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**NRC Public Meeting on the Review of Emergency Preparedness
Regulations and Guidance for Commercial Nuclear Power Plants
(8/31 - 9/1/05)**

Comments Mary Lampert, Town of Duxbury, Massachusetts

EMERGENCY PLANNING IN THE EVENT OF A NUCLEAR DISASTER

KEY ISSUES

Goal/ Assumptions Underlying Emergency Planning – False

Goal: The current Goal of emergency planning is to prevent lethal radiation doses not prevent radiation linked cancer, disease and genetic damage. NRC requires evacuation planning for only those within the "plume exposure" pathway – 10 mile radius. The choice of this radius was based in part on NRC's analysis indicating that in a severe accident, dose rates high enough to cause early fatalities from acute radiation syndrome would be confined to about 10 miles. However dose rates outside this region, though on average not high enough to cause early fatality, could be high enough to cause significant risk of cancer, disease and birth defects unless effective measures are taken. NRC's emergency planning was not designed to limit such exposures in the event of "worst core melt consequences" for which the protection goal is that "immediate life threatening doses would generally not occur outside that zone¹." Emergency planning should be designed to prevent human suffering – not simply prevent immediate death; just as, for example, fire codes and fire drills for schools are designed not simply to prevent children from immediately burning to death but to prevent them from being hurt, period.

Assumptions: Emergency planning should be designed to deal with accidents of major consequence spreading over a large area. NRC and FEMA continue to assert that such events are unlikely to occur.

This is no longer relevant in age of terrorists who have technical expertise and are actively targeting critical infrastructure facilities with the intent of maximizing casualties and economic disruption.

If current emergency plans are incapable to cope with all credible terrorist-induced events, they should be upgraded. If upgrading is so cumbersome or impossible to a sufficiently protective level, then other operations, including shutdown should not be ruled out.

Deliberate accidents

It is true that a spontaneous occurrence of multiple system failures necessary to cause a serious accident is typically an improbable event. However, if one considers the possibility of sabotage or deliberate accidents, the low probability argument that NRC uses to justify the continued operation of plants, when plans are based on a deliberate event not occurring, completely breaks down.

Terrorists with readily available knowledge of how nuclear reactors work can design their attack to maximize the chance of achieving a core melt and large radioactive release; or worse, a spent fuel pool accident with greater release.

¹ NRC, Criteria for preparation and Evaluation of radiological Emergency Response Plans and Preparedness in Support of Nuclear Plants, NUREG-0654, 1980, p.12.

False Assumptions Underlying Current Planning

1. Emergency Planning Zone (EPZ) 10-Miles – However Impact Much Wider

Emergency response plans and procedures [evacuation and sheltering] do not include plans for residents outside the 10-mile EPZ.

2004 Emergency Calendar (page 17), "The federal government selected 10 miles because it is the distance beyond which any radiation exposure would be so small as to not warrant any type of protective actions for the public. Most credible accidents would not require protective actions beyond five miles or less."

Core Melt – Sandia CRAC-II Study

However a core melt at Pilgrim NPS, calculated by the federal government, would result in a 20 miles peak 1st year fatal radius; a 65 miles peak 1st year injury radius; and 23,000 peak cancer deaths.² A spent fuel accident would be many times worse. See Appendix 2 for a graphic.

These estimates are conservative. The federal study, CRAC II:

- used census data from 1970;
- assumed entire 10-mile EPZ would be evacuated within at most six hours after issuance order;
- assumed aggressive medical treatment for all victims of acute radiation exposure in developing numbers for early fatalities;
- used a now obsolete correlation between radiation dose and cancer risk that underestimated the risk by a factor of 4 relative to current models; and current models need to be recalculated again based on the National Academy's BEIR VII Report (June 2005) that reconfirmed that there is no safe level of radiation, risks are greater than previously thought and health risks other than cancer must be considered –such as heart disease and birth defects;
- sampled only 100 weather sequences out of over eight thousand (an entire year's worth), a method that underestimates the peak value over the course of a year by 30%

² Calculation of Reactor Accident Consequences U.S. Nuclear Power Plants (CRAC-2), Sandia National Laboratory, 1982. "Peak" refers to the highest calculated values – it does not mean worst case scenario. This is due to uncertainties in the meteorological modeling acknowledged by Sandia. The model only considered one year's worth of data and does not model for precipitation beyond a 30-mile radius. This is significant because the highest consequence are predicted to occur when a radioactive plume encounters rain over densely populated area. Peak Early Fatalities are deaths that result within the first year. Peak Early Injuries are radiation-induced injuries occurring in the first year that require hospitalization of other medical attention – such as sterility, thyroid nodules, vomiting and cataracts. Peak Cancer Deaths are predicted to occur over a lifetime. However, this is not the case with leukemia which is assumed to have occurred within the first 30 years following the accident.

Spent Fuel Pool Accident -National Academy of Sciences³

"Finding 2A: Spent fuel storage facilities cannot be dismissed as targets for such attacks because it is not possible to predict the behavior and motivations of terrorists, and because of the attractiveness of spent fuel as a terrorist target given the well known public dread of radiation...The committee judges that attacks by knowledgeable terrorists with access to appropriate technical means are possible." NAS, p.4

"Terrorists view nuclear power plant facilities as desirable targets because of the large inventories of radionuclides they contain. The committee believes that knowledgeable terrorists might choose to attack spent fuel pools because: (1) at U.S. commercial nuclear power plants, these pools are less well protected structurally than reactor cores; (2) they typically contain inventories of medium – and long-lived radionuclides that are several times greater than those in individual reactor cores." NAS, p.36

"A loss-of-pool-coolant event resulting from damage or collapse of the pool could have severe consequences. Severe damage of the pool wall could potentially result from several types of terrorist attacks, for instance: (1) Attacks with large civilian aircraft; (2) Attacks with high-energy weapon; Attacks with explosive charges." NAS, p.49

"Finding 3B –... a terrorist attack that partially or completely drained a spent fuel pool could lead to a propagating zirconium cladding fire and the release of large quantities of radioactive materials to the environment. Details are provided in the committee's classified report." NAS, p.6

"Such (zirconium cladding) fires would create thermal plumes that could potentially transport radioactive aerosols hundreds of miles downwind under appropriate atmospheric conditions." NAS, p.50

"The excess cancer estimates ...to between 2,000 and 6,000 cancer deaths"ⁱ p.45

Example: Town of Duxbury Implementing Procedures

- The REWNDS (area workers go for monitoring and decontamination) and Reception Center (area where residents go for monitoring, decontamination, transportation assistance to hospitals, if required; family reunification) although outside the 10-mile limit are respectively within the 1st year peak fatal radius (REWNDS) and just outside (Braintree High School). See Appendix 4 for a graphic.
- Regulators may follow the 10-mile EPZ but the public will not. Academic research, Dr. Donald Zeigler, after Three Mile Island and in NY showed that people living well beyond 10-miles evacuated – the shadow evacuation. Unless their evacuation is

³ Safety and Security of Commercial Spent Nuclear Fuel Storage
Public Report, National Academy of Sciences, April 2005

planned for, they will effectively place a "cork in the bottle" and those in the core will not be able to evacuate in a timely fashion.

