Indian Point ISE – Panel Responses to Post-Report Public Questions

1. Responses to questions from Gary Shaw:

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General	As professionals who are clearly involved in critical thinking exercises, does it not strike you as suspect that Entergy objected to a legislatively mandated Independent Safety Assessment, but was willing to spend multiple millions of dollars for an "Independent Safety Evaluation Panel" which is named suspiciously similarly to what was proposed in the US Congress and whose co-chairmen are known promoters of the nuclear power industry?	There is nothing suspect here. As stated in the ISE Report (pages 6 and 20), the proposed Independent Safety Assessment was <u>not</u> mandated by Congress. Evidently recognizing the potential value and high public interest of such an evaluation, Entergy chose to conduct its own. The term "Independent Safety Evaluation" describes precisely what Entergy said it intended to achieve – and since that is presumably what the proposed legislation was intended to produce as well, the similarity in descriptors is quite logical. The ISE Co-chairmen – and the entire panel – were chosen based on their experience, capability, demonstrated integrity, as well as their independence from Entergy and Indian Point, as described clearly on pages 7 and 20-22 of the ISE Report.
Executive Summary	The report states that "Although Congress took no action on these legislative proposals (i.e., Maine Yankee Style ISA) Entergy – Indian Point's owner – chose in early 2008 to commission its own independent evaluation of Indian Point safety, security and emergency preparedness." At the public meeting I objected to this portrayal as a voluntary and beneficent action by Entergy rather than as a response to repeated findings of inadequacy by the NRC. My contention was	Your assumption that the ISE was conducted in response to an NRC requirement is not correct. The action to which the March 7th New York Daily News (AP) article refers is NRC's *Annual Assessment Letter – Indian Point Generating Units 2 and 3* dated March 3, 2007, in which NRC requested that Entergy "conduct an assessment of the safety culture at Indian Point Energy Center", as a consequence and means of addressing the third consecutive annual finding regarding procedural adequacy at the station. The March 3rd letter is a public document, available on the NRC website. This NRC

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	rebutted and dismissed by Dr. Rhodes in particular. The following is how the AP reported the cause for this panel's existence (published in the NY Daily News, March 7, 2008): THE ASSOCIATED PRESS Friday, March 7th 2008, 4:00 AM The Nuclear Regulatory Commission has ordered an independent safety study at the Indian Point power plant. In its annual assessment of the plant, the NRC found that for the third consecutive year, there were problems with operating procedures at both its reactors, Indian Point 2 and Indian Point 3, and difficulties finding and fixing problems at Indian Point 2. Indian Point 1 was mothballed in 1974. …. The NRC said the plant's problems were "cross-cutting issues" affecting several areas of performance. It noted that for three years in a row, it found that some procedures were not rigorous enough or did not contain sufficient detail. I reiterate my objection to your portrayal of this misnamed "Independent" Safety Evaluation panel as a voluntary and self-motivated action by Entergy.	"cross-cutting issue" regarding procedure compliance and the resultant Entergy action to assess Indian Point safety culture is discussed in the ISE Report on page 36 and again on page 38. In response to the NRC request, Entergy engaged an entirely separate group of specialists to conduct the safety culture evaluation. We understand that that safety culture evaluation is complete or nearly so and we presume that it will be reported publicly. Entergy had chosen to commission this ISE many months prior to the March 3rd NRC letter. The ISE Co-chairs were selected in late 2007, and by early March 2008 selection by the Co-chairs of Panel members was nearly complete and ISE planning and preparation were well underway. As a related point, we note that the NRC March 3rd letter called for Entergy to conduct an evaluation "by individuals who are independent from the corporate and site organizations being assessed". This definition of "independence" is fundamentally the same as that adopted for the ISE, and it contradicts your (and others') assertions that an evaluation paid for by Entergy could not possibly be considered to be independent.

