is a scientific fiction. In fact, all exposure results in an increased mutation and cancer risk. The "safe" exposure represents a judgment about how much risk is acceptable. In this context. MIT's distinction between a "badge exposure" and an "excessive exposure" is somewhat specious.

Regarding the NRC's review, mentioned several times below, It should be noted that while this agency provides valuable oversight, it is charged with both overseeing and promoting nuclear energy and research, an inherent conflict of interest that most other regulatory agencies are not encumbered by.

Question and Response	Comments
7. Does the MIT reactor meet all current provisions of the Massachusetts Building Code, particularly regarding seismic design? The building was designed and built in the late 1950s and conformed to all building regulations at that time. It is regularly inspected by civil authorities/insurer for compliance on certain issues including fire, elevator safety, air compressor tanks, and the crane. The integrity of the containment building is verified annually with the results of the test being reviewed, also annually, by the NRC. The seismic design was reviewed by the NRC as recently as 2010.	*Seismic codes have become much more stringent in recent years, so a building that met the criteria in 1956 may well have substantive deficiencies under current codes.* *The containment vessel is not the only structure whose seismic integrity is essential. Failure of secondary components such as internal equipment, cooling towers, storage tanks, etc. can undermine otherwise well-conceived safety protocols.* *The Fukushima incident occurred because minor components, were disabled in the tsunami, leading to a cascade of escalating failures, even though the containment buildings were not initially damaged.*
8. Has a comprehensive seismic analysis and risk assessment been performed by a qualified engineering firm with no affiliation to MIT or the NRC, and if so, by whom and how recently? No. However, seismic analyses were performed by MIT personnel both for the license renewal in the early 1970s and for the more recent one in 2010. Both were reviewed by the NRC.	*It is widely understood that in-house analysis is less likely to identify and pursue problems than analysis by unaffiliated experts. Given the high stakes, it seems only reasonable to require such "best practices" in this case.*
9. Has this analysis included seismic and blast damage evaluation of all equipment, both internal and external, including backup power, water, communication and other systems? A summary of the analysis is contained in the MIT reactor's safety analysis report (chapter two) which is a public document on file with the NRC.	*It is not clear from MIT's response and the documents available online, whether, or how seriously, blast damage was considered. Sabotage is a serious threat, given the toxicity and persistence of the uranium fuel used. MIT should confirm that this potential has been very thoroughly examined and that robust protections are in place.* *The National Council on Radiological Protection, a respected scientific group has evaluated the potential for normally stable fuel elements to be vaporized by conventional explosives (TNT, C4,etc.) and has concluded that such a weapon could be devastating.* http://www.ncrponline.org/ *According to the 2000 NRC filings, there are more than 70 openings in the containment vessel ranging from small pipe penetrations to doors up to 10' x 14'.* http://pbadupws.nrc.gov/docs/ML0531/ML053190384.pdf *(see section 6.5.3)* *All are carefully sealed. The larger openings are provided with airlocks and inflatable gaskets, however it is unlikely that any operable door or damper has the blast resistance of the 2' thick concrete and steel vessel they penetrate.* *It is not clear whether or how these penetrations were considered in whatever blast analysis was done.*