Recommendation:

A. Plans should be based taking full account of the potential consequences of a terrorist attack or accident – planning must be for both the worst and best scenarios.

B. Currently there is (1) planning Zone, the 10-mile EPZ; it makes more sense to consider (3) planning zones.

Perhaps the inner zone would remain at the current 0-10 miles; mid zone at 10.01-20; and 20.01 – out, to be determined. As an example, potassium iodide would be pre-distributed to both inner and mid zones, out to 20 miles, as mandated by Congress - Bioterrorism Act. The mid zone would be instructed to shelter with KI followed by an evacuation – phased in after inner core evacuates.

C. Federal and State planners can not assume that equipment/supplies/personnel required in an emergency (such as radiation monitors, potassium iodide stockpiles) can be shifted from one EPZ site within the state to another. There may be multiple attacks, as occurred in 9/11.

2. Key Hole Theory of Plume Dispersion – ignores variability wind in coastal communities

What is it? Evacuation models implemented for severe accidents generally use the following principles: All people within a specified radius of the incident (usually 2 miles) are evacuated, and; people living downwind from the projected path of plume travel and bordering sectors are also evacuated. This area, the downwind sector and two adjacent sectors, affords protection from potential wind shifts and plume meander. This is known as a "keyhole" because of its appearance⁴

2004 Pilgrim NPS Emergency Calendar, page 17, "Radiation would move in a relatively narrow "plume" with a size and shape determined by wind and other weather conditions. Only those in the direction of the narrow radiation plume-those in potentially affected subareas of the Emergency Planning Zone – would have to take actions as directed."

Analysis: Pilgrim is located on the coast and the wind is highly variable. Therefore planning must be for the entire radius – not simply for those inside one imaginary "relatively narrow plume."

Hourly wind direction archives for southeastern Massachusetts are recorded on <http://www.iwindsurf.com/windandwhere.iws?regionID=102&geographicalAreaID=19&snapShotBar=snapshot>

⁴ US NRC Description: Principles of Evacuation, source: <http://www.nrc.gov/what-we-do/emerg-preparedness/evacuation-sheltering/principles-evac.html>; 2004 Emergency Public Information Calendar, Pilgrim, page 17.

The "key hole" is contradicted by actual weather analysis; however, it allows for limited resources to appear adequate.

Example: Implications for Duxbury: Emergency planning reflects this assumption. For example, school busses housed in Duxbury and Duxbury emergency resources may be directed to another EPZ community if the wind is not blowing towards Duxbury at the time of the call.

Recommendation Planning and targeting resources on the "key hole" should be taken out of all plans and procedures. Communities should refuse to move their resources to service another community in a nuclear disaster and not count on resources from other near-by communities to provide service to them in a nuclear disaster. Help should be contracted with communities not expected, realistically, to be affected by the disaster and more important that their own population will not react to the news necessitating a strain on their services.

3. Plan Assumes Slow Breaking Accident – Post 9/11 not realistic

Emergency planning should be designed to account for the full spectrum of potential consequences, including the so-called "fast-breaking" release scenarios in which radioactive releases would begin within 30 minutes after an attack. This is one of the major conclusions of the report conducted for the government of New York by James Lee Witt Associates. Certain terrorist attack scenarios could be capable of causing such rapid releases.⁵

However, the plan and tests of the plan are designed to address a slowly-evolving emergency, in which it is assumed that evacuation could occur over a 10 hour span or more.

Example: The precautionary transfer of schoolchildren is widely claimed and in most, if not all, communities parents/guardians are not instructed how to pick up their children at school in the event of a disaster (route and parking) and check them out so as not to interfere with an orderly evacuation.

Current Goal Emergency Plans -Prevent Lethal Doses not Prevent Cancer, Disease, Genetic Damage

NRC requires evacuation planning for only those within the "plume exposure" pathway – 10 mile radius. The choice of this radius was based in part on NRC's analysis indicating that in a severe accident, dose rates high enough to cause early fatalities from acute radiation syndrome would be confined to about 10 miles. However dose rates outside this region, though on average not high enough to cause early fatalities could be high enough to cause significant risk of cancer unless effective measures were taken. NRC's emergency planning was not designed to limit such exposures in the event of "worst core melt consequences" for which the protection goal is that "immediate life threatening doses would generally not occur outside that zone⁶."

BEIR VII

⁵ James Lee Witt Associates, *Review of Emergency Preparedness of Areas Adjacent to Indian Point and Millstone*, March 2002, Executive Summary, page X.

⁶ NRC, *Criteria for preparation and Evaluation of radiological Emergency Response Plans and Preparedness in Support of Nuclear Plants*, NUREG-0654, 1980, p.12.

The National Academy of Sciences (NAS) June 2005 report, *The Biological Effects of Ionizing Radiation Report*⁷ (BEIR VII) conclusion was simple: No amount of radiation is safe and women and children are the most at risk.

Women and Children Most at Risk: The National Academy reported that overall cancer mortality risks for females are 37.5 percent higher than for men, and the risks for all solid tumors (lung, breast, and prostate) are almost 50 percent higher. The differential risk for children is even greater. The same radiation in the first year of life for children produces three to four times the cancer risk as exposure between the ages of 20 and 50. Female infants have almost double the risk as male infants.

Impact Offspring from Parents Exposure: While the report states there is no direct evidence of harm to human offspring from exposure of parents to radiation, the committee noted that such harm has been found in animal experiments and that there is "no reason to believe that humans would be immune to this sort of harm." This should be of concern to nuclear worker's families.

Heart Disease and Stroke: The National Academy stated that No amount of radiation exposure is safe; and noted that relatively high levels of radiation exposure increase risk not only of cancer but also of heart disease and stroke.

What does this mean to us? The Federal Government's "permissible" maximum radiation dose for members of the public exposed to reactors under normal operations is 100 millirads per year for a 70-year lifetime. According to the Academy's report this translates to (1) in (100) members of the public getting cancer if so exposed. In addition, 1 in about 5 workers would get cancer if exposed to the legally allowable occupational doses over their 50 years in the workforce.

Currently what is the exposure level that determines emergency classification and protective action calls? How do those levels have to be readjusted after BEIR VII?

Clearly preventing cancer, disease and genetic damage must be the goal not simply preventing death.

Hazard Assessment – equipment to monitor and track the plume – Currently Inadequate

Managing an event – making the proper emergency call - requires first grappling with what has happened. Plans assume and regulations require [50.47 (b)(9)], that data regarding the status of plant conditions, radiological release and weather are reliable, accurate and timely – they may not be, and are not at Pilgrim NPS. Additionally, Pilgrim installed a Torus Vent. It has no monitoring capability. If during an accident scenario venting occurs via the Torus – no monitoring is in place.

The state is dependent on the licensee's reports and accuracy of the licensee's equipment. Radiation monitors and weather equipment is not computer linked to the state and local authorities from all points that radiation is released from Pilgrim and from appropriate off-site locations. Local communities are dependent on the state's interpretation of the licensee's accident reports of what is happening and how it may affect the population. The

⁷ National Academy of Sciences, Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2 (2005) <http://lab.nap.edu/nap-cgi/discover.cgi?term=Beir+VII&restric=NAP&GO.x=31&GO.y=11>

state sends a team to take samples and sends those samples back to state labs for analysis. However that takes time – too much time. For a complete analysis, we can provide a report.

