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General Comment

See attached file(s)

Attachments

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<u>Docket ID NRC-2014-0002</u>

COMMENT NSIR/DPR-ISG-02 (DRAFT INTERIM STAFF GUIDANCE EMERGENCY PLANNING EXEMPTION REQUESTS FOR DECOMMISSIONING NUCLEAR POWER PLANTS (APRIL 10, 2014)

Pilgrim Watch (hereinafter "PW") in conjunction with the Town of Duxbury Nuclear Advisory Committee, Cape Downwinders and Pilgrim Coalition support maintaining offsite radiological emergency planning, with all offsite costs borne by the licensee, so long as fuel remains onsite at a nuclear power plant. The Interim Staff Guidance (ISG) conclusions regarding circumstances that licensees undergoing decommissioning can be exempted from offsite emergency planning are erroneous. Offsite emergency planning must be, without exception, required due to the risks posed by both high-density, closed- frame spent fuel pool storage and, to a lesser but not insignificant degree, dry cask storage. The ISG's real goal has nothing to do with public health and safety but everything to do with protecting the licensee's wallet.

ISG's Position

ISG maintains that exemptions from offsite emergency planning can be provided to licensees when operations cease based on the following <u>incorrect</u> assumptions. These assumptions underlie the specific showings required for exemptions.

- ISG assumes that spent fuel pools protect public health and safety – the probability of something going wrong is remote and after a certain amount of time there is an increased probability that the fuel is air coolable. ISG ignores dry cask risks.
- ISG assumes that it is possible for licensees to show that offsite radiological release is not postulated to exceed the EPA PAGs at the site boundary in order to be exempt from offsite emergency planning.
- ISG assumes that licensees can be exempt based on the belief that after one year of decay time, in the case of an event that could lead to a zirconium fire, licensees would have 10 to 12 hours which is considered by NRC staff to be a sufficient amount of time to implement appropriate mitigative measures, as well as, offsite protective actions, if necessary, without preplanning.

ISG's position is clearly stated at Section 5.0 *Evaluation of Exemptions to Emergency Planning Requirements*, pg., 6. It says:

> Consistent with previous exemption requests informed by the most recent SFP studies, the NRC should not grant approval for the exemption of EP requirements for decommissioning power reactor licensees until site-specific analyses provide sufficient assurance that an offsite radiological release is not postulated to exceed the EPA PAGs at the site boundary, or that there is sufficient time to initiate appropriate mitigating actions by offsite agencies on an ad hoc basis to protect the health and safety of the public.
> The expected analysis will include the amount of time that lapses from when the SFP drains and air flow passages are blocked to when the hottest fuel assembly reaches 900 degrees Celsius. The staff concluded in SECY-00- 0145 that, because of the considerable time available to initiate and implement mitigative actions, or if necessary, protective actions, formal emergency plans for rapid initiation and implementation of protective actions are no longer needed. For SFPs, after one year of decay time, in the case of an event that could lead to a zirconium fire, licensees would have 10 to 12 hours, which can be considered by NRC staff to be a sufficient amount of time to implement appropriate mitigative measures, as well as, offsite protective actions, if necessary, without preplanning.

In summary, the ISG claim is that "after a certain amount of time, the overall risk of a zirconium fire become insignificant due to two factors: 1) the amount of time available for preventative and mitigating actions, and, 2) the increased probability that the fuel is air coolable. The supposed lower risk supports the reduction in EP as described in Table 1."

ISG'S POSITION – LUDICROUS

1. <u>Contrary To ISG - Spent Fuel Pools Present Risk For Pool Fire</u>

Contrary to the ISG whenever spent fuel is onsite, it presents real risk to the public; therefore offsite emergency planning is necessary. Like the NRC's *Draft Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a US Mark I Boiling Water Reactor* (Hereinafter "Earthquake Study") the ISG says that spent fuel pools protect public health and safety. They do until they don't. Yet neither the Earthquake Study nor the ISG provides any bases for that claim. In fact, NRC's Earthquake Study found that a pool fire at each Bottom could lead to an average area of 9,400 square miles (24,300 square kilometers) rendered uninhabitable for decades, displacing as many as 4.1 million people. (Earthquake Study, 2013, Table 33, page 16) The Massachusetts Attorney General showed that Pilgrim's spent fuel pool was vulnerable and

the consequences of a pool fire estimated up to $488 billion dollars in damages and 24,000 latent cancers from the release of Cs-137.[1]

Pool Fire

Dr. Gordon Thompson explained in some detail the potential for a spent fuel pool fire and its devastating consequences.[2]