10.	If so, has the blast analysis included the risk posed by explosive contents of freight railroad cars passing within 50' of the facility? The MIT reactor is located 80' from the railroad and 100' from Albany Street. Blast analysis was performed subsequent to 9/11 by a qualified individual who was not affiliated with the MIT reactor. The study showed that the building that surrounds the MIT reactor might be damaged but the reactor core would not be damaged and there would be no radiation release to the general public. That analysis was provided to the cognizant government authorities including the City of Cambridge (Department of Emergency Management at the time).	*See note 3 above.* *It is commendable that MIT retained an unaffiliated expert to review blast risks, and encouraging that they concluded the blast risk was minimal. Given the many complex assumptions that any such analysis would require, it would be useful to know what the assumptions were. Until 2001 no one considered the possibility of an airplane intentionally striking a major skyscraper.* *For example, did the blast analysis consider the impact load which could result from the collapse of the 150' tall masonry vent stack onto the containment building?*
11.	Has a risk assessment evaluated the potential for negligent or malicious acts by operators, including both students and employees, i.e., Fort Hood, etc.? Yes. The nature of the checks is detailed in the Code of Federal Regulations (Part 10) and entails fingerprint checks by the FBI as well as a criminal background check for anyone having unrestricted access to the facility.	*Malicious acts can result from many factors, including psychological instability or political animus, which is unlikely to be detected by fingerprint analysis or criminal background checks.* *There have been a number of disturbing incidences of mental illness and antisocial violence on college campuses in recent years, most dramatically at Virginia Tech in 2007. Therefore, the potential for intentional damage by an operator cannot be discounted altogether, and precautions should be taken to limit the potential scope of this.*
12.	Are there fail-safe mechanisms in place to assure that operators follow established procedures and to limit damage if they do not? Yes. The MIT reactor achieves safety through use of a defense in depth strategy. The first element of this strategy is good design and use of passive safety. For example, the core is designed for natural circulation should off-site electricity be lost. The second layer is a well-trained, qualified, licensed operator. All of our operators are licensed by the NRC. The third layer is administrative - procedures and well-designed control systems. The fourth layer is a safety system that will cause an automatic shutdown if certain license conditions are not met.	*MITR's response does not specifically address measures to limit the potential for malicious damage by an operator. It would appear logical to create robust defenses against this risk.* *See response to question 5.*
13.	What is the age of the oldest components of the cooling system, including piping, valves, and the heat exchangers which transfer heat from the reactor to the external cooling tower?	*While it is reassuring that much of the cooling system has been recently replaced, the remaining components dating to the 1970's are now forty years old. Most mechanical equipment of that age*

	The oldest components in the cooling systems date to the early 1970s. However, most of the internal cooling system was replaced in 2010. Also, most of the external system (including the cooling towers) was replaced within the last few years. The MIT reactor is in excellent material condition.	*is not in perfect condition, regardless of the diligence with which it has been maintained.*
14.	How often is this piping inspected by X-ray or other means? The frequency of inspections depends on the safety significance of the piping in question. For example, in-core components are inspected monthly. Other systems are inspected on either a quarterly or annual basis.	*MIT has not clarified whether inspections are visual or include more sophisticated metallurgical tests such as X-ray or ultrasonic waves..*
15.	Is the NRL connected to the public water supply and sewage systems? The building is connected to public water and sewer. These connections incorporate special safety features. For example, the ones for city water all use backflow preventers and the ones for discharges employ physical separation between the reactor building and the pubic sewer.	*According to MIT's regulatory filings, the reactor facility discharged nearly 1.5 million gallons of low-level radioactive liquid effluent into the public sewers in 2010 alone. They store this liquid in above ground tanks pending discharge.* *Amidst all the discussion of the steel and concrete containment building with walls 2 feet thick, it is easy to overlook just how porous this facility is.*
16.	How is ventilation air provided to plant operators, and how long can the facility function without a connection to the outdoor atmosphere? Ventilation is provided by intake and exhaust ducts that will be sealed automatically if abnormal radiation levels are detected in the building. Each duct has redundant dampers and the instruments that would initiate closure are quadruply redundant. In addition, the option exists for manual closure and the ducts seal automatically on loss of off-site electricity. Our operating procedures direct that the facility be shutdown on loss of ventilation.	*No response has been provided regarding the length of time the facility can function without access to outside air, which during normal operation is continuously drawn into the building and vented through the exhaust stack, after filtration.* *It is also not clear (and doubtful) that the operable dampers used in an emergency to seal the ducts that penetrate the containment vessel have the same degree of blast resistance as the 2' thick concrete walls they penetrate.* *The building is regularly pressure tested, but a leakage rate of 1% of the building volume per day per psi of overpressure is deemed acceptable.*
17.	Is the NRL located in a federally designated Flood Plain? No	*In 1938 in Providence, RI, water levels rose rapidly during a hurricane, to 8' above street level in much of the downtown area. MIT's analysis concluded that the flood hazard in Cambridge is minimal, however global weather patterns appear to be*

changing. Like the residents of Providence, New Orleans, and countless other coastal locations, the designers and operators of the Fukushima plant never expected to see the water levels that eventually swept aside their best-laid plans.