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Executive Summary	The Maine Yankee inspection included about 17,000 hours by a 25 person inspection team. Your panel was about 4000 - 6000 hours. With less than one third of the time allocated can your job possibly be as comprehensive?	The comparison of the Maine Yankee ISA and the Indian Point ISE is addressed in the ISE Report, both in Appendix 3 (Public Issue #1, on page 7) and in the text box on page 23 of the Report. We are unaware of the source of your estimate that 17,000 hours were expended in the Maine Yankee ISA. As noted on page 7 of the ISE Report, NRC reported that 4000 hours were expended in on-site work at Maine Yankee; by comparison, the on-site time for the ISE team's inspection is estimated to be about 2,500 hours, also as noted on that page. More to the point, and also as explained in our report, the two efforts were very different in objectives, scope, methodology, and team composition. A major fraction of the Maine Yankee ISE involved investigation and analysis of one narrow and highly technical issue. The ISE, in contrast, covered a much broader scope but did not demand the kind of intense and time-consuming engineering analysis conducted at Maine Yankee. Therefore a comparison of hours expended is not particularly meaningful. The Indian Point ISE was targeted and planned to address the central issues of nuclear safety, security and emergency preparedness, and to identify and consider public interest issues; in our view, the 6000 hours expended in this effort yielded an exceptionally thorough evaluation.
Executive Summary	The panel mentions “high performing” plants, what are the specific metrics that are used for this	As stated in the ISE Report under “Evaluation Criteria” on page 8, “The Panelists evaluated Indian Point performance in

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	standard across various systems and procedures that were investigated? At the public meeting in Cortlandt, I asked Dr Rhodes to name some of the high performing plants that were cited as benchmarks and he could not name any. Can this panel name any low performing plants to provide a context for the standards being cited?	comparison with their own *experience* and *expectations* of *high performing* nuclear plants and other facilities…. This criterion was applied to the evaluation of IPEC nuclear safety, security and emergency preparedness, based on the *collective professional judgment* of the Panel members and taking into account a range of *qualitative* and *quantitative* factors. Given the diversity and depth of Panelist experience, this approach made possible an unusually broad *composite perspective* on the station." (emphasis added). Therefore, no single or set of high (or low) performing plants were used as benchmarks in evaluating Indian Point. Rather, Panelists reached composite judgments about Indian Point performance relative to that of high (and low) performing plants, in each area examined, based on their extensive experience and on applicable quantitative information. This approach was described at the Public Meeting on July 31. We point out that nuclear plants are very large, complex industrial facilities with wide differences in design, construction, operation and personnel. Plant health depends on a variety of factors, many of which are qualitative in nature. An attempt to reduce the ISE to a numerical, rank-ordered comparison would not have been be defensible, in our view.
1.4 – The Process	Point 1 states that "interactions with and observations of individuals and groups at all levels along with assessment of the organizational	The ISE Panel members had unrestricted access to all Indian Point personnel. Observations, meetings and interviews included hundreds of individuals, at all levels of the organization. None

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	structure, size and capabilities." -- why did these interactions not include confidential meetings with employees, either current or former, who had raised safety concerns, especially if subsequent evaluations of those employees' performance was lower than prior evaluations?	were selected by Entergy. Interviews were conducted in private and in confidence. We are confident that our interactions with plant personnel yielded a very broad and representative picture of the entire staff. Further, as described in the ISE Report (pages 143-144) we examined the Indian Point Employee Concerns Program, the vehicle for employees to raise safety and other concerns.
3.3; p.42	The chart lists five outages in 2006 (3 for IP2 and 2 for IP3), an additional five in 2007 and three already in 2008. How do these numbers compare to other "high performing plants?" Please detail the distribution of the number of outages among the 65 "plants" or the 104 operating units. Whichever measure is easier to compile would be adequate.	Outages can be caused by planned shutdowns, manual trips, or automatic trips. The overall consequence of plant outages is a function of both their frequency and duration. In response to this question, perhaps the most meaningful and available basis for comparison of the Indian Point units' recent outage history with that of the U.S. nuclear fleet is to relative turbine on-line time (since all outages involve disconnection from the electric grid, and all plants report turbine availability or on-line time data). In the three years of 2005-2007, Indian Point 2 ranks 4th of the 103 U.S. nuclear units with a three year time turbine on-line of 96.46%. Indian Point 3, which had two planned refueling outages in this period, ranked 46 of the 103 units with an availability of 92.39%. Both units exceeded the industry average for this period of 91.30%. The industry range was 69.73% to 97.60%.
3.3; p.50	Chart on the various types of buried piping: How many linear feet are there for each type of piping? Categories 1 and 2 of the piping are designated as either non-radioactive or radioactive, but category	The Panel identified the linear feet of piping only for those systems (auxiliary feedwater and auxiliary steam) carrying water /steam with detectable radioactivity and which were carbon steel (see Appendix 3, page 27) and hence vulnerable to an unexpected