> (T)he closed-form configuration of the high-density racks would create a major problem if water were lost from a spent-fuel pool. The flow of air through the racks would be highly constrained, and would be almost completely cut off if residual water or debris were present in the base of the pool. As a result, removal of radioactive decay heat would be ineffective. Over a broad range of water-loss scenarios, the temperature of the zirconium fuel cladding would rise to the point (approximately 1,000 degrees C) where a self-sustaining, exothermic reaction of zirconium with air or steam would begin. Fuel discharged from the reactor for 1 month could ignite in less than 2 hours, and fuel discharged for 3 months could ignite in about 3 hours.[35] Once initiated, the fire would spread to adjacent fuel assemblies, and could ultimately involve all fuel in the pool. A large, atmospheric release of radioactive material would occur. For simplicity, this potential disaster can be described as a "pool fire".
>
> Water could be lost from a spent-fuel pool through leakage, boiling, siphoning, pumping, displacement by objects falling into the pool, or overturning of the pool. These modes of water loss could arise from events, alone or in combination, that include: (i) acts of malice by persons within or outside the plant boundary; (ii) an aircraft impact; (iii) an earthquake; (iv) dropping of a fuel cask[3]; (v) accidental fires or explosions; and (vi) a severe accident at an adjacent reactor that, through the spread of radioactive material and other influences, precludes the ongoing provision of cooling and/or water makeup to the pool.

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[1] The Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plants Operating License and Petition for Backfit Order Requiring New Design features to Protect Against Spent Fuel Pool Accidents, Docket No. 50-293, May 26, 2006 includes a Report to The Massachusetts Attorney General On The Potential Consequences Of A Spent Fuel Pool Fire At The Pilgrim Or Vermont Yankee Nuclear Plant, Jan Beyea, PhD., May 25, 2006 (NRC Electronic Hearing Docket, Pilgrim 50-293-LR, 2—6 pleadings, MAAGO 05/26 (ML061640065) & Beyea (ML061640329)

[2] Environmental Impacts of Storing Spent Nuclear Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Waste Confidence Decision and Environmental Impact Determination, Dr. Gordon Thompson, February 6, 2009, Section 5.1, pg., 18

[3] NUREG/CR-5176, analysis cask drop effect, pg.,7-4

Vulnerability to Hostile Action[4]

The ISG, like the Earthquake Study, avoids hostile actions targeting a spent fuel pool and/or ISFSI. The vulnerability of spent fuel pools, and to a lesser but not insignificant degree dry casks, negates any NRC assurances of spent fuel pool safety making offsite emergency planning necessary after operations cease until all fuel leaves the site.

The terrorist threat did not end after 9/11; acts of malice can occur at random from other parties – example, Timothy McVey the Oklahoma Bomber. Nuclear reactors are an attractive target for both its symbolic value and the horrific damage that can result. Spent fuel pools can be thought of as pre-deployed nuclear weapons capable of unimaginable destruction to lives, property and the economy.

Nuclear reactors are vulnerable as they were not designed to withstand attack. For example, attackers could sever the site's electricity grid connection and disable the service water system without needing to penetrate the site boundary.

The National Academies back in 2005[5] showed that terrorist attacks pose a real threat to spent fuel pools.

- *"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:*
- *at U.S. commercial nuclear power plants, these pools are less well protected structurally than reactor cores; p. 36*
- *they typically contain inventories of medium – and long-lived radionuclides that are several times greater than those in individual reactor cores."* p. 36
- *"A loss-of-pool-coolant event resulting from damage or collapse of the pool could have severe consequences."* p. 49

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[4] Ibid, Discussion summarizes Section 7 and Tables

[5] Safety & Security of Commercial Spent Nuclear Fuel Storage Public Report, National Academy of Sciences, April 2005, http://www.nap.edu/books/0309096472/html/

Aircraft

Aircraft are obvious instruments of attack. Most likely smaller, general aviation aircraft laden with explosive material would be preferred by attackers. The US General Accounting Office (GAO) expressed concern, in September 2003 testimony to Congress, about the potential for malicious use of general-aviation aircraft. The testimony said: [6]

> Since September 2001, TSA [the Transportation Security Administration] has taken limited action to improve general aviation security, leaving it far more open and potentially vulnerable than commercial aviation. General aviation is vulnerable because general aviation pilots are not screened before takeoff and the contents of general aviation planes are not screened at any point. General aviation includes more than 200,000 privately owned airplanes, which are located in every state at more than 19,000 airports. Over 550 of these airports also provide commercial service. In the last 5 years, about 70 aircraft have been stolen from general aviation airports, indicating a potential weakness that could be exploited by terrorists.

BWR Mark I and Mark II reactors are especially vulnerable to an air attack because the spent fuel pool is located outside primary containment, in the upper floor of the reactor with a thin roof overhead making the pool vulnerable.

Other modes of attack are summarized by Dr. Thompson, Table 7-4

Table 7-4: Some Potential Modes and Instruments of Attack on a US Nuclear Power Plant

Attack Mode/Instrument	Characteristics	Present Defense
Commando-style attack	• Could involve heavy weapons and sophisticated tactics • Successful attack would require substantial planning and resources	Alarms, fences and lightly-armed guards, with offsite backup
Land-vehicle bomb	• Readily obtainable • Highly destructive if detonated at target	Vehicle barriers at entry points to Protected Area
Anti-tank missile	• Readily obtainable • Highly destructive at point of impact	None if missile launched from offsite

[6] Gerald L. Dillingham, US General Accounting Office, testimony before the Committee on Commerce, Science and Transportation, US Senate, "Aviation Security: Progress Since September 11, 2001, and the Challenges Ahead", 9 September 2003, pg., 14.