Recommendation: Advocate upgrading the reactor's monitors from all egress routes and computer link those monitors to the state and local authorities; install high-tech computer radiation monitors, with real-time weather data integrated into the program, in local communities – placing them in the EOC would make sense. A similar recommendation was made by James Witt in his analysis of Indian Point. Additionally key emergency responders in likely-to-be-affected communities should be provided with devices to detect radiation --- NukAlerts or RadAlerts are examples of available products.

Plans/IPs Fail to Adequately Address Notification of Public

Rapid notification of emergency responders and the public is central to planning.

Emergency Responders: Emergency responders must have communication equipment that is interoperable. Example radios in Duxbury are off frequency; this means, for example, the EOC can not communicate with the schools.

Public notification: At present notification systems are inadequate in that they essentially rely on one system - sirens. Sirens can not be heard in all parts of town and can not be heard inside if the windows are down - they are simply an outdoor warning system. Sirens can and have failed. Pilgrim's sirens have been unreliable. They failed 12 times from January 2000 to January 2004. The latest siren failure came after a brand-new siren system was installed. All systems require battery back-ups.

A combination of warning systems is recommended - redundancy. This should be funded by the licensee and/or Homeland Security, recognizing that some upgrades are multi-purpose.

Warning/communication systems should all have backup power so that they operate when off-site power is lost. This is a logical extension of NRC's requirement that the telephone system used by licensees to inform the NRC about meltdowns have a backup power source so the NRC will get this notification even if offsite power is lost. The same logic applies to assuring communication to the public and state/local officials.

What is needed?

Outdoors: sirens in sufficient number with an audible, but simple, voice message and battery back-up.

Indoors: rapid dialing systems that have the capability to notify workers and every household and business within the EPZ in less than 15 minutes. Systems are on the market today that can do the job – for example Sigma Reverse 911 and DCC. Sigma Reverse 911's MassCall System allows 2,000 calls to be sent out at once, 30 second message. DCC's phone bank has 500 phones capable of making 1,000 calls a minute, based on a 30 second transaction. Either using Sigma's MassCall or contracting with DCC to use two of their phone banks would permit contacting 30,000 households within 15 minutes, the approximate number of households in Pilgrim's EPZ. More phone banks could be added, as required.

Roads:

- Reader boards –more installed on major highways and portable reader boards provided to EPZ communities.
- Low frequency dedicated radio capability.
- Busses/Vans for transportation dependent – radio equipment on board so that they can be notified.

Upgrading the notification system would not only save lives in an emergency but also reduce the need for Police to try to perform this function. If sirens fail, current emergency plans call for local police to drive up and down streets to warn residents over their PA system - a waste of resources and unlikely to accomplish the task.

Potassium Iodide (KI)

Potassium Iodide (KI) is a U.S. Food and Drug Administration (FDA) approved over-the-counter drug that should be taken *immediately* to protect the thyroid gland from radiation injury caused by radioactive iodine released during a nuclear accident.

Thyroid Cancer – Distance from Accident Site

Congress passed the Bioterrorism Act, 2002, and stated that KI should be made available to citizens within 20 miles of reactor sites. They charged in Section 127 the U.S. Health and Human Services with implementation. HSS has dragged their feet and Congress' mandate to HSS remains unfulfilled and the public not protected.

The American Thyroid Association recommends that: Potassium iodide should be made available to populations living within 200 miles of a nuclear power plant and should be "pre-distributed" to households within 50 miles of a plant. Massachusetts Medical Society advised that KI be provided to all Massachusetts residents.

Rationale:

U.S. Nuclear Regulatory Commission, NUREG/CR 1433 showed that for children, the following dangers may occur from the inhalation of nuclear materials after a massive core-melt atmospheric accident (like Chernobyl). Also note that the estimates are conservative in that they do not take into account the vast quantities of iodine now stored in spent fuel pools from recently unloaded reactor cores that would be released in a worst case accident scenario.

Approximate Dangers of a Core-Melt Atmospheric Accident for Children

Distance in Miles	Mean Thyroid Dose (rem) for Exposed Children Outdoors*	Probability of Thyroid Damage to Exposed Children Located Outdoors if not Protected by Stable Iodine (like KI)
1	26,000	100%
5	11,600	100%
10	6,400	100%
25	2,200	80%
50	760	26%
100	200	7%
150	72	2%
200	32	1%

Chernobyl: NRC's NUREG-1623 points out that radioactive iodide can travel hundreds of miles on the winds. An increase in cancer caused by Chernobyl... "was detected in Belarus, Russia and Ukraine. Notably, this increase, seen in areas more that 150 miles from the site, continues to this day and primarily affects children who were 0-14 years old at the time of

the accident...the vast majority of the thyroid cancers were diagnosed among those living more than 31 miles from the site. The 2001 figures were 11,000 thyroid cancers at 31 miles.

World Health Organization: (1999) World Health Organization (WHO) Guidelines for Iodine Prophylaxis following Nuclear Accidents states in its abstract regarding thyroid cancer caused by the Chernobyl disaster:

"This increase in incidence has been documented up to 500 km from the accident site." ...And therefore...""That stockpiling (KI or KIO3) is warranted, when feasible, over much wider areas than normally encompassed by emergency planning zones, and that the opportunity for voluntary purchase be part of national plans."

Recommendation:

- Implement the Bioterrorism Act's, Section 127.
- Implementation is not difficult. Important elements include: public education (notice in local tax and/or utility bills and local media); stockpiling KI in schools, shelters, group homes, hospitals, nursing homes, businesses; advising individuals to get KI and keep it at home, in their glove box and recreational vehicles – boats/campers; simplest distribution is to distribute a bulk supply to each local community's Emergency Management Agency or Health Board and let the community redistribute.

Evacuation Concerns

1. Shadow Evacuation: We know that many in the official 10-mile evacuation zone will try to evacuate, and that they will be joined by people from further out. Three Mile Island provides the best, and perhaps only, realistic example. There, the Pennsylvania Governor issued an evacuation advisory (note, it was not an order). It was expected to have precipitated the flight of only 3,400 people (pregnant women and pre-school children within five miles of the plant); instead, a total of 144,000 people (a government figure) evacuated the surrounding region.

Recommendation:

Include communities beyond the 10-miles in planning. In this case, advocate sheltering as a first response for those communities followed by a phased evacuation/ entry on to the major egress routes after the core has evacuated. This would save lives for those likely-to-be affected, In recent research near Indian Point demonstrated that sheltering individuals in the 10.7-25 mile region would be preferable to evacuation – evacuation tends to increase population doses by placing more people in direct contact with the radioactive plume.⁸

2. Service Stations

Cars running out of gas will delay evacuation for everybody. Unfortunately not everyone keeps their tanks full. Town Emergency Management Agencies that do not have 24- hour service stations should develop Letters of Agreement (LOAs) or Memoranda of

⁸ Chernobyl on the Hudson? - The Health and Economic Impacts of a Terrorist Attack at Indian Point Power Plant," was authored by Dr. Edwin Lyman, a senior staff scientist Union of Concerned Scientists.http://riverkeeper.org/document.php/317/Chernobyl_on_th.pdf

Understanding (MOUs) outlining the specific procedure to open pumps in an emergency after business hours.

