Dry Cask Storage FAQs

GENERAL QUESTIONS

How prevalent is this technology in the nuclear industry?	DCS has been used successfully in the US since the 1980s. About half of the nuclear power plants in US are either using Dry Cask Storage now or have a project to implement the capability. (See map of locations at www.nrc.gov/reading-rm/doc-collections/fact-sheets/dry-cask-storage.html)
What is ISFSI?	This stands for Independent Spent Fuel Storage Installation. The NRC has granted a general license to IPEC to own and operate an Independent Spent Fuel Storage Installation (ISFSI) under Title 10 of the Code of Federal Regulations, Part 72. Entergy secured this license after it successfully demonstrated to the NRC that it has complied with all 10CFR72 requirements and is proficient in the use of equipment and steps needed to perform loading of casks.
How long will dry cask storage be used at IPEC?	The United States Department of Energy DOE is expected to begin storing the spent nuclear fuel from civilian reactors by 2010-2015. Indian Point will begin shipping spent fuel to the DOE as soon as DOE begins the process. Depending upon the pace at which this is done, it may be necessary to store the fuel on-site for 40 years. The federal NRC licenses the storage casks and has concluded that they can be safely used for as long as a century, although it requires re-licensing every twenty years.
How much fuel will Entergy transfer from the pools to the casks?	Entergy plans to place only that spent fuel in casks which is needed to maintain sufficient room in the spent fuel pools to conduct reactor refueling, and only until the spent fuel can be transported to the national spent fuel repository.
Is the IPEC ISFSI licensed by the NRC?	The NRC approved this dry storage method under a general license, publishing a final rule in 10 CFR Part 72 entitled, ``General License for Storage of Spent Fuel at Power Reactor Sites" (55 FR 29181; July 18, 1990) for 10 CFR 50 reactor Licensees (www.nrc.gov/reading-rm/doc-collections/cfr/part072/). In the Federal Register: May 1, 2000 (Volume 65, Number 84)], [Rules and Regulations], [Page 25241-25265], the NRC published a supplemental document entitled “List of Approved Spent Fuel Storage Casks: Holtec HI-STORM 100 Addition” which identifies the Holtec cask system IPEC is using, as meeting the requirements of 10 CFR Part 72 .(www.epa.gov/fedrgstr/EPA-GENERAL/2000/May/Day-01/g10393.htm)
Can you give a general description of the dry cask storage pad?	The storage pad will be approximately 3 feet thick and 100 feet by 200 feet with a crushed rock apron. Pad design and construction take into consideration the issues of earthquakes, access roads, drainage, instrumentation, cask transport equipment, security systems and lighting. Dynamic Load Factor Equations have been calculated and are included in the Hi-Strom FSAR. All static stress calculations use these dynamic load amplifiers to evaluate the adequacy of final safety factors. About 2000 cubic yards of concrete is needed. The concrete will be mixed on site to minimize truck traffic through the surrounding community. During the construction of the pad and prior to loading of casks, the NRC will be present on site to verify Entergy has met all applicable requirements.
What are the design and construction specifications for the storage pad?	The design and construction specifications for the cask storage pad are found in NRC regulations and industry standards. They include: • The Standard Review Plan for Dry Cask Storage Systems, NUREG-1536 • The Certificate of Compliance COC, a 318 page document issued by the U.S. Nuclear Regulatory Commission, pursuant to 10 CFR 72, "Licensing Requirements for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste", including, Subpart G-Quality Assurance • American Concrete Institute-349-85 and 91, Code Requirements for Nuclear Safety Related Concrete Structures • HOLTEC Hi Storm Technical Specifications and Final Safety Analysis Report (a 2651 page analytical document)

Are there any upgrades needed to the Fuel Storage Buildings?	A 110-ton single-failure proof gantry crane will be installed in the IP2 Fuel Storage Building to provide the capability of lifting and manipulating the loaded casks. For IP2, the floor is being reinforced to support the heavy cask, the height of the loading bay door will be raised, and the roadway will be modified in front of the Fuel Storage Building. The upgrades for the IP3 Fuel Storage Building are expected to be substantially the same as for the IP2, pending the outcome of an engineering analysis.
Does Entergy plan to reconfigure the Indian Point spent fuel pools?	Reconfiguration of the spent fuel pool Is not part of the dry cask storage project. There are studies underway by the NRC and industry groups that are looking at alternative arrangement of spent fuel in the pools. If any of these studies prove beneficial, Entergy would implement a reconfiguration of the fuel in the pools.
How much capacity is left in the spent fuel pools?	The pool at IP 2 can hold a maximum of 1374 fuel assemblies and is presently about 80% full. The IP 3 pool capacity is 1345 assemblies and is almost 70% full. Each pool holds the entire inventory of spent fuel generated from the adjacent reactor since initial operation. See SFP Fact Sheet.

Who is the company building the ISFSI?	The NRC has approved a number of different dry storage designs for general use, and in the process, has analyzed hundreds of safety factors. Each system has unique characteristics that are considered for particular applications, depending on the design of the different plants, spent fuel buildings, geographic locations, etc. Entergy selected Holtec through a competitive bid process involving technical and commercial review of various vendors and systems. Holtec was not the least-cost alternative. The Holtec system has been in use at several Entergy plants and many plants throughout the United States, and has an outstanding in-service record.