Commercial aircraft	• More difficult to obtain than pre-9/11 • Can destroy larger, softer targets	None
Explosive-laden smaller aircraft	• Readily obtainable • Can destroy smaller, harder targets	None
10-kilotonne nuclear weapon	• Difficult to obtain • Assured destruction if detonated at target	None

Notes: This table is adapted from Table 7-4 of: Thompson, 2007c. Sources supporting this table include: (a) Jim Wells, US Government Accountability Office, testimony before the Subcommittee on National Security, Emerging Threats and International Relations, US House Committee on Government Reform, 4 April 2006. (b) Marvin Fertel, Nuclear Energy Institute, testimony before the Subcommittee on National Security, Emerging Threats and International Relations, US House Committee on Government Reform, 4 April 2006. (c) Danielle Brian, Project on Government Oversight, letter to NRC chair Nils J. Diaz, 22 February 2006. (d) National Research Council, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report*, National Academies Press, 2006.

The shaped-charge is another potential instrument of attack. It is exceedingly powerful and readily available (Table 7-6)

Table 7-6 The Shaped Charge as a Potential Instrument of Attack

Category of Information	Selected Information in Category
General information	• Shaped charges have many civilian and military applications, and have been used for decades • Applications include human-carried demolition charges or warheads for anti-tank missiles • Construction and use does not require assistance from a government or access to classified information
Use in World War II	• The German MISTEL, designed to be carried in the nose of an un-manned bomber aircraft, is the largest known shaped charge • Japan used a smaller version of this device, the SAKURA bomb, for kamikaze attacks against US warships

A large, contemporary device	• Developed by a US government laboratory for mounting in the nose of a cruise missile • Described in an unclassified, published report (citation is voluntarily withheld here) • Purpose is to penetrate large thicknesses of rock or concrete as the first stage of a "tandem" warhead • Configuration is a cylinder with a diameter of 71 cm (27 inches) and a length of 72 cm (28 inches) • When tested in November 2002, created a hole of 25 cm (9 inches)diameter in tuff rock to a depth of 5.9 m (19 feet) • Device has a mass of 410 kg; would be within the payload
A potential delivery vehicle	• A Beechcraft King Air 90 general-aviation aircraft will carry a payload of up to 990 kg at a speed of up to 460 km/hr • A used King Air 90 can be purchased in the US for $0.4-1.0 million

Source: This table is adapted from Table 7-6 of: Thompson, 2007c. (PW provided approximate conversions to inches/feet)

Table 7-7; Performance of US Army Shaped Charges, M3 and M2A3

Target Material	Indicator	Type of Shaped Charge	
		M3	M2A3
Reinforced concrete	Maximum wall thickness that can be perforated	60 in	36 in
	Depth of penetration in thick walls	60 in	30 in
	Diameter of hole	• 5 in at entrance • 2 in minimum	• 3.5 in at entrance • 2 in minimum
	Depth of hole with second charge placed over first hole	84 in	45 in
Armor plate	Perforation	At least 20 in	12 in
	Average diameter of hole	2.5 in	1.5 in

Notes: (a) Data are from: Army, 1967, pp 13-15 and page 100. (b) The M2A3 charge has a mass of 12 lb, a maximum diameter of 7 in, and a total length of 15 in including the standoff ring. (c) The M3 charge has a mass of 30 lb, a maximum diameter of 9 in, a charge length of 15.5 in, and a standoff pedestal 15 in long.

In a Mark I BWR, such as Pilgrim, the spent fuel pool's outer reinforced concrete wall is 2 feet thick, penetrable by a shaped-charge; the roof is much thinner and not reinforced concrete ---both can be perforated by shaped charges.

Dry Cask Risks

ISG also minimized risk posed by dry casks. ISG incorrectly concluded that "cask storage systems provide a safe means to store spent nuclear fuel." (Section 4.0) But "Safe" does not mean the absence of risk. Although, casks are far safer than high-density, closed-frame spent fuel pool storage, they are not without risk; therefore offsite emergency planning is necessary.

Dr. Gordon Thompson explained in some detail scenarios that could result in significant release of radioactivity offsite from dry casks[7]. Excerpts are below.