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	3, which is where the leaks existed is not so designated. Are auxiliary feedwater and steam systems supposed to be non-radioactive, and if so, why was tritiated steam being released?	leak. The table so identifies these systems as containing 'very low tritium levels'. While the fluids carried in these systems are nominally non-radioactive, they are subject to ingress of trace quantities of tritium from diffusion through steam generator tube piping or leakage from this tubing over past operating history.
4.3; p73	In the Protection From External Threats section, airborne attacks are mentioned along with waterborne attacks. The report mentions the topography as the defense against airborne attacks, but goes into some length concerning waterborne attacks. Does this mean that there really isn't any airborne defense in operation? I have now read the appendix related to airborne attack and I am still reassured. Your entire analysis involves hijacked passenger liners and September 11 made us all understand that the terrorists who include suicide attacks as a viable approach look for creative alternatives to traditional attack methodologies. Your write-up still suggests that air attacks are not Entergy's problem. As a local resident, I believe that an air attack is everyone's problem.	We agree that an airborne assault against any nuclear facility or any other major infrastructure facility is everyone's problem. Within the ISE Report (pages 70 and 128-132), we characterized the responsibilities of the Federal government, the airline industry, local law enforcement agencies and Entergy. Each party has an important role in public protection from external threats. The fact is, however, that Entergy, like the owner/operator of any critical infrastructure facility (such as bridges, large buildings and public gathering places), has limited ability to prevent attacks. The major responsibility for attack prevention rests with the federal government, and as the report shows (pages 70 and 128) the government has put in place a number of procedures to prevent and/or interdict attacks. Specific information regarding the government's airborne defense strategies is classified; specific steps that Entergy has taken are, likewise, controlled as "Safeguards" information. Entergy's primary role with respect to airborne attacks is to have in place equipment, procedures and personnel to minimize the

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		consequences and maximize the response effectiveness, in order to protect the public in the unlikely event of a successful attack (pages 129-133).
4.7; p.9	Please cite the specific study that indicates a fully loaded airliner could not penetrate containment structure. Please define containment structure. Is that only the reactor structure? What studies have shown the impact on spent fuel storage if an airliner hit one? What would be the effect of the aerosolizing and ignition of jet fuel on control room, response teams, back-up equipment including the back-up diesel generators that would be necessary if outside power went down. David Lochbaum of the Union of Concerned Scientists indicates that a major problem, including potential meltdown scenarios, could occur even without breach of the containment structure if an impact resulted in vibration or shaking of the reactor structure, and the impact on piping and conduits that could compromise cooling. What is your perspective on this concern?	The term containment structure refers to the specially designed reinforced concrete and steel building that houses the nuclear reactor and associated systems. There have been numerous analyses and tests to evaluate the vulnerability of containment structures to aircraft impact. A publicly available report of the results of such work is *Deterring Terrorism: Aircraft Crash Impact Analyses Demonstrate Nuclear Power Plant's Structural Strength, Electric Power Research Institute (EPRI),* published by the Nuclear Energy Institute in December 2002. This report concludes that a fully loaded aircraft could not penetrate steel reinforced concrete containments like those at Indian Point. (This is the report cited in footnote #37 on page 8 of Appendix 3 of the ISE Report.) As summarized in Appendix 3 of the ISE Report (Issue #3, beginning on Page 8 of the Appendix), this same report addresses the potential effects of a commercial aircraft crash on spent fuel in the containment, fuel pool and dry spent fuel storage (pages 13, 14 and 17 respectively). Please note also that the ISE Panel had access to and reviewed the classified analyses supporting in detail the conclusions in the public report cited above. The report's conclusions are very well founded.

