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August 16, 2013

Leo P. Denault  
Chief Executive Officer  
Entergy Corp.  
639 Loyola Avenue  
New Orleans, LA 70112

Dear Mr. Denault:

We are writing to raise serious concerns regarding Entergy's draft estimate of the time it would take to evacuate residents around Plymouth, Mass. in the event of a nuclear accident at the Pilgrim Nuclear Power Station, and to urge you to direct that all necessary revisions be made before finalizing this document. We are also concerned that the current draft completely ignores the potential need for residents of Cape Cod to evacuate and makes highly unrealistic assumptions about how quickly people living nearest the reactor could evacuate. Entergy's document, as it is currently drafted, is simply non-credible and inadequate, and fails to sufficiently protect those living near the reactor or those located on Cape Cod, who could find themselves trapped and unable to evacuate at all for hours or longer by traffic congestion and/or bridge closures. Entergy should go back to the drawing board and create a plan that properly takes into account the realities of weather, traffic, human behavior and other factors into account. Right now, such a real-world plan does not appear to exist.

In the event of a nuclear accident, it is critical to quickly evacuate people in the immediate vicinity of the nuclear power plant who could potentially be exposed to radiological materials in the air they breathe. Accordingly, the Nuclear Regulatory Commission (NRC) requires detailed evacuation plans be established for the Emergency Planning Zone (EPZ), which extends ten miles from the nuclear power plant. It may also be necessary to evacuate people from a larger area to prevent their exposure to radiological materials that have settled onto the ground or are present in food and water. This larger area is typically estimated as up to 50 miles from the nuclear plant, depending on wind, the severity of the accident, and other factors. After the nuclear melt-downs at the Fukushima Daiichi Nuclear Power Plant in Japan, the NRC recommended American citizens located within 50 miles of the plant evacuate<sup>1</sup>.

Cape Cod is a unique geographical area, with over 200,000 permanent residents and as many as 300,000 vacationers in the summer. While none of the Cape falls within the 10 mile

<sup>1</sup> [http://articles.washingtonpost.com/2011-03-16/national/35207282\\_1\\_fukushima-daiichi-fuel-rods-spent-fuel-pool](http://articles.washingtonpost.com/2011-03-16/national/35207282_1_fukushima-daiichi-fuel-rods-spent-fuel-pool)



EPZ, almost all of it falls within the 50 mile zone. The only routes off of the Cape cross the Sagamore and Bourne bridges, which consequently would take evacuees first closer to the nuclear accident and onto roadways used by evacuating residents that live near the reactor before they are able to move to safety. Past evacuation plans have called for closing these bridges entirely during the evacuation of the EPZ to avoid traffic congestion coming from the Cape that would delay evacuation of those that are closest to harm, thus trapping all those on Cape Cod until EPZ residents have evacuated (see Figure). The current draft document, contrary to previous plans, does not explicitly acknowledge that these bridges could close, although the Massachusetts Emergency Management Agency have confirmed that one or both bridges could need to be closed for a time to facilitate evacuation of the EPZ<sup>2</sup>. While we were pleased to learn that Entergy recently agreed to perform a study specifically related to the potential need to evacuate Cape Cod residents in a nuclear emergency, we are concerned that Entergy's underlying estimation of the time it would take to evacuate the EPZ contains so many unrealistic assumptions that it is likely that those on Cape Cod may be trapped for far longer than is envisioned, to the potential detriment of their health and safety.

The need to develop credible, realistic and specific evacuation plans could be well-informed by an examination of similar efforts that occurred during the Fukushima meltdowns. It took the NRC five days to order the evacuation of U.S. citizens within 50 miles surrounding the stricken reactors<sup>3</sup>. The Japanese government first ordered a mere 1.8 mile evacuation zone about seven hours after the earthquake<sup>4</sup>, instructed those living between 1.8 miles and 6.2 miles to stay indoors after about nine hours<sup>5</sup>, ordered all living within 6.2 miles to evacuate after about 16 hours<sup>6</sup>, and only broadened that to a 12.4 mile evacuation zone about 26 hours after the earthquake, which was also several hours after the first hydrogen explosion occurred<sup>7</sup>. In fact, a recent article<sup>8</sup> indicated that “in one area, the level of radiation had surged to more than 700 times the normal level, indicating that many local residents were exposed to high levels of radiation before they evacuated.”