> One type of scenario for an atmospheric release from an ISFSI module would involve mechanical loading of the module in a manner that creates a comparatively small hole in the MPC. The loading could arise, for example, from the air blast produced by a nearby explosion, or from the impact of an aircraft or missile. If the loading were sufficient to puncture the MPC, it would also shake the spent fuel assemblies and damage their cladding.
>
> Table 6-1 addresses the "blowdown" (escape of helium and gases) of an MPC that has been subjected to a loading pulse sufficient to cause a comparatively small hole. The table shows that, for a hole with an equivalent diameter of 2.3 mm, radioactive gases and particles released during the blowdown would yield an inhalation dose (CEDE) of 6.3 rem to a person 900 m downwind from the release. Most of that dose would be attributable to release of two-millionths (1.9E-06) of the MPC's inventory of radioisotopes in the "fines" category.
>
> Another type of scenario for an atmospheric release would involve the creation of one or more holes in an MPC, with a size and position that allows ingress and egress of air. In addition, the scenario would involve the ignition of incendiary material inside the MPC, causing ignition and sustained burning of the zirconium alloy cladding of the spent fuel. Heat produced by burning of the cladding would release volatile radioactive material to the atmosphere. Illustrative calculations in Table 6-2 show that heat from combustion of cladding would be ample to raise the temperature of adjacent fuel pellets to well above the boiling point of cesium.

A typical ISFSI module would contain 1.3 MCi of cesium-137, about half the amount of cesium-137 released during the Chernobyl reactor accident of 1986. Most of the offsite radiation exposure from the Chernobyl accident was due to cesium-137. Thus, a fire inside an ISFSI module, as described in the preceding paragraph, could cause significant radiological harm (Chernobyl released 2.4 MCi)

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[7] Environmental Impacts of Storing Spent Nuclear Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Waste Confidence Decision and Environmental Impact Determination, Dr. Gordon Thompson, February 6, 2009, Section 6, pg., 30

Vulnerability Casks to Acts of Malice

Casks are stored on concrete pads, as pictured below; not dispersed and hardened to reduce the risk of attack and reduce consequences.

Candlepin Bowling for Terrorists

Casks are vulnerable to attack, for example, by shaped charges. A Holtec HI-Storm 100 cask shell canister = 0.5" (1.3 cm) and the cask concrete wall = 26.75" (68 cm). A shaped charge is capable of penetrating.

Table 7-7: Performance of US Army Shaped Charges, M3 and M2A3

Target Material	Indicator	Type of Shaped Charge	
		M3	M2A3
Reinforced concrete	Maximum wall thickness that can be perforated	60 in	36 in
	Depth of penetration in thick walls	60 in	30 in
	Diameter of hole	• 5 in at entrance • 2 in minimum	• 3.5 in at entrance • 2 in minimum
	Depth of hole with second charge placed over first hole	84 in	45 in
Armor plate	Perforation	At least 20 in	12 in
	Average diameter of hole	2.5 in	1.5 in

The release from a cask as a result of an attack could exceed EPA PAGS at the fence line and most certainly justify maintaining emergency planning offsite.

Table 7-8 Types of Atmospheric Release from a Spent-Fuel-Storage Module at an ISFSI as a Result of a Potential Attack

Type of Event	Module Behavior	Relevant Instruments and Modes of Attack	Characteristics of Atmospheric Release
Type I: Vaporization	• Entire module is vaporized	• Module is within the fireball of a nuclear-weapon explosion	• Radioactive content of module is lofted into the atmosphere and amplifies fallout from nuc. explosion
Type II: Rupture and Dispersal (Large)	• MPC and overpack are broken open • Fuel is dislodged from MPC and broken apart • Some ignition of zircaloy fuel cladding may occur, without sustained combustion	• Aerial bombing • Artillery, rockets, etc. • Effects of blast etc. outside the fireball of a nuclear weapon explosion	• Solid pieces of various sizes are scattered in vicinity • Gases and small particles form an aerial plume that travels downwind • Some release of volatile species (esp. cesium-137) if incendiary effects occur
Type III: Rupture and Dispersal (Small)	• MPC and overpack are ruptured but retain basic shape • Fuel is damaged but most rods retain basic shape • No combustion inside MPC	• Vehicle bomb • Impact by commercial aircraft • Perforation by shaped charge	• Scattering and plume formation as for Type II event, but involving smaller amounts of material • Little release of volatile species
Type IV: Rupture and Combustion	• MPC is ruptured, allowing air ingress and egress • Zircaloy fuel cladding is ignited and combustion propagates within the MPC	• Missiles with tandem warheads • Close-up use of shaped charges and incendiary devices • Thermic lance • Removal of overpack lid	• Scattering and plume formation as for Type III event • Substantial release of volatile species, exceeding amounts for Type II release

Table 6-1: Estimated Atmospheric Release of Radioactive Material and Downwind Inhalation Dose for Blowdown of the MPC in a Spent-Fuel-Storage Module

Indicator		MPC Leakage Area		
		4 sq. mm (equiv. dia. = 2.3 mm)	100 sq. mm (equiv. dia. = 11 mm)	1,000 sq. mm (equiv. dia. = 36 mm)
Fuel Release Fraction	Gases	3.0E-01	3.0E-01	3.0E-01
	Crud	1.0E+00	1.0E+00	1.0E+00
	Volatiles	2.0E-04	2.0E-04	2.0E-04
	Fines	3.0E-05	3.0E-05	3.0E-05
MPC Blowdown Fraction		9.0E-01	9.0E-01	9.0E-01
MPC Escape Fraction	Gases	1.0E+00	1.0E+00	1.0E+00
	Crud	7.0E-02	5.0E-01	8.0E-01
	Volatiles	4.0E-03	3.0E-01	6.0E-01
	Fines	7.0E-02	5.0E-01	8.0E-01
Inhalation Dose (CEDE) to a Person at a Distance of 900 m		6.3 rem	48 rem	79 rem

Notes:

(a) Estimates are from: Gordon Thompson, *Estimated Downwind Inhalation Dose for Blowdown of the MPC in a Spent Fuel Storage Module*, IRSS, June 2007.