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		The effects of jet fuel fires on site are addressed in Appendix 3, page 18. By design, nuclear plant redundant safety systems, including fire protection systems, are separated to prevent loss of multiple protective systems from a single fire. The redundant and separate capabilities of the two Indian Point units add to this diversity. While large jet fuel fires would cause significant damage to facilities near the point of crash impact, other locations on site would survive and these locations have the safety equipment, personnel, water sources and electric power necessary to mitigate the damage and protect the reactor core and spent fuel on the site. The potential for damage to the reactor and its safety systems inside the containment due to vibration or shaking even if the containment structure were not penetrated is covered in the ISE Report on pages10 and 14 of Appendix 3. As described in that section, analyses have shown that the energy transmitted to the inside shell of the containment for a perpendicular impact is not sufficient to cause enough damage to disable key equipment. Factors contributing to this conclusion are the ruggedness of the structure itself, the extensive physical supports and protection of interior safety equipment (driven primarily by the design requirement to protect against consequences of very severe earthquakes) and the fact that the reactor and safety related equipment for the accident response are protected and located very low in the containment and therefore are not subjected to the major building motions and vibrations.

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		It is also important to remember that any angle of impact on a circular containment other than perpendicular (i.e., along a radius) results in substantially lower impact energy and force. Analyses assuming a perpendicular impact create the worst possible impact on the walls. Finally, numerous strategies using available equipment, personnel, power supplies and water supplies can be effectively employed to keep the core covered and cooled should there be damage to equipment inside or outside either containment building.
5.6; p.114	Your report says "Contrary to popular perception, the Witt report was *not* an assessment of the likelihood of a terrorist attack on a nuclear station or of the potential consequences should one occur." Please explain on what basis you believe that this is a "popular perception." I have been very active in this region's opposition to the operation of Indian Point and I have never heard a single person say that the Witt report suggested a higher likelihood of a terrorist attack. However, the Witt report says the following -- In our report we discuss significant planning inadequacies, expected parental behavior that would compromise school evacuation, difficulties in communications, outdated vulnerability assessment, the use of outdated technologies, lack	The Witt Report was cited by several members of the public at our Public Meeting we hosted on April 28th 2008. Our purpose in including it in the public issue and addressing it in Section 5.6 of the ISE Report was to provide context for our readers, explaining what it is – and what it is not. While we can cite no statistical basis for our statement regarding "popular perception", we believe it is clear that in the public eye Mr. Witt's assessment and its conclusions are strongly linked to the threat of terrorism. This work was commissioned shortly after the 9/11 terrorist attacks, and the very first sentence in Chapter 1 refers to "recent national events" resulting in "reassessment of public safety and security at nuclear facilities". In the passage you cite in your question, the Witt Report asserts that existing emergency preparedness measures to protect the public from the radiological consequences of a release from Indian Point, particularly the "faster and larger" releases, which is suggested