While it is fair to note that the Japanese government was faced with the challenge of dealing with the aftermath of the massive earthquake and tsunami that devastated portions of the country in addition to the nuclear meltdowns, this is not the only instance in which evacuations have left much to be desired or in which experts have noted problems with evacuation plans. Despite careful evacuation planning in prior years, for example, many residents were unable to leave New Orleans ahead of Hurricane Katrina in 2005. Moreover, a 2003 report by former FEMA Commissioner James Lee Witt, entitled “Review of Emergency Preparedness of Areas Adjacent to Indian Point and Millstone<sup>9</sup>”, concluded that the NRC's emergency response plans

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<sup>2</sup> [http://www.bizjournals.com/boston/blog/bottom\\_line/2012/10/cape-cod-evacuation-route.html?page=all](http://www.bizjournals.com/boston/blog/bottom_line/2012/10/cape-cod-evacuation-route.html?page=all)

<sup>3</sup> <http://www.nrc.gov/reading-rm/doc-collections/news/2011/11-050.pdf> Other countries ordered similar measures. Please see, for example, page 257 of <http://pbadupws.nrc.gov/docs/ML1128/ML11285A009.pdf>

<sup>4</sup> <http://www.tepco.co.jp/en/press/corp-com/release/11031106-e.html>

<sup>5</sup> <http://www.tepco.co.jp/en/press/corp-com/release/11031203-e.html>

<sup>6</sup> <http://www.tepco.co.jp/en/press/corp-com/release/11031211-e.html>

<sup>7</sup> <http://www.tepco.co.jp/en/press/corp-com/release/11031227-e.html>

<sup>8</sup> <http://mainichi.jp/english/english/newsselect/news/20130222p2a00m0na009000c.html>

<sup>9</sup> <http://www.nirs.org/reactorwatch/emergency/epwitrpt2003.pdf>



## PILGRIM NUCLEAR FACILITY



assumed that people would comply with directions they were provided with and “do not consider the reality and impacts of spontaneous evacuation,” meaning that individuals ordered to evacuate might not do so in the manner they were directed and that others directed to stay in their homes might choose to evacuate anyway. A recently released report from the Government Accountability Office (GAO)<sup>10</sup>, “NRC Needs to Better Understand Likely Public Response to Radiological Incidents at Nuclear Power Plants,” calls for a study of what fraction of people outside the EPZ will choose to voluntarily evacuate. The report makes clear that “without knowing reactions outside the 10-mile zone, NRC cannot be confident that its estimates of shadow evacuations outside the 10-mile zone provide a reasonable basis for planning off-site protective action strategies.”

<sup>10</sup> <http://www.gao.gov/assets/660/652933.pdf>

Regrettably, the December, 2012 Evacuation Time Estimate (ETE) report prepared for Entergy by KLD Engineering makes a number of faulty assumptions that seriously call into question whether the estimated evacuation times for the EPZ are reasonable. The report concludes that even in the worst case scenario, everyone in the EPZ will be evacuated shortly more than six hours after the accident, implying that even if both bridges to Cape Cod did need to be closed, they would not be closed for longer than this amount of time. However, in our analysis of the report we found numerous fundamental flaws, detailed below, that would likely add considerably to the time required for those in the EPZ to evacuate, and thus potentially leave those on Cape Cod trapped even longer.