(b) The assumed multi-purpose canister (MPC) contains 24 PWR spent fuel assemblies with a burnup of 40 MWt-days per kgU, aged 10 years after discharge.

(c) The following radioisotopes were considered: Gases (H-3, I-129, Kr-85); Crud (Co-60); Volatiles (Sr-90, Ru-106, Cs-134, Cs-137); Fines (Y-90 and 22 other isotopes).

(d) The calculation followed NRC guidance for calculating radiation dose from a design- basis accident, except that the MPC Escape Fraction was drawn from a study by Sandia National Laboratories that used the MELCOR code package.

(e) CEDE = committed effective dose equivalent. In this scenario, CEDE makes up most of the total dose (TEDE) and is a sufficient approximation to it.

(f) The overall fractional release of a radioisotope from fuel to atmosphere is the product of Fuel Release Fraction, MPC Blowdown Fraction, and MPC Escape Fraction.

(g) For a leakage area of 4 square mm, the overall fractional release is: Gases (0.27); Crud (0.063); Volatiles (7.2E-07); Fines (1.9E-06). Fines account for 95 percent of CEDE, and Crud accounts for 4 percent

Conclusion: Any reasonable person can see from the foregoing that casks are vulnerable and that requires offsite emergency response. The releases can be rapid. Absent offsite emergency planning, there can be no reasonable assurance that the public will evacuate in a timely manner so as to have reasonable assurance of protection of their health and safety.

Probability

The ISG incorrectly claims that the probability of something going wrong is remote. Hostile action events are "Wild Cards," along with other uncertainties. Therefore it cannot be claimed

that "the probability of something going wrong is remote and after a certain amount of time there is an increased probability that the fuel is air coolable."

Kamiar Jamali's (DOE Project Manager for Code Manual for MACCS2) *Use of Risk Measures in Design and Licensing Future Reactors*[8] explains that "uncertainties are so large and so unknowable that it is a huge mistake to use a single number coming from them for any decision regarding adequate protection. "Examples of these uncertainties include probabilistic quantification of single and common-cause hardware or software failures, occurrence of certain physical phenomena, human errors of omission and commission, magnitudes of source terms, radionuclide release and transport, atmospheric dispersion, biological effects of radiation, dose calculations, and many others." (Jamali, Pg., 935)

2. ISG Provides Unreasonable Assurance That "After A Certain Amount Of Time, The Overall Risk Of A Zirconium Fire Becomes Insignificant

Despite the known threat, the ISG provides unreasonable assurance that "after a certain amount of time, the overall risk of a zirconium fire becomes insignificant due to two factors: 1) the amount of time available for preventative and mitigating actions, and, 2) the increased probability that the fuel is air coolable. ISG incorrectly claims that this supposed "lower risk supports the reduction in EP as desribed in Table 1." Not true.

a. Contrary to the ISG there is no reasonable assurance of an increased probability that the fuel is air coolable. The foregoing discussion from Dr. Thompson explains.

> (T)he closed-form configuration of the high-density racks would create a major problem if water were lost from a spent-fuel pool. The flow of air through the racks would be highly constrained, and would be almost completely cut off if residual water or debris were present in the base of the pool. As a result, removal of radioactive decay heat would be ineffective. Over a broad range of water-loss scenarios, the temperature of the zirconium fuel cladding would rise to the point (approximately 1,000 degrees C) where a self-sustaining, exothermic reaction of zirconium with air or steam would begin...[35] Once initiated, the fire would spread to adjacent fuel assemblies, and could ultimately involve all fuel in the pool. A large, atmospheric release of radioactive material would occur. (Emphasis added)

[8] Kamiar Jamali, *Use of Risk Measures in Design and Licensing Future Reactors*. Reliability Engineering and System Safety 95 (2010) 935-943

Further the NRC's claim that there is a decay time after which ignition is impossible; but NRC only looks at relatively rapid drain-downs. It has not released calculations on other scenarios,like partical drain-downs.

b. Contrary to the ISG there is no reasonable assurance that there will be time for preventative & mitigative actions.

The ISG assumes that there will be time for mitigating actions such as providing makeup water to the pool. NRC ignores, for example, the possibility that radiation fields and other onsite impacts (such as severe natural events that would disallow personnel and equipment) and preclude mitigation for an extended period. Most important US reactors have comparatively light defense and a hostile action event, as discussed above, could preclude mitigation.