3. Transportation dependent - bussing school children and those without cars in an evacuation, inclusive of latch-key children.

Mobilize transportation Resources at Alert:

Current steps mobilization, example Pilgrim NPS [State Implementing Procedure Rev 17, p.3] At Alert

Consider requesting the Governor declare a State of Emergency, if it appears that precautionary actions may be needed.

Based on emergency prognosis, direct the MEMA Region II Director, to stage/mobilize: At Alert MEMA resources, including pre-staging buses at EPZ schools, as appropriate.

Transportation Providers have a 3 hour mobilization time period. However, the best time estimate for this procedure is 3-5 hours.

Implication:

Transportation providers must be required to mobilize at the Alert Stage of an accident – defined as sent out, to arrive on location, ready to load evacuees. Information from NRC documents explains that large amounts of radiation can be released within as little as 30 minutes from the start of some types of accidents/ attacks. If plans wait until a later stage of an accident to mobilize busses, they may arrive too late. If the accident de-escalates, the busses can be called off; and at worse a real-time response drill is achieved. There is no "precautionary Transfer" of school children in anything but a very slow breaking accident.

Contracts/Transportation Matrixes Sent Annually to Town

In order for the EPZ towns to have "reasonable assurance" all towns should see, annually, the contracts between the state and bus/van providers, the transportation work sheets and the matrixes. Only in this way can each town be certain that the following is in order: number busses available during off business hours and business hours and their capacity; number of busses with conflicting obligations, that is they provide bussing for a local district and emergency services, and the number that would honor their contract with the local district first before their commitment to evacuate those within the zone; number drivers agree to participate, trained and have pagers so that they can be contacted off-hours in a timely fashion; communication capability on busses; where busses are dispatched from and their estimated mobilization time to arrive at EPZ site.

Busses Housed in a likely-to-be-impacted community for Exclusive Use of that community in a Radiological Disaster

Busses housed inside one EPZ community should be for the exclusive use of that community and not slated to potentially serve another community in the event of an accident.

Real-time Test time to mobilize Transportation

Past table-top tests have not been designed to accurately measure response time under a variety of conditions. Require unannounced real-time transportation test for transportation providers for the dependent population - public, private and nursery schools and child-care programs, nursing homes, group homes, latch-key children and others without transportation.

4. Evacuation route signs: Standardized permanent road signage indicating evacuation routes should be in each community. It is important for visitors; given cuts in staffing at Police and DPW, it would free those town emergency workers for other tasks; and it would remind citizens to think ahead about emergency planning.

5. Reception Center

Location: The key to any site for monitoring and decontamination is that it is sufficiently distant from the reactor and at an angle perpendicular to the wind direction.

Capacity: 20% -"Krimm's Memorandum"

Plans assume that only one in five (20%) will go to the Reception Center and Reception Centers are only equipped with personnel and materials to handle 20%– despite NUREG 0654 (J-12) that states that Reception Centers should be capable of monitoring 100% of the population within 12 hours.

This policy leaves 80% without an opportunity to be monitored and decontaminated risking their health. The policy is based on the Krimm's Memorandum – a FEMA official who came up with the 20% based on the response of resident's to a hurricane warning.

You can't base policy on hurricanes. People react very differently to a nuclear disaster than to a hurricane warning. Public warning for a hurricane is ample –TV & Radio Storm Watch reports give ample warning, often days in advance; in contrast, the time of official notice of a nuclear attack/accident can be very short –less than 30 minutes.

Consequence: if 80% are not monitored and decontaminated they will not only put at unnecessary risk their physical and psychological health; they will contaminate populations in other areas with dirty vehicles. Also, it is likely many more than 20% will go to the Reception Center and it will be overwhelmed so none will be served.

Institutionalized populations may not go to the Reception Centers at all. School children, the most vulnerable population, may simply be sent to the "Host School," facilities that do not have monitors or decontamination capability. Residents at Nursing Homes, Group Homes and detainees in jail are not brought to the Reception Centers. They will be brought to other locations – locations without monitors and decontamination equipment.

Recommendation: Large Reception Centers, appropriately located, should be developed. They can be multi-functional so that they could be used in a number of different emergencies. Colleges, large business complexes or indoor football/sports stadiums are an example of places to look at in some localities. Gillette Stadium in Foxborough would work for parts of Pilgrim NPS's EPZ.

6. Special Areas – Unique Geographic Location makes evacuation impossible

Some areas are likely-to-be exposed but due to geography the population can not evacuate in a timely manner – they are trapped. Cape Cod is an example vis a vis Pilgrim NPS. Planning and Procedures must be adapted to fit their needs – notification; sheltering with

KI; and eventual orderly evacuation when the plume has passed and roadways are open to moving traffic.

Sheltering Concerns

1. Town Shelters

Recommendations

- **Dose Reduction Capability:** The EPZ town shelters must be analyzed for dose reduction capability – inclusive of their interior spaces. We cannot build nuclear fallout shelters; however, we can analyze the spaces according to basic sheltering principles and then determine capacity.

Basic Sheltering Principles: the safest location is furthest away from the roof and windows and doors that will open to allow entry to the building – entry door should be located, if possible, on side of building facing away from reactor. Hence appropriate interior spaces are in the basement or lowest level possible and in rooms without windows – if the public must be in rooms with windows they should be instructed to sit on floor below window level.

- **Schools as shelters when school is in session:** Schools should be locked-down if the emergency call is to shelter so that doors cannot be opened and let radiation inside and harm those inside. Parents and the community at large must be educated and signs prepared to place at entrances to building at lock-down

2. Sheltering instructions for the public:

Public Education: Place instructions in the Emergency Calendar; but recognizing that many do not read them periodically place “sheltering instructions” in local papers.

3. Masks

After Call to shelter terminates, the public and all institutionalized populations are advised to cover mouths and exposed skin when leaving shelter (not simply during the call to shelter) to reduce contamination from radiation deposited on the ground. This is not practical advice for school children and the rest of the public for that matter.

Recommendation

Masks should be stockpiled in schools; group homes, shelters etc and the public recommended stockpiling them, along with KI, for home use.

3-M type masks are cheap, about 7 cents each; come in child and adult sizes; and those with N-95 or better efficiency to screen out > 0.1 microns should be purchased.

Example: Kimberly-Clark makes 'child sized' masks [47027]. Suitable for ages 3 - 10
Technical data: particle filtration efficiency >97% at 0.1 microns

Kimberly Clark Adult Face Masks [47080] NIOSA approved and designed to provide an effective facial fit for N95 respiratory protection.

Technical data: particle filtration efficiency 99% at 0.1 microns

Because our shelters can not be 100% effective in eliminating dose, masks should be considered for use inside the shelter.