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	of first responder confidence in the plan(s), problems caused by spontaneous evacuation, the nature of the road system, the thin public education effort, and how these issues may impact an effective response in a high population area. None of these problems, when considered in isolation, precludes effective response. When considered together, however, it is our conclusion that the current radiological response system and capabilities are not adequate to overcome their combined weight and protect the people from an unacceptable dose of radiation in the event of a release from Indian Point. We believe this is especially true if the release is faster or larger than the typical exercise scenario. SOURCE: www.ipsecinfo.org/Witt_executive_summary.htm So the report actually estimates failure of the emergency plan under any scenario, but expresses greater skepticism about any event that surpassed the existing DBT, without a mention of terrorism specifically. What, if anything, has Entergy done on their part to improve the chances for a successful evacuation in the event of a large radiation re lease event? Your report suggests that the company is working to try and prevent the occurrence, but does not indicate anything that actually addresses shortfalls in the evacuation plan itself.	elsewhere in the report as the potential outcome of a terrorist attack. Yet the report does not evaluate the potential for or consequences of radiological releases from terrorism or other causes. On Page 247, the Witt Report states "The James Lee Witt Associates / IEM Team was not tasked to study the physical security of the Indian Point or Millstone plants, or the credibility of terrorist attacks or other potential initiators of a radiological event at either facility". Your extracted quote from the Witt Report is correct, but we note that the potential emergency response difficulties it cites – parental behavior, difficulties in communications, and the like – are generic emergency planning issues, applicable to disasters of all kinds and have nothing to do with terrorism, just as the ISE Report states on page 114. As noted on pages 8 and 23 of the ISE Report, off-site aspects of emergency preparedness, including off-site evacuation and planning, are not within the scope or control of Entergy and therefore were not part of the ISE scope. However, we call your attention to the ISE Report Section 5.6, and particularly the subsections titled "Emergency Planning in the Post 9/11 Era" and "Improved Protective Actions", on pages 113-116. These describe actions done by Entergy to address issues raised by the Witt Report and also work by Entergy and others to utilize new analytical tools that now provide better understanding of radiological release events and on that basis develop more

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	I do want to compliment Dr. Rhodes for specifically mentioning that a large release event is a possibility at Indian Point (as it is at any nuclear plant). It was surprisingly refreshing to have some candor from a strong supporter of nuclear power generation.	effective public protective action strategies. This latter work is still in progress, and any resulting emergency preparedness work will be the responsibility of federal, state and county authorities. But it is potentially very significant.
6.2; p.122	The report states that "the ISFSI has the capacity to store all of the spent fuel created during the lifetime of all of the three IPEC units." Just as a point of reference, can you state how many times more fissile material is being stored currently at IPEC than was released in the fire at Unit #4 of the Chernobyl plant in 1986?	The ISE was focused on Indian Point. U.S. commercial nuclear plants are fundamentally different from those at Chernobyl in design, construction and operation, and an accident at Indian Point like that at Chernobyl is not possible. A direct comparison of the Chernobyl core contents with the Indian Point spent fuel would not be meaningful. The source of the radiological release from Chernobyl was hot, operating graphite-based fuel bundles. Spent fuel at Indian Point is of entirely different design and has been cooling and decaying radiologically for an average of over 20 years. The short-lived isotopes contained in Indian Point stored spent fuel have diminished, through radioactive decay, by many orders of magnitude and the heat generation (needed for dispersal of the fission products beyond their container) is miniscule in comparison with the full core energy in the Chernobyl accident.
6.3; p.128-129	The analysis includes only the hijacking of a commercial passenger aircraft. While those aircraft would have greater impact (mass*speed), one could	The analysis (pages 128-129) included looking at large passenger jets, large freight carrying aircraft, and medium sized aircraft carrying explosives. We also considered the relative difficulty