3. Contrary To The ISG It Is Absurd To Propose That Any *Honest* Licensee Analysis Could Show That "Offsite Radiological Release Is Not Postulated To Exceed The <u>EPA PAGs At The Site Boundary</u>."

a. Inventory Spent Fuel Pools: The radioactivity in pools is huge. There is no requirement for expedited transfer. The Draft Waste Confidence Rule envisions allowing storage in either pools or dry casks for 60 years after the licensee expires. For Pilgrim NPS, the rule would allow its densely packed, closed-frame pool to remain until 2092 when the pool's support structures are 120 years old.

Pilgrim's pool, as an example, will have 3,859 assemblies at closure, about 10 times the C-137 inventory in the core. There is a potential for release of <u>≥ twice</u> the amount of Cs-137 being released in a disaster in Pilgrim's pool than was released at Chernobyl. [Cs-137 released during Chernobyl, 1986 = 2,403,000 curies; Cs-137 in Pilgrim <u>Core</u> during license extension = 190,000 TBq or 190,000 X 27 Ci = 5,130,000 curies]. Therefore a spent fuel pool accident at Pilgrim could have 8 times the consequences of a core accident where offsite emergency planning IS required. The ISG makes no sense.

Second, site specific studies have shown that the offsite consequences of a spent fuel pool fire would be horrendous. For example: The Massachusetts Attorney General's vulnerability and

consequence study of a spent fuel pool accident at Pilgrim Station showed tat the offsite consequences in the event of water loss and a pool fire could be as much as $488 Billion dollars, 24,000 cancers and contamination hundreds of miles downwind.[9] Much of the damage from a pool fire is due to the release of Cesium-137.

The National Academy of Sciences April 2005 report on the *Safety and Security of Spent Nuclear Fuel Storage* showed that a succesful attack could have significant effects on the public.

- *"Such fires would create thermal plumes that could potentially transport radioactive aerosols hundreds of miles downwind under appropriate atmospheric conditions."* 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."* p. 49

And as mentioned above, NRC's Consequence Study Of A Beyond Design-Basis Earthquake Affecting The Spent Fuel Pool For A U.S. Mark I Boiling Water Reactor (October 2013)[10] quoted and relied on in the ISG showed from their study of Peach Bottom that if even a small fraction of the inventory of a Peach Bottom reactor pool were released to the environment in a severe spent fuel pool accident, an average area of 9,400.00 square miles (Massachusetts = 6,692.824 square miles) would be rendered uninhabitable for decades, displacing as many as 4.1 million people (MA population=6,692,824).

Indeed there is no way an honest analysis of a pool fire could have releases at the fence line that could be less than EPA PAGs.

Dry casks, discussed in the foregoing, are vulnerable and a typical cask contains one-half the

[9] The Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene With respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plants Operating License and Petition for Backfit Order Requiring New Design features to Protect Against Spent Fuel Pool Accidents, Docket No. 50-293, May 26, 2006 includes a Report to The Massachusetts Attorney General On The Potential Consequences Of A Spent Fuel Pool Fire At The Pilgrim Or Vermont Yankee Nuclear Plant, Jan Beyea, PhD., May 25, 2006 (NRC Electronic Hearing Docket, Pilgrim 50-293-LR, 2—6 pleadings, MAAGO 05/26 (ML061640065) & Beyea (ML061640329)

[10] Consequence Study Of A Beyond Design-Basis Earthquake Affecting The Spent Fuel Pool For A U.S. Mark I Boiling Water Reactor (October 2013) at 232 (Table 62) and 162 (table 33),Adams Accession NO ML13256A342)

C-137 released in Chernobyl. The following table shows that it is preposterous to suggest that "any licensee's analysis could show that "offsite radiological release is not postulated to exceed the EPA PAGS at the site boundary."

Table 6-1: Estimated Atmospheric Release of Radioactive Material and Downwind Inhalation Dose for Blowdown of the MPC in a Spent-Fuel-Storage Module

Indicator		**MPC Leakage Area**		
		4 sq. mm (equiv. dia. = 2.3 mm)	**100 sq. mm (equiv. dia. = 11 mm)**	**1,000 sq. mm (equiv. dia. = 36 mm)**
Fuel Release Fraction	**Gases**	3.0E-01	3.0E-01	3.0E-01
	Crud	1.0E+00	1.0E+00	1.0E+00
	Volatiles	2.0E-04	2.0E-04	2.0E-04
	Fines	3.0E-05	3.0E-05	3.0E-05
MPC Blowdown Fraction		9.0E-01	9.0E-01	9.0E-01
MPC Escape Fraction	**Gases**	1.0E+00	1.0E+00	1.0E+00
	Crud	7.0E-02	5.0E-01	8.0E-01
	Volatiles	4.0E-03	3.0E-01	6.0E-01
	Fines	7.0E-02	5.0E-01	8.0E-01
Inhalation Dose (CEDE) to a Person at a Distance of 900 m		6.3 rem	48 rem	79 rem

Last, present knowledge does not allow an accurate theoretical or empirically-based prediction of the source term for a postulated pool-fire scenario.[11]

4. It Is Equally Ridiculous To Assume That A Licensee Could Show That After One Year Of Decay Time, In The Case Of An Event That Could Lead To A Zirconium Fire, Licensees Would Have 10 To 12 Hours Considered By NRC Staff To Be A Sufficient Amount Of Time To Implement Appropriate Mitigative Measures.