Evacuation versus Sheltering

Dr. Edward Lyman in analyzing Indian Point stated that evacuation and sheltering are equally effective in eliminating risk of early fatalities among residents of the 10-25 mile radius. On the other hand one sees that evacuation also tends to increase the number of latent cancer fatalities relative to normal activity, while sheltering reduces the number. It appears that sheltering in the 10.7 to 25 mile region would be preferable to evacuation. Evacuation tends to increase population doses by placing more people in direct contact with the radioactive plume. Other models (Lyman used MACCS2) and other shielding parameter choices may lead to different conclusions. Lyman urges emergency planning officials to evaluate degrees of shielding that structures in region may provide to determine the types of actions would provide greatest protection of residents of regions outside the 10-mile EPZ (page 49, Lyman)

Protecting Worker Safety

Recommendations

Protective Gear: Emergency workers should have sophisticated protective gear. The licensee and state have opposed – an economic, not a health based decision.

Currently protective gear is not provided even in a general emergency described in the Emergency Calendar as "...the most serious type of emergency. It could involve serious damage at the plant and a release of radioactive materials." However Police and DPW workers are outside on duty at this time. Worse protective gear is not provided for those who volunteer for lifesaving missions that is to go outside after their dosimeter has exceeded the recommended "safe" level.

Clearly workers need to be provided with uniforms/clothes to cover all exposed skin; and some sort of breathing apparatus to prevent inhalation of radioactive materials. The protective gear should be in the local community, ready for use.

Until the community is properly equipped, workers should be advised to cover all exposed skin, no shorts or short-sleeved shirts.

Stockpile: Tyvek suits, boots and gloves; 3-M type masks (N-95); KI; and advise that cars/trucks do not provide adequate radiation shielding. Multi-purpose breathing masks - biological, chemical and radiological - should be made available to emergency workers who have received training for their use.

REWMDS: The center to decontaminate emergency workers (REWMDS) must be outside the peak fatal zones – preferably 20-25 miles away.

At Pilgrim NPS, the REWNDS is within the "peak injury zone" and close to the "peak fatal zone." It is located in Carver, directly across the street from the 10-mile demarcation line. It should be moved. There should be more than one center – so that there is an alternative site if the wind is blowing towards one of the centers.

Exposure Forms: Current state policy provides workers with a copy of their exposure forms at the worker radiological center (REWMDS) -Dosimeter readout and EWE forms; Monitoring Report at REWMDS. This procedure must be clearly written into the procedures and be part of worker training so that all workers understand the policy. Workers receive a copy of their TLD readouts from MDPH after it is sent to a lab for analysis. Workers should be sure to know this, too and keep all forms for future health purposes.

Injured and Contaminated – Medical Facilities

50.47 (b) (12) requires that arrangements be made to treat the contaminated and injured. However, the plan does not acknowledge that some accident scenarios will result in large numbers of injured and contaminated individuals.

Hospitals listed to serve those within the 10-mile EPZ of Pilgrim, for example, cannot handle monitoring and decontaminating large numbers of people. Also, some hospitals listed to serve the EPZ are too close to the reactor site to be of use.

The Commonwealth of Massachusetts has stated that they intend to set up mobile decontamination tents. Do they have an adequate supply of monitors, decontamination equipment, KI and trained personnel? Because of the possibility that there may be multiple attacks, as occurred in 9/11, States can not rely on moving needed equipment from other reactor sites.

Local communities must be provided annually with LOA's and MOU's to verify providers have agreed to participate; are equipped, inclusive of monitoring/decontamination equipment; the number of patients that they can handle per hour; annual training provided and completed; emergency testing completed, date and results.

Example: Pilgrim NPS – only 11 facilities are under agreement. What is the maximum number of contaminated/injured that each hospital can handle within 12 hours?

Medical Facility 2003-2004	Location
Brockton Hospital	Brockton
Cape Cod Hospital	Hyannis
Charlton Memorial Hospital	Fall River
Good Samaritan Hospital	Brockton
Falmouth Hospital	Falmouth
Metro West Medical Center	Framingham
Morton Hospital	Taunton
Quincy Hospital	Quincy
St Luke's Hospital	New Bedford
Sturdy Medical Center	Attleboro
Tobey Hospital	Wareham

Training

Emergency responders, including school teachers, are required to have training – 50.47 (a), (b). What percent have received training, each year? Is it sufficient that they have only

been offered training, but not taken it? Is there, or should there be, a fixed percent of each category of responder (Fire, Police, DPW, Harbor/Beach personnel, teachers, nursing/group home workers, bus drivers etc) that must receive training in each calendar year for the local plan to be in compliance?

Plan to Strengthen Department of Homeland Security (DHS)/Federal Emergency Management Agency (FEMA) Biennial Emergency Simulation Exercises

Biennial Emergency Response Exercises are conducted by the Department of Homeland Security/Federal Emergency Management Agency to assess the level of State and local preparedness in responding to a radiological emergency in the 10-mile Emergency Planning Zone (EPZ).

Nuclear Emergency Exercises must be based on realistic post 911 scenarios; be comprehensive; measure the effectiveness of the emergency response system; allow participation by independent experts; and allow interested stakeholders to observe these exercises.

Pilgrim EPZ's Biennial Exercise was held April 14, 2004. The public meeting to discuss the exercise was held April 20, 2004. The public was not allowed to observe the exercise; nor was the public notified about the Public Meeting via the media. Therefore the public does not have reasonable assurance that the exercise provided an effective, realistic and comprehensive test of emergency plans and that responses to the exercise were appropriate.

Recommendations: to Strengthen Biennial Emergency Simulation Exercise

1) Ensure that exercises are based upon a scenario involving a fast breaking release of radiation that results in the contamination of a significant portion of the 10-mile emergency planning zone and the 50-mile ingestion pathway zone. (Federal government reports note that a radioactive release can begin is less than an hour.)

2) Ensure that the exercise is realistic.

Exercises can be *no-notice* causing emergency personnel to mobilize suddenly as they would in a real emergency. (NUREG-0654, the federal regulation that defines emergency planning for nuclear sites, recommends that some exercised be unannounced.)

Exercises can *occur during non-duty hours*. (NUREG-0654 states that "each organization should make provisions to start an exercise between 6:00 pm and 6:00 am.)

Exercises can involve *real drills involving the practice of the current plan* – not simply "table-top" exercises, paper shuffling, and phone calls.