MIT's NRC filings state that the water table at the facility site is only slightly below ground level."

Therefore, the basement level of the reactor, which includes the fuel storage room, is located below the water table, and potentially subject to a heightened flood risk.

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18. How long is the facility capable of operating safely with the access door below water level?

Such a water level has never occurred, and the facility would not be operated under such circumstances.

See notes above.

Another potential flood hazard concerns water used for firefighting. At Fukushima damage was compounded by the fact that firefighting water laden with radioactive materials was allowed to flow directly from the facility onto surrounding land.

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19. How often is the reactor containment inspected for corrosion or other deterioration between the concrete and steel jacket?

We perform an integral containment building leak test every year. That test would identify any incipient deterioration of the building.

While a leak test might identify breaches in the steel jacket, it might not identify thinning or weakening of the metal. The 55 year old steel containment vessel is only 3/8" thick, and not galvanized, a common method of corrosion protection for outdoor steel. It extends into the earth, below the water table, making inspection difficult or impossible. MIT takes precautions to protect this steel with zinc anodes and a cathodic protection system last renewed in 1994, but it is unlikely that the structure was ever intended to last more than 50 years. There is considerable potential for water to be trapped between the steel and the concrete liner, which can be particularly damaging in our harsh New England climate.

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20. What radiation exposure would be created if Highly Enriched Uranium or spent fuel were vaporized outside the reactor core during delivery or removal?

Neither of these scenarios is a credible event. There is no mechanism for vaporizing the fuel and there is a strong security presence. In the case of delivery, the fuel would be unirradiated and hence it is not a radiation hazard. In the case of spent material, the fuel is sealed in a DOT-approved shipping container before it is removed from our building.

It has been well documented that spent fuel can be vaporized using conventional explosives (e.g., C4 or TNT) creating a "radiological bomb". While not a nuclear weapon, such a bomb would have devastating consequences that should not be minimized or dismissed as "not a credible event" as MIT has done.

See

- *NCRP Report #165: "Responding to a Radiological or Nuclear Terrorism Incident" (2010);*
- *"Research Reactor Vulnerability to Sabotage by Terrorists", Science and Global Security, 11:85-107, 2003*

Regarding the DOT shipping container, this is a small metal canister or cask, designed to withstand mishandling and minor shipping damage, not intentional attack. There is at least one instance, at another regulated NRC facility, of a container being improperly sealed and radioactive contents inadvertently released during shipment.