Assuming that a licensee could show after one year of decay time there would be 10 to 12 hours so that the licensee would have ample time to implement mitigation ignores that ignition by incendiary could occur at any age of the fuel. NRC refuses to consider scenarios in which a

[11] Environmental Impacts of Storing Spent Nuclear Fuel and High-Level Waste from Commercial Nuclear Reactors: A Critique of NRC's Waste Confidence Decision and Environmental Impact Determination, Dr. Gordon Thompson, February 6, 2009, pg., 24

malevolent actor uses incendiary material to ignite zircolay. It also ignores that an assembly exposed for the majority of its length could heat up to ignition temperature in a few hours.[12]

Further there is no comprehensive technical understanding of the phenomena related to pool fires (heat transfer, zircaloy ignition, and fire dynamics) to enable a licensee to show that after one year decay time, in an event that could lead to a zirc fire, that licensees would have 10 to 12 hours to implement mitigative measures. The scientific work in pool fires simply has not been done.

Further the ISG fails to specify how the licensee is supposed to perform the analysis required. For example, do the have to identify: the rack and pool configuration; identiy the rack loading (distribution older and younger fuel); identify a full range water loss scenarios; identify collateral conditions that could affect fuel ignition or fire dynamics. Relevant conditions could include: the presence of extraneous objects in the pool (e.g., transfer cask, fuel-handling machinery, overhead crane, debris from the upper portion of the pool building); identify ventilation status of the pool building; and deformation of racks? Also relevant fire characteristics to model would include the production of hydrogen and its impact in the pool. The ISG simply gives the licensee a blank check.

5. IT IS EQUALLY ABSURD TO ASSUME THAT A LICENSEE COULD SHOW THAT AFTER ONE YEAR OF DECAY TIME, IN THE CASE OF AN EVENT THAT COULD LEAD TO A ZIRCONIUM FIRE, LICENSEES WOULD HAVE 10 TO 12 HOURS (CONSIDERED BY NRC STAFF TO BE A SUFFICIENT AMOUNT OF TIME) TO IMPLEMENT OFFSITE PROTECTIVE ACTIONS, IF NECESSARY, WITHOUT PREPLANNING.

Licensees are required to prepare Evacuation time Estimates (ETEs). The ETE's are prepared by KLD Associates and they use essentially the same false assumptions and methodology from one

[12] Gordon Thompson, *The Potential for a Large, Atmospheric Release of Radioactive Material from Spent Fuel Pools at the Harris Nuclear Power Plant: The Case of a Pool Release Initiated by a Severe Reactor Accident* (Cambridge, Massachusetts: Institute for Resource and Security Studies, 20 November 2000), pg., 46

licensee's ETE to the next. The result is to severely minimize/underestimate actual evacuation time in the event of a radiological disaster[13].

Pilgrim's ETE estimated six hours to evacuate the EPZ. The Commonwealth and local EMDs reconized the estimate was not reliable. However, for argument assume the 6 hour ETE is correct. It is obvious that in a severe release from a spent fuel pool fire and/or an ISFSI that it will take far longer to evacuate offsite if there are no emergency plans and procedures in place.

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[13] Example: *KLD Pilgrim Evacuation Estimate December 12, 2012 Final Report KLD-TR-59* NRC Electronic Library, Accession Number ML13023A03. See also *Pilgrim Watch's 2.206 Petition To Modify, Suspend, Or Take Any Other Action To The Operating License Of Pilgrim Station Until The NRC Can Assure Emergency Preparedness Plans Are In Place To Provide Reasonable Assurance Public Health & Safety Are Protected In The Event Of A Radiological Emergency*, August 20, 2013 (Adams) It shows:

Inaccurate Assumptions Underestimate Demand - Total Number People & Vehicles Evacuating:

1. ETE, unlike the Cape Survey, relied on a Telephone Survey that did not inform survey respondents that the questions related to a nuclear emergency, and thus significantly underestimated how many would evacuate.
2. The ETE's Shadow Evacuation assumptions incorrectly assume that only 20% of those instructed not to evacuate will voluntarily evacuate anyway.
3. The ETE incorrectly assumes that those in the EPZ will follow a staged keyhole evacuation. (ETE, 7.2)
4. The KLD ETE underestimated demand by failing to take proper account of the Summer Transient Population.
5. The ETE Study underestimated employees, thus Lowering Demand Estimates
6. Evacuation of the school population & transportation dependent at nursing/group homes were underestimated.