- 4) Ensure that exercises are comprehensive and cover a variety of conditions: inclement weather; different seasons; holidays; grid lock on primary transportation routes; terrorism scenarios; and scenarios that assess stress on limited emergency resources and personnel. (For example, test a scenario involving multiple attacks in the region i.e. attacks on electrical transmission lines or a regional electrical blackout.)
- 5) Ensure that the exercise is based upon a scenario in which significant self-evacuation, or "shadow evacuation," occurs beyond the 10-mile radius and as far away as 50 miles. (Academic research and the experience at Three Mile Island demonstrate there will be significant shadow evacuation outside of the 10-mile zone.)
- 6) Include numerous sub-exercises that examine whether latchkey children, who lack adult supervision, will be protected in the event of radiological emergency. Latchkey children need to be treated as a special population.
- 7) Ensure that the exercise takes into consideration a large number of people, who have been injured and contaminated, requiring treatment and decontamination. (Medical personnel have expressed concerns about hospitals being overrun by citizens worried that they have been exposed to radiation and the ability to treat a large number of contaminated people.)
- 8) Ensure that the exercise assesses how long it takes various emergency officials to travel to state and local emergency operations centers; and what happens if EOCs are transferred during the accident out of the community to a more distant location.
- 9) Involve and cooperate with independent experts, like James Lee Witt Associates, to monitor and evaluate the exercise and publish their own findings.
- 10) Involve elected officials at the local, state, and federal level; representatives from public interest groups; and members of the public as evaluators, observers and players. FEMA should provide training exercise evaluations to those selected to be evaluators. (New York Governor Pataki-commissioned Witt report called for greater public involvement in emergency planning: "Cities, special facilities, private employers, and selected citizen groups or neighborhoods should be encouraged to participate in exercises. Elected officials should participate in exercises to make sure that the decision-making element is well represented and that they receive needed training. We further recommend that interested stakeholders be allowed to observe these exercises.")
- 11) Ensure that emergency communications systems are interoperable and available.
- 12) DHS/FEMA should devise and publish a set of specific standards by which they evaluate the adequacy of the exercise and the plan as a whole. FEMA's current standards are deliberately vague and allow the agency to sign off on an exercise that may be riddled with deficiencies.
- 13) Exercises should include a strong "lessons learned" component. The Witt report recommended: "Any weaknesses found in exercises should be traced back to changes

needed in plans, training, policies, equipment, public education, or job responsibilities." Any weaknesses that cannot be corrected for should be noted.

14) Ensure that the public meetings scheduled to discuss the exercise is widely announced in the media, held at a time and location to maximize public attendance, and allows the public to ask questions and make comment.

15) Practice makes perfect; therefore exercises should not simply be biennial but instead have quarterly drills and annual exercises.

Submitted by,

Mary Lampert
148 Washington Street
Duxbury, MA 02332
Tel 781-934-0389/Fax 781-934-5579
Email Lampert@adelphia.net

APPENDIX 1

Population Statistics - Pilgrim NPS's Emergency Planning Zone

**Population & Household Data Pilgrim NPS
Emergency Planning Zone**

Town	Population 2004	No. Households
Carver	11,348	3,984
Duxbury	15,160	4,946
Kingston	11,737	4,248
Marshfield (entire town-note small % town within EPZ)	25,200	8,905
Plymouth	55,100	18,423

Source: Patriot Ledger, Answer Book 2004-2005,
August 25, 2004

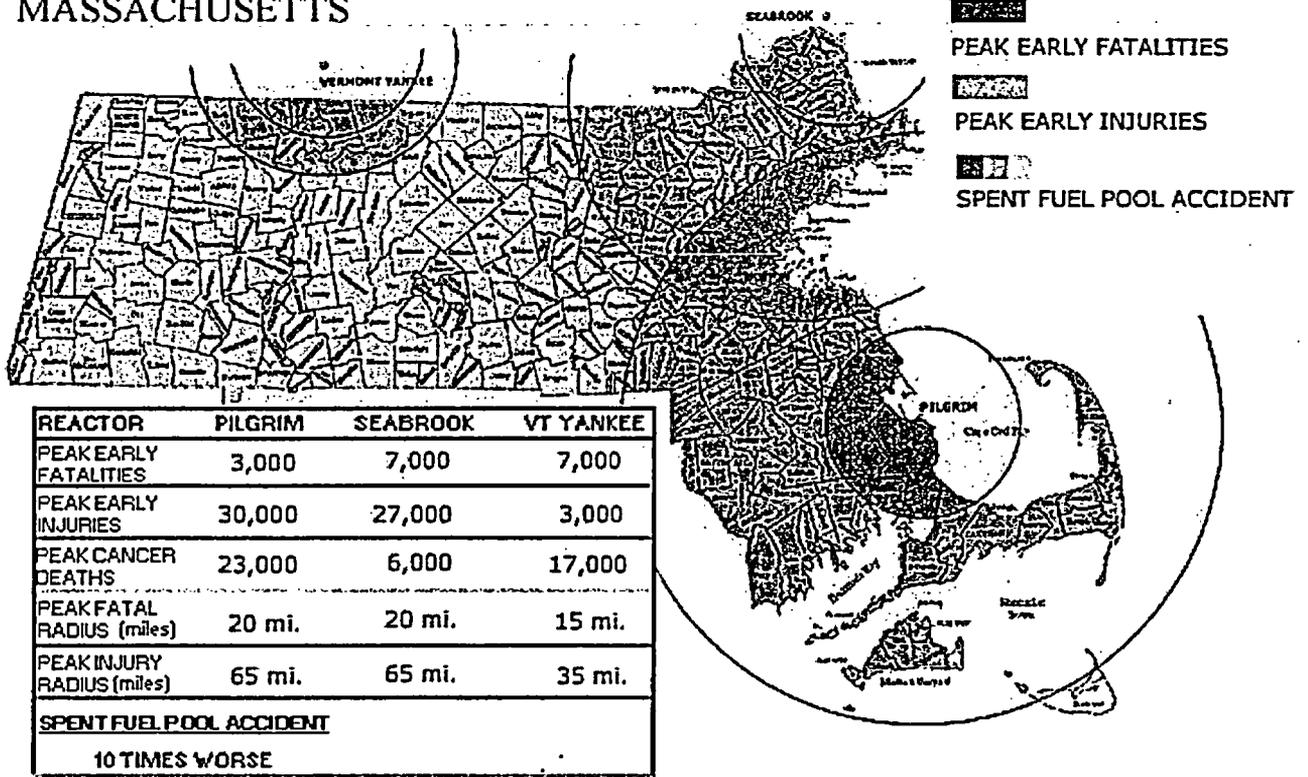
**Population Figures Pilgrim's Emergency Planning Zone, 2004 - Provided by
Massachusetts Emergency Management Agency**

Permanent	84,533
Transient	34,202
Employee	16,246
TOTAL	134,981

Appendix 2

Consequences of an Accident or Terrorist Attack

MASSACHUSETTS



CORE MELT - CONSEQUENCES

Calculation of Reactor Accident Consequences U.S. Nuclear Power Plants (CRAC-2), Sandia National Laboratory, 1982.

"Peak" refers to the highest calculated values – It does not mean worst case scenario. This is due to uncertainties in the meteorological modeling acknowledged by Sandia. The model only considered one year's worth of data and does not model for precipitation beyond a 30-mile radius. This is significant because the highest consequences are predicted to occur when a radioactive plume encounters rain over a densely populated area.

Peak Early Fatalities are deaths that result within the first year. The **red area** represents the zone for peak fatalities. This radius is the largest calculated distance from the plant at which early fatalities are expected to occur for a core melt.