http://pbadupws.nrc.gov/docs/ML0111/ML011130274.pdf

21.	(NOT USED)	
22.	How long would the radiation persist, and how long would it take and cost to clean up? **Not applicable given that the situation envisioned in question #20 is not credible.**	*This is a lawyerly evasion of the question.* *The fuel used at the MIT reactor, Uranium 235, has a half-life of 700 million years. If any leak were to occur, the $100M cleanup of the Gulf Oil Spill pale by comparison. It is not clear why a $500 Billion indemnification would be needed if there was no risk.*
23.	What is the likely evacuation radius and duration following a worst-case radiation event? **The worst case event is the reactor's design basis accident which is described and analyzed in the Safety Analysis Report (public document on file with the NRC). The reactor building is designed to contain completely the radiation from this event. Thus, there would be no "likely evacuation radius" and no "duration." The public would not be affected because the MIT reactor is enclosed by a full containment building and that building would be sealed if such an event were to occur. The NRC mandates emergency planning for research reactors for a zone of only 100 meters around the site. This small radius is indicative of the low risk posed by such facilities.**	*It appears from MIT's response that the "design basis accident" does not acknowledge the potential for sabotage.* *Clearly, any release occurring outside the building would not be contained by it.* *The assurance that "the reactor building is designed to contain completely the radiation from this event (a leak)" could well have been made by the Fukushima operators a year ago, and probably was.* *MIT's own NRC filings clearly acknowledge that under certain emergency conditions, emergency venting and related public evacuation could be necessary, which is at odds with their assertion here that this could never occur and is therefore irrelevant. Ease of evacuation is cited in the permitting documents for a number of other comparable reactor facilities located in less populated areas.*
24.	Is the MIT NRL participating in the latest NRC-mandated seismic upgrades which were implemented following the 2011 Virginia earthquake? **No, thus far the NRC has mandated actions only for the power plant community. Research reactors do not pose a significant risk to the community.**	*Even if research reactors are held to a lower standard, one would hope MIT would duly consider the lessons of seismic damage the occurred in Virginia.* *The statement that "research reactors do not pose significant risk to the community" is directly contradicted by numerous industry experts and government agencies, who consider Highly Enriched Uranium (HEU), and the highly radioactive spent fuel that results from its fission, to pose a significant security risk. These concerns have been documented in countless authoritative studies. MIT's unsubstantiated dismissal of such concerns is not credible.*
25.	How much Highly Enriched Uranium is present at the MIT NRL, and how does this amount compare to the minimum amount needed to construct a functioning nuclear weapon?	*The fuel used at the MITR is essentially the same material the Iranians are spending billions and risking war to produce, and which numerous international agencies are working to eliminate from research use.* *Based on publicly available information, it appears that there is not sufficient nuclear material at the MIT reactor to construct a functioning nuclear weapon (New York Times, April 12, 2010), however a coordinated attack on several lightly secured*

That figure is given in our license which is a public document that is on file with the NRC. We see no value to discussing what is required to build a weapon. We do note that (1) the MIT reactor does "just-in-time" refuelings so that our inventory of fresh fuel is almost always zero, (2) that the amount of fresh fuel brought in for any given refueling is always significantly less than what would be required to construct a weapon, and (3) it is not possible to construct a weapon from spent fuel given the presence of highly radioactive fission products.

facilities (of which more than 100 remain globally), could net a sufficient quantity.

From the Times article:

"In Cambridge, Mass., at the Massachusetts Institute of Technology, a nuclear reactor emits an eerie blue glow 24 hours a day, 7 days a week. Its fuel is 93 percent uranium 235 — the high-purity uranium it takes to energize an atom bomb and exactly what the West fears that Tehran wants to produce. The facility at M.I.T. is just one of some 130 civilian research reactors around the globe that use highly enriched uranium. Nuclear experts say that running them takes tons of bomb-grade fuel, enough to build many hundreds of nuclear warheads. And most are lightly guarded."

http://www.nytimes.com/2010/04/13/science/13nuke.html?pagewanted=all

Furthermore, it is inaccurate to state that " it is not possible to construct a weapon from spent fuel", since the "highly radioactive fission products" it contains make it ideal for use in a radiological weapon ("dirty bomb"). Spent fuel, vaporized with with conventional explosives such as C4 of TNT, would cause untold devastation.

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26. What is the status of MIT NRL's plans to convert to less enriched Uranium 235 (originally to have been completed by 2014)?

We are enthusiastic to implement the conversion and have a very active program in progress. We are awaiting qualification of low enriched uranium (LEU) fuel suitable for use at the MITR by the U.S. Department of Energy.

The MITR's director was quoted last year in the New York Times as stating that the deadline to convert by 2014 has slipped to 2015. It would be helpful to know the current conversion schedule.

17 US reactors, and scores of overseas reactors have been converted from Highly Enriched Uranium to Low Enriched Uranium. Only two reactors in the US continue to use the more dangerous fuel. MIT is on track to be the last to convert. Nuclear security agencies have been attempting to get MIT to convert by 2014, but it appears from MITR's response that they are not committed to that date unless all their research and financial needs are met without compromise. Given their facility's location in an atypically dense urban area, a greater commitment to conversion seems appropriate.

In addition to the hazard MIT's foot-dragging causes locally, delays in the conversion of the two remaining US reactors complicate efforts to convert the more numerous and dangerous facilities elsewhere in the world, undermining global security.