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	suggest that a smaller aircraft loaded with high explosive or incendiary materials might be a more likely vehicle. In fact, the nearest airport to Indian Point -- Westchester Airport – has many charter and private aircraft. What investigations did this panel include in their analyses?	terrorists would have in seizing a cargo plane, and the difficulty in acquiring a large quantity of explosives, getting it onto an airport and aircraft, and flying it undetected into a critical IP structure. Panelists discussed these matters with the FAA and with Westchester Airport security personnel because of its close proximity to Indian Point. While there is of course an infinite range of hypothetically possible threats, our evaluation concentrated primarily on threats considered credible, based on assessments by U.S. intelligence agencies and the Nuclear Regulatory Commission, as identified in the classified "Safeguards" reports to which Panel members had access. As we examined terrorist incidents worldwide involving aircraft, the hijacking of passenger aircraft is the number one credible threat, and as our report indicates (pages 70 and 128-129), the probability of such an event is very low and even if successful its consequences would be manageable.
6.3; p.129	Explain why this panel created a chart comparing total area of the Pentagon against different structures, including the reactor structure which is, in fact more than twice the height of the pentagon. If a relatively novice pilot could smash into a structure only 70 feet height, why would it be more difficult to strike a structure that is about 2.15 times as tall?	The charts in the ISE Report (page 129) show the relative sizes of all of the facilities targeted on September 11, in comparison to potential targets at Indian Point. You are correct in pointing out the Pentagon's 70' height compared it to the Indian Point containment height of 160'. What you fail to mention is that the Pentagon has a width of 1489' (921' per side), compared to the containment building width of 130'. The difficulties in flying at low altitudes are a combination of both vertical stability and horizontal maneuverability. It is the differences in the widths of the two structures, and their

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		corresponding topographies, that makes striking the IP target much more difficult. The key fact is that the potential targets at Indian Point are ~20%, 3% and 0.2% as big as the Pentagon. This size comparison and its implications are further discussed in the ISE Report Appendix 3, pages 10-17. Note also, as explained on pages 10 and 11, that the circular cross-section of a nuclear containment structure, in comparison with the flat surface of the Pentagon, greatly increases the difficulty of achieving a damaging strike. Anything but a direct perpendicular hit on the centerline of the containment would result in a glancing blow with far less damage potential.
6.3; p.130	Why was a speed of 350 mph used? What speeds did the analysis of the 9/11 planes conclude? I think I recall a New York Times article that indicated the plane that struck the North Tower was at a speed in excess of 500 mph. If all the hijacker wants to do is strike the plant property and do as much damage as possible, why would 250 mph be an appropriate speed estimate.	The basis for selection of 350 mph as the speed of the aircraft is discussed on page 9 of Appendix 3 of the Indian Point ISE Report. While there are a number of claims that the 9/11 aircraft were flying at a speed close to or above 500 mph, these have been discounted by the experts. At such low altitudes, 350 mph is the maximum speed (and therefore the maximum potential impact force on the structure) at which a large aircraft can be flown and effectively controlled. Experienced pilots, aircraft design information and the limits placed on pilots all support that judgment. The Panel accepted the judgments of the experts in this matter. At a speed of 250 mph, control of a large aircraft that low to the ground would be very difficult; the kinetic energy and force of impact would be greatly reduced compared to 350 mph, and therefore the impact would be less damaging than under the

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		assumptions chosen by the analysts and used by the Panel.
6.3; p.130	In public issue #30, you refer to pressure testing by increasing *internal pressure.* Are the physics of impact from an external force the same as the measures of expansion and resistance because of internal pressure increases? If not, why is your measurement valid?	Public Issue #30 has nothing to do with external impact forces on the containment buildings. It addresses a question about water-to-cement ratios and their potential impact on the strength of concrete. Water-to-cement ratios are only one factor in the strength of the reinforced containment structures. The ISE Panel concluded that there are no safety concerns associated with water-to- cement ratios. (See Appendix 3 to the ISE Report, pages 46-47.) The response and associated analysis of reinforced concrete structures to internal and external forces is quite different. The ISE Panel specifically addressed the capability of the reactor containment building to withstand external impact forces in its review of Aircraft Attack (Public Issue #3) in Appendix 3, pages 8-21. The internal pressure design capability and pressure testing of the containment building are not factored into or relied upon in the analyses of the structure's capability to withstand external impact forces.
7.2; p.139	I apologize if I am just not calculating correctly, but if I start with the 12/2007 Fund Balance and just multiply by 1.05, which I think is a 5% interest rate, and continue annually with the same formula, my end amount at 2013 for IP2 and 2015 for IP3 are significantly lower than the Projected Fund Balance you indicate. I am assuming no additional contributions. Can you explain this to me? Thank	The ISE Report calculation is correct. As stated on page 139, and discussed in more detail in the cited reference (footnote #31 on that page), the earnings of 5 percent per annum accumulate until the middle of decommissioning, on the basis that unexpended funds will continue to generate earnings even after decommissioning begins. The mid-points of decommissioning are currently assumed to be December 2016 for