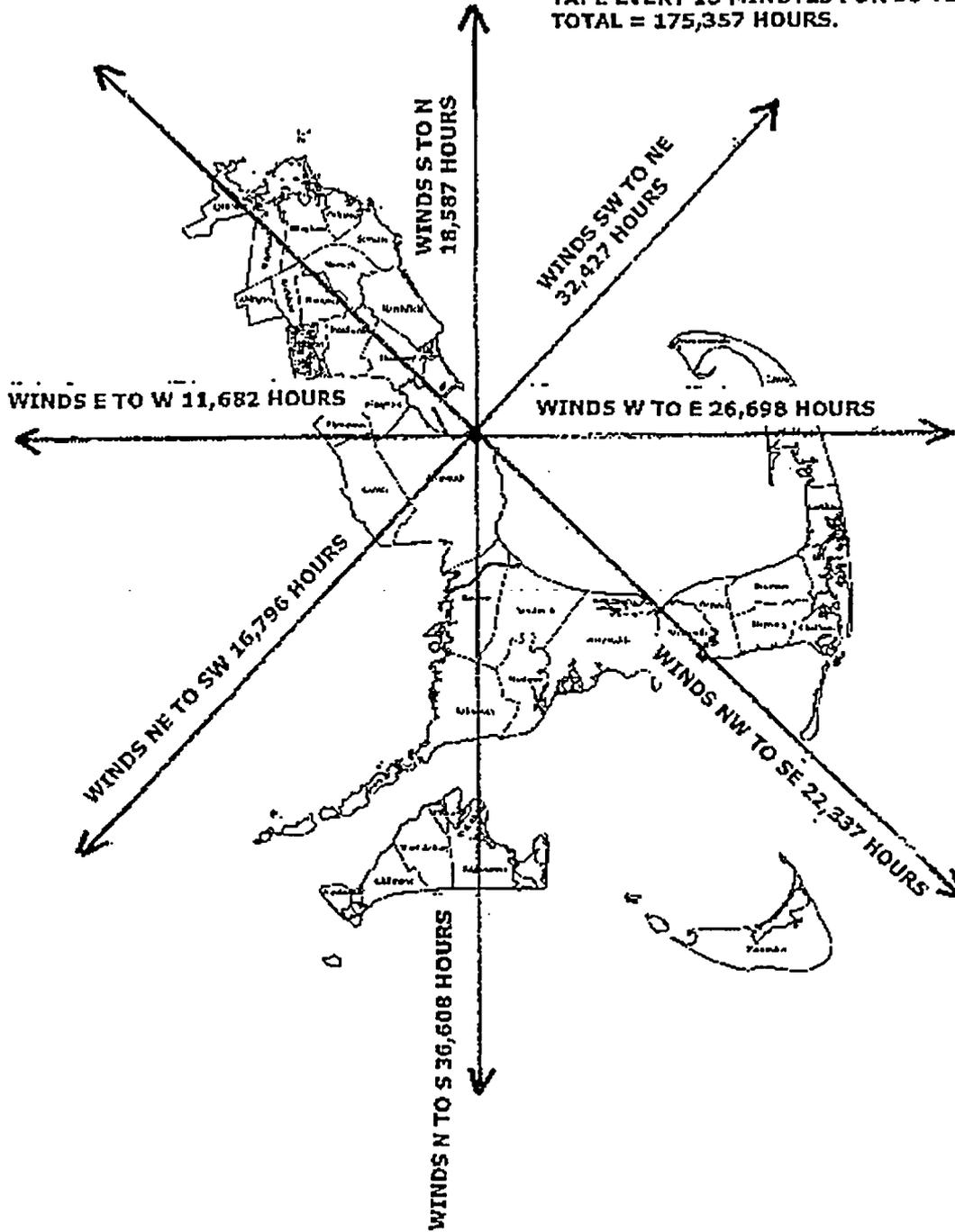
Peak Early Injuries are radiation-induced injuries occurring in the first year that require hospitalization of other medical attention – such as sterility, thyroid nodules, vomiting and cataracts. The **orange area** represents the zone for peak early injuries. This radius is the largest calculated distance from the plant at which early injuries are expected to occur for a core melt.

Peak Cancer Deaths are predicted to occur over a lifetime. However, this is not the case with leukemia which is assumed to have occurred within the first 30 years following an accident.

Spent Fuel Accident - In the case of a spent fuel pool accident, **red, orange and yellow** areas would experience more than 10 times the radioactivity released in Chernobyl, and the consequences, 10 times worse!

APPENDIX 3: Wind Movement around Pilgrim

WIND DATA COMPILED BY JOHN BARROWS,
ROCKY HILL RD., PLYMOUTH
NEIGHBOR PILGRIM NPS
READINGS RECORDED ON PAPER
TAPE EVERY 15 MINUTES FOR 10 YEARS
TOTAL = 175,357 HOURS.



APPENDIX 4

LOCATION RECEPTION CENTER & REWMD

A page out of the... **2004 Emergency Public Information Calendar**
Prepared by, **Massachusetts Emergency Management Agency**

Evacuation Route
Reception Center
Host Schools
REWMD
Regional Emergency
Worker Monitoring &
Decontamination Center

Added Data:

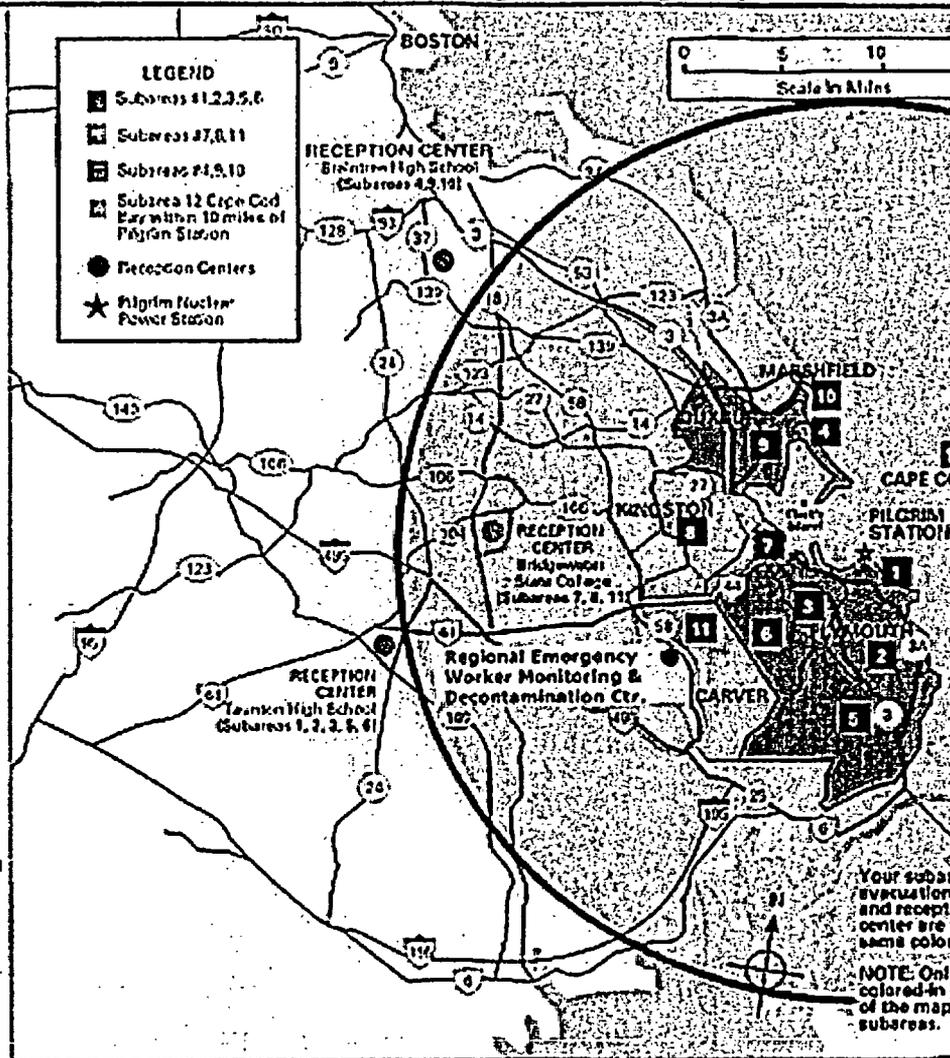
Consequences of Core Melt
At Pilgrim - According to a
Federal study (CRAC-2)
Performed by Sandia
National Laboratory, 1982.