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27. Is adequate (military level) security provided during delivery and removal of bomb-grade materials?

The prominent scientific journal NATURE published the following assessment on October 14, 2010, p. 774

"The threat is more than academic: in 2007, two teams of armed men assaulted the Pelindaba reactor near Pretoria, South Africa. While one team engaged the site's security forces, who fled, the

	Yes. Details of the security that is provided are "safeguards information." That information is shared with the cognizant civil agencies including those of the City of Cambridge and the Commonwealth of Massachusetts, as well as federal authorities.	other men penetrated an electrified fence and made their way to an emergency control center inside the facility. There, they shot a worker in the chest before fleeing. They were never apprehended. No uranium-235 fuel was reported missing — indeed, no one knows what the assailants were after — but the incident underscores the vulnerability of civilian nuclear facilities." http://www.nature.com/news/2010/111010/full/467772a.html *MIT uses the same military-grade fuel as the Pretoria reactor, but with less security.*
28.	Is the MIT NRL participating in the latest Homeland Security upgrades to secure weapons grade or "dirty bomb" materials? **Yes, again details are "safeguards information." The City of Cambridge (Fire and Police) have been briefed on our upgrades under this federal program.**	*It is appropriate that the details of this cooperation are not a matter of public record, however there should be an appropriate oversight mechanism to assure that procedures are adequate, perhaps similar to Cambridge's model regulatory scheme for biohazards..*
29.	What is the maximum amount of spent fuel that is permitted to be stored at the MIT NRL, and what is the maximum amount that has actually been stored? **We minimize the spent fuel that is stored on site by regular off-site shipment. The U.S. Department of Energy retains title to the fuel and they arrange for its return to a DOE site at a regular frequency. Again, shipment details are "safeguards information" that is shared with city and state authorities.**	*Vaporization of even a modest amount of spent fuel, as noted above, would be catastrophic in an urban area. While MIT takes steps to secure the shipments, it is not clear that they have evaluated the potential consequences of a significant release.*

Economic Risk Questions

30.	Has there been any comprehensive, independent analysis of the economic impact which would result from a radiation leak at the MIT facility? **No, because the worst-case event does not produce a radiation leak. Please see response to question #23 above.**	*MITR's apparent unwillingness to acknowledge the possibility of a leak is reminiscent of the complacency that preceded the Fukushima disaster, not the self-critical spirit one hopes would follow it.* *The fact that the NRC provides a $500 Billion indemnification to MIT at public expense suggests that the potential cost of an accident is large, and that private insurers are unwilling or unable to write the coverage.*
31.	Is the facility subject to the liability caps imposed by the Price-Andersen Act, and if so, what is that amount of the cap? **According to the provisions of Price-Anderson, the government-sponsored insurers pay claims above $250k for nuclear incidents.**	*Many drivers carry more than $250,000 in automobile liability coverage.* *The "government sponsored insurers" who indemnify MIT for losses up to $500 M are essentially the US taxpayers. As the current financial crisis and many recent natural disasters have made abundantly clear, the capacity and will of the US government to make cities whole after a*