- **The Entergy document relied on a telephone survey that did not inform survey participants that the questions related to a nuclear emergency, and makes poor assumptions about behavior in the event of a nuclear emergency.** The Entergy document was predicated in part on residents' presumed behavioral data (e.g. Would you evacuate even if advised to shelter in place?, Would you bring pets?, Would you wait for family members to return home before evacuating, or evacuate immediately and meet them later?) from a telephone survey that failed to mention that it was regarding an evacuation after a nuclear accident. Previous experience and studies have shown that people view a nuclear accident very differently than, for example, a weather-related evacuation order, and choose to evacuate in greater numbers and with less regard for official instructions<sup>11</sup>.
- **The Entergy document ignores the effect of voluntary evacuations from Cape Cod, which could have the largest impact on traffic in the EPZ in a slowly-developing emergency.** The report assumes a rapidly escalating emergency, where a General Emergency evacuation order is the first advisory that is issued. The report rightly notes that in a more slowly developing emergency, many residents in the EPZ may choose to voluntarily evacuate when they learn of an Alert or Site Area Emergency ahead of any evacuation order, thus reducing the number of people in the EPZ. The report fails to consider, however, the impact of residents of Cape Cod evacuating voluntarily in such a case. Such an "early shadow evacuation," coupled with the need for people leaving the Cape to cross the Bourne or Sagamore bridges, could add to the congestion faced by residents evacuating from the EPZ. Furthermore, after an evacuation order that closed the bridges, this could leave a significant number of such early evacuees trapped in their cars on the Cape just outside the EPZ for hours, at greater risk of radiation exposure than they would be inside their homes or other shelter.
- **The Entergy document contains assumptions about traffic flow during inclement weather that strain credulity.** Entergy's draft document assumes that area roads to be used in an evacuation would be able to handle 80% of the good weather highway capacity in the event of snow and 90% in the event of rain. The report claims "it is reasonable to assume that the highway system will remain passable-albeit at a lower capacity- under the vast majority of snow conditions<sup>12</sup>." It was also assumed that snow

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<sup>11</sup> <http://www.nirs.org/reactorwatch/emergency/epwittrpt2003.pdf>

<sup>12</sup> <http://pbadupws.nrc.gov/docs/ML1302/ML13023A031.pdf>



clearing personnel would be fully available and that clearing efforts would be highly effective and keeps roadways open. In a recent blizzard (Feb. 8-9, 2013), road conditions were so severe that the Massachusetts Governor placed a ban on driving<sup>13</sup> that lasted 24 hours in some places<sup>14</sup>. During Hurricane Sandy in late 2012, storm surge overtopped Plymouth Beach and led to a closure of Route 3A, one of the evacuation paths from Plymouth<sup>15</sup>. It was several days before all downed power lines and trees were cleared. As has been fully realized by Japan's melt-downs and warned<sup>16</sup> of by the shut-downs and equipment failures in the United States at multiple nuclear reactors during Hurricane Irene, natural hazards and severe weather conditions are one potential trigger of a nuclear accident. Thus, assuming that the worst storm-related traffic conditions will never coincide with a nuclear accident is short-sighted. In addition, in the event of heavy snow during a nuclear emergency, it is unlikely that all snow plow operators will report for snow clearing duties at their own personal risk as opposed to evacuating themselves and their families. Snow plow operators should be anonymously surveyed to determine what fraction would tend to their families either ahead or instead of clearing roads.