Colored Area Inside Circle =
Peak Early Fatalities -
Deaths that result within the first year.

Kingston & Carver Reception Centers,
Host Schools & REWMD for all
EPZ Emergency Workers
Inside peak 1st year fatal zone.

White Area Outside Circle =
Peak Early Injuries-
Radiation-induced injuries occurring
In the 1st year requiring hospitalization
Or other medical attention -
Such as sterility, thyroid nodules,
Vomiting and cataracts

Duxbury, Marshfield, Plymouth
Reception Centers & Host Schools -
Just outside the peak 1st year fatal
Zone; Inside the peak 1st year
Injury zone.



APPENDIX 5

Public Meeting on the Review of Emergency Preparedness Regulations and Guidance for Commercial Nuclear Power Plants (8/31 - 9/1/05)

The meeting is open to all stakeholders and the public.

The purpose of the meeting is to discuss selected topics for the review of emergency preparedness regulations and guidance for commercial nuclear power plants. The selected topics also include emergency preparedness-related issues that arose during the 2005 National Radiological Emergency Preparedness Conference, NRC/FEMA workshop.

The first day of the meeting will cover topics pertaining to potential changes to emergency preparedness regulations and guidance for commercial nuclear power plants. This portion of the meeting will be conducted as a roundtable discussion among participants who have been invited to represent the broad spectrum of interests in the area of emergency preparedness. The spectrum includes representatives from State, local, and Tribal governments; Department of Homeland Security (DHS)/Federal Emergency Management Agency (FEMA); NRC; advocacy groups; and the nuclear industry. The meeting is open to the public, and all attendees, including State, local, and Tribal governments not represented at the roundtable, will have an opportunity to offer comments and ask questions throughout the meeting.

The second day of the meeting will include a discussion of emergency preparedness-related issues that arose at the NRC/FEMA workshop during the 2005 National Radiological Emergency Preparedness Conference. This part of the meeting will be conducted in a town hall-type setting, and all attendees are encouraged to participate in the discussion.

ROUNDTABLE PARTICIPANTS (NRC as of 8/06/05)

Shannon Rindfleisch
Emergency Planner -Prairie Island Indian Community
615-385-4178/651-775-1560 (mobile)/651-267-4008 (fax)/srindfleisch@piic.org

Andrew Feeney
Deputy Director-New York State Emergency Management Office
518-457-2222/Andrew.Feeney@semo.state.ny.us

Jana Falrow
Manager of Preparedness Programs-Illinois Emergency Management Agency
217-785-6984/fairow@iema.state.il.us

Michael Delorenzo
State of Florida
850-410-1597/Michael.Delorenzo@dca.state.fl.us

Onalee Grady-Erickson
Minnesota Department of Public Safety-Division of Homeland Security and Emergency Management
444 Cedar Street/Suite 223 -St Paul, MN 55101
651-297-1387/onalee.grady-erickson@state.mn.us

Ted Jackson
Manager-Environmental Emergency and Radiation Program-Georgia Environmental Protection Division

Ste 1452, Floyd Towers East -#2 Martin Luther King Jr. Drive, SE Atlanta, GA 30334-9000
404-362-2675/404-362-2653 (fax)/Ted_Jackson@dnr.state.ga.us

Aubrey V. Godwin
Director -Arizona Radiation Regulatory Agency
4814 South 40th Street Phoenix, AZ 85040
602-255-4845, x222/agodwin@arra.state.az.us

Pat Mulligan
State of New Jersey Chair, CRCPD E-6 Committee
609-984-7536/Patrick.Mulligan@dep.state.nj.us

Anthony Sutton
Commissioner-Westchester County Department of Emergency Services
914-231-1688/914-231-1622 (fax)/aws1@westchestergov.com

Mary Lampert
Town of Duxbury Nuclear Advisory Committee
148 Washington Street Duxbury, MA 02332
781-934-0389/lampert@adelphia.net

Tab Troxler
St. Charles Parish
Department of Emergency Preparedness
Hahnville, LA 70057
985-783-5050
ttroxler@stcharlesgov.net

Tracey Vardas
Emergency Services Coordinator-Office of Emergency Services
San Luis Obispo County Government Center Room #D430 San Luis Obispo, CA 93408
805-781-1268/805-781-5005 (fax)/tvardas@co.slo.ca.us

Ned Wright
Director Linn County Emergency Management
P.O. Box 1387 Cedar Rapids, IA 52406-1387
319-363-2671/ned.wright@linnema.com

Jeffery A. Benjamin
Vice President, Licensing and Regulatory Affairs Exelon Nuclear
4300 Winfield Road Warrenville, IL 60555
(630) 657 2809 /Jeffery.benjamin@exeloncorp.com

Alan P. Nelson
Chief, Emergency Preparedness -Nuclear Energy Institute
Suite 400 1776 I Street, N.W. Washington, DC 20006-3708
(202) 739-8110/apn@nei.org

Mark S. Lemke
Emergency Planning Manager Pacific Gas and Electric Company
4325 South Higuera San Luis Obispo, CA 93424
(805) 545-6275/mull@pge.com

Susan Perkins-Grew
Emergency Preparedness Manager FPL Energy Seabrook Station
P.O. Box 300 (04-44)/Seabrook, NH 03874-0300
(603) 773-7278/susan_perkins-grew@fpl.com

David Lochbaum
Union of Concerned Scientists (a.m.)
202-223-6133/Dlochbaum@ucsusa.org

Paul Gunter
Nuclear Information and Resource Service (p.m.)
202-328-0002/pgunter@nirs.org

Debbie Grinnell
C-10 Research and Education Foundation

44 Merrimac Street Newburyport, MA 01950
978-465-6646/debbie@c-10.org

Rochelle Becker
Executive Director Alliance for Nuclear Responsibility
P.O. Box 1328/San Luis Obispo, CA 93406-1328/beckers@thegrid.net

Eric Epstein
TMI Alert/ericepstein@comcast.net

Craig Conklin
FEMA -DHS
202-646-3030/Craig.Conklin@fema.gov

William King
FEMA -DHS
william.king2@dhs.gov

Nader Mamish
U.S. Nuclear Regulatory Commission
301-415-1086/nfm@nrc.gov

Stacey Rosenberg
U.S. Nuclear Regulatory Commission
301-415-3868/s/r1@nrc.gov

Samuel Collins
Regional Administrator -NRC Region 1
King of Prussia, PA
610-337-5299/sic1@nrc.gov

¹ NAS, Ibid, p.45