Inaccurate Assumption/Estimates Regarding Road Capacity

7. The ETE fails to account for chronically heavy traffic over Summer weekends & special events that significantly increases travel times.
8 ETE assumptions about traffic flow during inclement weather & peak commuter/holiday traffic are not credible.
9. The ETE's estimates for specific roadway capacity are not credible
10. Emergency Personnel: The ETE assumes, absent factual support, that emergency personnel will be available in sufficent number to assure timely traffic flow.

Inaccurate Assumptions Regarding Trip Generation Times

11.Trip generation time relied on flawed telephone survey & assumptions.
12.The ETE incorrectly assumed a rapidly escalating accident, and that mobilization of the general population will commence within 15 minutes after siren notification.
13. KLD failed to consider the impact of delayed staffing traffic control points on the ETE.
14.The ETE incorrectly assumed that 25% of the EPZ households will await the return of a commuter prior to evacuating underestimating vehicles.
15.The ETE incorrectly assumes that 50% of the transportation dependent population will rideshare.
16. The ETE incorrectly assumes timely evacuation of transportation dependent.
17.The ETE assumptions about mobilization times for school population & special facilities are not credible.
18.The ETE assumptions about trip generation for populations on boats are not credible.
19.The ETE ignores the impact of voluntary evacuations from Cape Cod that would have a large impact on traffic in the EPZ; and ignores the effect of voluntary evacuations within the EPZ and shadow evacuation that would slow EPZ evacuation times.

If offiste emergency planning was not required, the licensee(according to the document's Tables) would be exempt from providing, for example: an EOF, sirens, traffic analyses, emergency planning information for the public, offsite monitoring capability, periodic drills and exercises; and training for emergency personnel.

Conclusion

We conclude where we began. Offsite emergency planning must be, without exception, required due to the risks posed by both high-density, closed- frame, spent fuel pool storage and, to a lesser but not insignificant degree, dry cask storage. NRC knows this. In response to Fukushima, NRC said that if Unit 4's pool drained the consequences would be such as to require evacuating Americans well beyond 50-miles. It does not matter if the licensee is operating or not, if the fuel is onsite.

The ISG goal in this document has nothing to do with protecting public health and safety but simply with protecting the licensee's wallet by relieving them of the expense of offsite emergency planning.

NRC's webpage on Emergency Planning[14] says that,

> Good planning leads to good response. Our emergency preparedness programs enable emergency personnel to rapidly identify, evaluate, and react to a wide spectrum of emergencies, including those arising from terrorism or natural events such as hurricanes.

Therefore if exemptions are allowed so that there is NOT good planning then it will lead to poor response.

NRC goes on to say that,

> A key component of the mission of the NRC is to ensure adequate protective actions are in place to protect the health and safety of the public. Protective actions are taken to avoid or reduce radiation dose[15]

[14] http://www.nrc.gov/about-nrc/emerg-preparedness.html
[15] http://www.nrc.gov/about-nrc/emerg-preparedness/protect-public.html

Therefore, the logical conclusion is that absent protective actions in place, public health and safety will not be protected, abdigating NRC's AEC's mandate; and, radiation dose will not be avoided or reduced.

Offsite emergency planning must be, without exception, required due to the risks posed by both high-density, closed- frame spent fuel pool storage and, to a lesser but not insignificant degree, dry cask storage. There is no denying onsite spent fuel storage risks absent playing games. Protecting public health and safety is mandated by the NRC and cannot be treated as an option.

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APPENDIX

The Town of Duxbury Masachusetts, located within the EPZ of the Pilgrim Nuclear Power Station, unanimously passed the following resolution at its Annual Town Meeting, March 8, 2014[16]

ARTICLE 29: ANNUAL TOWN MEETING 2014

PILGRIM POST OPERATION

The Town of Duxbury supports: DECOMMISSIONING (immediate dismantlement) as opposed to SAFSTOR (deferred dismantlement) when the Pilgrim Nuclear Power Station ceases to operate (generate electricity); requiring removal of spent fuel more than five years out of Pilgrim's reactor from the spent fuel pool to dispersed and hardened dry cask storage both before and after Pilgrim ceases to operate; limiting storage of waste at Pilgrim to only wastes generated at Pilgrim; and continuing offsite radiological emergency planning with all costs to offsite communities funded by Entergy so long as any fuel remains on-site at Pilgrim. The Clerk of Duxbury shall forward the text of this article to the Town of Duxbury's State and Federal delegations, the Select Boards within the Emergency Planning Zone of the Pilgrim Nuclear Power Station EPZ, the Nuclear Regulatory Commission and Entergy Corp., so that the intent of the citizens of Duxbury is widely known. Submitted by Duxbury Nuclear Advisory Committee

[16] http://www.town.duxbury.ma.us/Public_Documents/DuxburyMA_TownMan/atm/atm14/atm14warrant.pdf