	Question / MIT Response	Comments
		catastrophic event is often quite limited. *This arrangement, by absolving MIT of nearly all financial responsibility for an accident, removes an incentive that might encourage them to make wiser choices about the location of the facility and the fuel it uses.*
32.	What is the current amount of liability insurance carried by MIT for the NRL? **We have $3M in nuclear liability coverage**	*Many Cambridge homeowners carry $1M in liability coverage to cover slip-and-fall accidents on their doorsteps.*
33.	What is the current Assessed Value of property in the City of Cambridge, including both taxable and non-taxable properties? **This information is available on the City's Assessing Department website.**	*According to City records, the value of taxable property in Cambridge in FY 2011 is $24.2 Billion. The value of tax exempt property (Harvard, MIT, etc.) probably approaches another $10B. (Assessing Dept. should clarify). Obviously these numbers are dwarfed by values just across the River in Boston, and do not begin to capture the value of economic activity in these cities or the cost of any significant disruption.*
34.	What is the current value of the MIT Endowment, and is the University prepared to indemnify neighbors for all direct and indirect losses they might incur as the result of a leak? **MIT endowment was $9.9B at the end of fiscal year 2011. MIT exercises appropriate levels of controls and best practices in managing the activities of and access to our Nuclear Reactor Lab that are consistent with regulatory and insurer requirements and guidelines. To the extent that there is a nuclear incident resulting in a leak, MIT is prepared, through the Price-Anderson Act, to address all claims.**	*The Price Anderson Act is makes the taxpayer responsible for most costs related to a nuclear accident, which is to say that MIT is "prepared to address all claims" by transferring the costs to the public at large.* *Whether the US government is a reliable insurer is a matter of doubt, based on recent disaster recovery experience.*
35.	What is the potential value and alternative uses of the property currently occupied by the MIT NRL and its buffer zones? **Given our education and research mission, the current use is the highest and best use.**	*"Greatest" and" highest" are relative terms that are meaningless without a comparison. If other potential uses have not been considered, one cannot say that the current use is the "highest and best" simply because it is consistent with the university's mission. It would seem reasonable for MIT to periodically consider alternative uses for a large, centrally located site as part of its long-term planning process.*
36.	What is the cost to the of the public safety coordination that the City provides to the MIT NRL, and how does this compare to that provided for other research groups and property owners? **This question should be directed to the City of Cambridge Fire and Police Departments. We believe that our impact on those Departments is minimal. Our interaction primarily consists of cross-training of our people and their officers.**	*The City administration should provide the Council with this information.* *Having said that, it is clearly appropriatee for the city to provide such services, within reason, in support of and partnership with our research community.*

Question / Response	Comments
37. What costs and benefits would result if the MIT NRL were located elsewhere (for example, at another existing nuclear facility, such as Pilgrim Station, Plymouth MA (40 miles from Boston) or Seabrook Station, Seabrook NH (45 miles from Boston)? **The reactor is located on the MIT Campus to achieve synergy with the faculty and students. The reactor could not be relocated (one of the conditions of its license is its present location) and to do so would not benefit either education or research.**	*Off-campus research facilities have been an established and integral part of MIT's mission for decades. What slight inconvenience there may be is more than offset by other operational benefits. MIT's Lincoln Labs is 14 miles from Boston and an integral partner in advanced research* *http://www.ll.mit.edu/about/mitinteractions.html* *MIT's Ocean Engineering program works effectively with the Woods Hole Oceanographic Institute, 80 miles from the Cambridge campus. The program's motto is "Two world-class institutions, one community of scholars"* *http://mit.whoi.edu/* *The notion that any alternative location for the MITR would undermine its mission is simply not supported by the evidence. The major challenge to relocation would probably be related to licensing, because other localities might not welcome a nuclear facility. For this reason, a location within an existing nuclear facility would appear advantageous.*
38. Has MIT formally investigated alternative locations for the MIT NRL (at either the Departmental or University level), and if so, how recently? **No**	*Does it not seem surprising that this question has not even been asked?*
39. What is the remaining "Useful Life" of the MIT NRL? **The current license, which was issued in the fall of 2010, runs until the fall of 2030. So, the minimum useful life is 19 more years. In 2025 or thereabouts, a decision will be made as to the facility's additional future life.**	*This response addresses permitting issues, but not the larger questions of whether MIT and the City would enjoy greater benefit from another use of this site.* *I can appreciate that the NRL might not wish to drive this consideration, but other voices at MIT should assure that the needs of one department with a handful of students do not trump other institutional priorities, or pose an existential threat to the institution as a whole.*
40. What is the plan for decommissioning the facility, and when is this likely to occur? **MIT has no plans for decommissioning the reactor.**	*A "Conceptual Decommissioning Plan and Cost Estimates for the MIT Research Reactor" was prepared by GE Nuclear Energy in December 1988, presumably to meet NRC requirements that operators show financial capacity to pay for decommissioning.*