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	you.	IP 1 and IP 2 and December 2018 for IP3, consistent with their current operating license expiration dates for Units 2 and 3. Applying this earnings rate to the Current Fund Balances yields the Projected Fund Balances at Decommissioning indicated in the table on page 139. No additional funds are assumed.
p. 153	The report states "Panelists were uniformly impressed with the upbeat, enthusiastic attitudes and professionalism of plant personnel." Since this panel did not seek out and conduct confidential interviews with employees, present or former, who have raised operational issues, how meaningful or unexpected is a "happy face" when company (Panelists) are visiting?	As discussed in the ISE Report, the panel has a broad range of experience in evaluating people, processes, and plant equipment. This question focuses on people. The experience of the panelists in interviewing and observing nuclear power plant personnel at all levels, assessing their discipline in meetings and conduct of work, is extraordinary. Our collective judgment that led to the cited statement on page 153 of the report is based on the extensive experience of the panel and is well supported by the remainder of the report. Over the course of our extensive and unfettered on site evaluations, a panel with this broad and diverse experience would clearly recognize the difference between a "happy face" and genuine attitudes and professionalism of the people.
App 3; p.10	Why is the assumption of a strike against the spent fuel pool predicated on a "perpendicular strike on the side of a spent fuel?" The terrorists who struck on 9/11 were obviously prepared and willing to die in the attack. Since the report indicates that the topography is a major impediment, why create a scenario that requires a level flight path to the spent	The assumption of a perpendicular strike is not a requirement of the analyses but rather a conservative assumption in the analyses. As noted above, for any aircraft speed impact perpendicular to the wall surface results in the maximum force on the structure and therefore the maximum potential for damage. (See ISE Report, Appendix 3, pages 9-11). Any strike angle other than perpendicular results in lower force and less damage.

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	fuel storage rather than a vertical plunge into the IPEC facility, in general and the spent fuel storage in particular. The roofs on the spent fuel pools are not fortified concrete, but are the same types of metallic roofing used on many commercial buildings. What modeling has been done against a vertical plunge type attack and direct hit on the spent fuel storage?	The potential for a hit into the top of the fuel pool was assessed and is covered on pages 15-16 of Appendix 3. No mitigation credit was taken for the roof of the fuel pool building or the structural steel that supports the roof. Even though the Panel was convinced by experts that a vertical dive into the small fuel pool building roof would be virtually impossible because commercial aircraft are uncontrollable at the resulting dive angle and high speeds when at low (thick air) altitudes and that the aircraft would likely break-up under such conditions, we did consider the possible consequences of such a strike. The vertical plunge of an aircraft engine into one of the pools was modeled as the worst case and the calculations showed that a substantial amount of water would be displaced (we assumed none of it returned to the pool). The calculations showed that the water would cushion the landing to some extent, slowing the descent of the engine so that the energy of the mass would not be sufficient to cause significant fuel rack or fuel bundle damage. Furthermore, the water remaining in the pool would be sufficient to provide 30-100 hours (depending on the age of the spent fuel) before water boil off to the top of the stored fuel, thus providing ample time for the restoration of water inventory and cooling to the pool. (See Appendix 3, pages 15-17 for a more detailed explanation.)