- **The Entergy document fails to account for chronically bad traffic in the region during summer weekends and special events.** While the Entergy document considers the possibility of an evacuation being required during a time when more than normal numbers of people are near the reactor (they consider 4<sup>th</sup> of July fireworks in Plymouth), it fails to consider the truly bad traffic jams that often occur in the region. During the recent 4<sup>th</sup> of July weekend, for example, traffic was backed up on Cape Cod for 25 miles ahead of the Sagamore bridge, and it took as long as eight hours to drive from the Cape to Boston<sup>17</sup>. If a nuclear accident occurred during such traffic congestion, all this traffic would have to be halted or rerouted to provide uncongested roads for evacuation of the EPZ. Such considerations are not included in the current estimate of evacuation times.
- **The Entergy document assumes that parents will not attempt to pick up their children from schools and that bussing will be effective.** The report assumes that if an emergency occurs during school hours that schoolchildren will be evacuated using school busses to reception centers and that parents will meet their children. It is highly unlikely that no parents will choose to come directly to schools to pick up their children, making traffic near schools worse and slowing bus-based evacuation of schoolchildren. As with snow plow operators, it is also absurd to assume that all school bus drivers will shuttle students in and out of the EPZ at personal risk to themselves without tending to their own families. Bus drivers, like snow plow operators, should be anonymously surveyed to determine what fraction will choose to evacuate with their families in the event of a nuclear accident and thus not be available to bus schoolchildren.

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<sup>13</sup> <http://www.boston.com/news/local/massachusetts/2013/02/09/governor-deval-patrick-surprise-travel-ban-wins-praise-criticism/1cEcoQhBcaIwUQUIEpuTmN/story.html>

<sup>14</sup> <http://www.gazettenet.com/home/4359892-95/ban-inches-road-snow>

<sup>15</sup> <http://www.wickedlocal.com/plymouth/topstories/x1272748828/HURRICANE-SANDY-Dodged-that-bullet#axzz2MKf6CMs1>

<sup>16</sup> <http://markey.house.gov/press-release/august-29-2011-markey-hurricane-irene-exposes-holes-nuclear-plant-safety-regulations>

<sup>17</sup> <http://www.bostonglobe.com/metro/2013/07/08/cape-going-nowhere-holiday-traffic-nightmare-spills-over-into-monday/gRG9bQkdv0h7B4E8Chs13N/story.html>

- **The Entergy report assumes that only 20% of those living near the reactor but outside the evacuation zone will evacuate on their own.** This assumption runs counter to previous experience. In the Three Mile Island nuclear accident, although only about 3,500 people were advised to evacuate, more than 140,000 chose to leave. Assuming 20% of the population living 5 miles beyond the EPZ would evacuate uses NRC guidance that is based on faulty assumptions. As the GAO report indicates, the assumption that 20% of the population will evacuate even when asked not to is based on a 2008 phone survey of residents of EPZs conducted by Sandia National Laboratory for the NRC<sup>18</sup>. EPZ residents are well informed about nuclear accident preparedness due to required public outreach campaigns and planning exercises, and still 20% say they would ignore official instructions. The residents outside the EPZ are likely less informed and may be even less likely to follow official instructions. Certainly their expected behavior should not be based on a survey of EPZ residents. In addition, the report from James Witt recommends that large shadow evacuations, such as might be expected after a terrorist attack, be included as a scenario in calculating ETEs<sup>19</sup>. A larger than anticipated shadow evacuation would lead to traffic congestion upstream and could effectively trap those closest to the accident in the EPZ.
- **The Entergy report only accounts for non-EPZ residents who work in the EPZ for 15 employers and the schools.** This estimate fails to account for the many smaller employers in the EPZ who employ non-EPZ residents. While each business may only employ a few non-EPZ residents, there are many such small businesses and these potential evacuees need to be accounted for.

These faulty assumptions cast serious doubt on the validity of the ETE report and suggest that there would potentially be higher levels of congestion, poorer road conditions in inclement weather, and fewer available snow plow or school bus drivers. These would all lead to a significant lengthening of the time required for the EPZ to fully evacuate. We strongly urge you to reconsider these faulty assumptions and make a realistic estimate of the evacuation times that can guide robust emergency planning and to avoid similar mistakes in the upcoming study of evacuation from Cape Cod.

Sincerely,

  
Edward J. Markey

  
Elizabeth Warren

<sup>18</sup> <http://www.gao.gov/assets/660/652933.pdf>

<sup>19</sup> <http://www.nirs.org/reactorwatch/emergency/epwitrpt2003.pdf>