2. Questions from Rudy Cypser:

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What is the safety risk of transporting spent fuel to western storage for the next thousand years? What is the safety risk of container decomposition and leakage over the next thousand years? What is the cost to future generations, over the next thousand years, to monitor and preserve spent fuel storage?	The ISE focused on the safety, security and emergency preparedness of the Indian Point nuclear facilities today and in the near future, so your questions about the safety, risk and cost of the long-term storage of spent fuel in the United States are well outside the scope of the ISE Panel's work. As such, without further work to research your detailed and important questions, we are not in a position to supply you specific answers. However, there is a great deal of information on these topics from the US government, the nuclear industry and opponents of nuclear power available on the World Wide Web and in libraries (including, we expect, your local library). See the list of web sites below that will provide a good starting point for you in obtaining the answers to your questions. Perhaps the best place to start would be with the recently submitted USDOE License Application for a High Level Waste Geologic Repository at Yucca Mountain (Yucca License Application). Extensive detail in this Application and its initial acceptance for review by the Nuclear Regulatory Commission can be found at: http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html. Dr. Bernard L. Cohen's book The Nuclear Energy Option, published by Plenum Press in 1990 (see http://www.phyast.pitt.edu/~blc/book/chapter11.html), while dated, puts the risk and impacts of nuclear waste in perspective with other waste products we routinely produce and is well footnoted for further research. It may also provide you a quick and broad look at your questions. We hope also that several facts would help you start to put the answers to your questions in context. The references supplied will show that high level nuclear spent fuel has been shipped throughout the USA for many years. Over 3000 shipments have been made prior to 1990 covering 1.7 million miles and, while there had been 8 accidents involving these trains or trucks, no radioactive material had been released. The foreign/world-wide experience in shipping high level radioactive materials is much greater since the reprocessing/recycling of nuclear fuel has involved shipments from country to country around the world. The safety record has been equally impressive.

	The spent fuel containers integrity, even after centuries of burial, is discussed in detail in the Yucca License Application as is the long term cost of monitoring and preserving this storage capability. The Nuclear Regulatory Commission is expected to take years reviewing and challenging this USDOE Application to ensure the safety and health of the public can be protected should a construction and operating licenses be issued for Yucca Mountain. We hope this overview is helpful in answering your questions. Please excuse its brevity occasioned by the reality that these subjects were not within the scope of our investigations for the Indian Point ISE. References for the Study of High Level Nuclear Waste Safety Risk and Cost: http://www.nei.org/keyissues/nuclearwastedisposal/transportation/ http://www.nirs.org/factsheets/hlwfcst.htm http://www.nrc.gov/waste/hlw-disposal.html http://www.aboutnuclear.org/view.cgi?fC=Waste,Waste_Storage_and_Disposal,Deep_Repository_Disposal http://en.wikipedia.org/wiki/Radioactive_waste http://www.nei.org/resourcesandstats/nuclear_statistics/nuclearwasteamountsandonsitestorage/ http://www.phyast.pitt.edu/~blc/book/chapter11.html http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html

3. Question from Michel Lee, Esq., Steering Committee, Indian Point Safe Energy Coalition:

At the Public Meeting of the ISA Panel on July 31, 2008, I inquired as to the evidential support for the Panel's conclusion that Indian Point is not vulnerable to a hit from an aircraft (or an airborne attack).	The following references which are available in the open literature. As noted in the Panel report additional industry safeguards and proprietary data and analyses were available to the Panel. 1. Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report by a Committee of the National Research Council of the National Academies (2006) 2. Deterring Terrorism: Aircraft Crash Impact Analyses Demonstrate Nuclear Power Plant's Structural Strength, Electric Power Research Institute (EPRI); Public Report by the Nuclear Energy Institute, December 2002. (This is an extended citation of the report footnoted as #37 on page 8 of Appendix 3 of the Report)