RADIATION

Radiation Protection	
How much radiation do people who live near IPEC receive from the plants?	All people experience natural and man-made radiation. About 82 percent of our total exposure to radiation comes from natural sources: radon gas; outer space; rocks, soil etc. Radioactive elements in our own bodies account for 11 percent of our total exposure. The average annual radiation dose for a person living in the United States is 360 millirem. Theoretically, people who live within a 50-mile radius of a nuclear power plant receive an additional 0.009 millirem/year or 0.0025% of their total annual dose from the plant, although that amount is so small that it is impossible to verify by actual measurements. www.nei.org/index.asp?catnum=2&catid=54)
Are there standards for radiation exposure to members of the general public living around IPEC?	Yes. The standards are published in 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations and include the following annual dose equivalent limits for members of the general public: • < 25 millirems to the whole body • < 75 millirems to the thyroid, and • < 25 millirems to any other organ www.access.gpo.gov/nara/cfr/waisidx_01/40cfr190_01.html Environmental radiation monitoring will be continuous at several places in and around the ISFSI and along the site boundary. Calculations of expected radiation levels at the ISFSI indicate they will be well below applicable limits. By way of example, at Entergy's James A. Fitzpatrick JAF plant in Oswego, NY the

	dose rate is < 2 millirem per hour at the wall of a fully loaded cask. Calculations of expected dose rates at IPEC indicate that we should see similar results here. The total dose accumulation (pool to pad) at JAF was 2.4 Person-rem for the transfer of fuel to 3 casks, or an average of 0.8 Person-Rem/cask. Our calculations lead us to expect similar results at IPEC. The majority of that dose will be from cask loading within the Fuel Storage Building FSB.
Does dry cask storage pose a risk of exposure to low levels of radiation?	No. According to the United States federal government, the health risks from small amounts of radiation, if any, are very low in comparison with other health risks. For instance, compared to receiving 100 millirem of radiation every year for your lifetime, smoking a pack of cigarettes a day is 400 times more risky, being 15 percent overweight is 100 times more risky, and driving a car 12,000 miles a year is 40 times more risky. There may, in fact, be no adverse health impacts from low levels of radiation. The environmental and public health risks associated with irradiated fuel and placed in casks produced by Indian Point are well below federally mandated minimum requirements. These requirements are found in 10 CFR 72 and the cask system vendor's Final Safety Analysis Report. The systems, structures and components that ensure these requirements are continually met, are maintained through a stringent program of continuous inspections, in-service and post-maintenance tests, preventive maintenance, and regulatory oversight. The Indian Point FSAR is available in the NRC on-line public reading room.
Is there any scientific evidence that people living near nuclear power plants have an increased risk of cancer?	No. The National Cancer Institute publication, "No Excess Mortality Risk Found in Counties with Nuclear Facilities" states there is "no general increased risk of death from cancer for people living in 107 U.S. counties containing or closely adjacent to 62 nuclear facilities."

SAFETY

Does NRC require casks to be designed for resistance to these postulated terrorist acts and natural disasters?	The Nuclear Regulatory Commission must certify all container designs. Before approval, containers must meet rigorous engineering and safety criteria and be able to pass a series of hypothetical accident conditions that create forces greater than the containers would experience in actual accidents. The same container must, in sequence, undergo • A 30-foot free fall onto an unyielding surface • A 40-inch fall onto a steel rod six inches in diameter • A 30-minute exposure to fire at 1,475 degrees Fahrenheit that engulfs the entire container • Submergence under three feet of water for eight hours Also, by a separate test, containers are submerged under 50 feet of water for eight hours. Engineers and scientists at Sandia National Laboratories in New Mexico have also subjected used nuclear fuel containers to actual accidents to see what would happen in real-world conditions. For example: • A flatbed tractor-trailer carrying a container was run into a 700-ton concrete wall banked with 1,700 tons of dirt at 80 miles per hour • A container on a tractor-trailer was broad sided by a rocket-assisted 120-ton train locomotive traveling 80 miles per hour • A container was dropped 2,000 feet onto soil as hard as concrete, traveling 235 miles an hour at impact. In all these cases, the containers survived intact. Post-crash assessments demonstrated that the containers would not have released their

	contents. (www.nei.org/index.asp?catnum=3&catid=725)
Can the dry cask units withstand earthquakes without a release of radiation?	Yes. The Indian Point storage pad has been designed to satisfy federally mandated requirements for structural characteristics and resistance to seismic events occurring at the pad, during handling of casks over the spent fuel pool and en-route from the spent fuel pool to the storage pad.
Should the casks be anchored together?	No. The seismic profile of the Indian Point site does not require anchoring the casks.
What is the design basis earthquake DBE for the storage system? How does that differ from the operating basis earthquake OBE?	The DBE is defined as the largest earthquake which can reasonably be expected to occur at the site, based on the known seismicity of the area. IPEC safety systems are designed to remain functional both during and after this event, which measures 0.15g peak ground acceleration on the Housner spectrum. The design basis earthquake for the Indian Point region is roughly a Mercalli level VII. The Operating Basis Earthquake is a smaller earthquake than the DBE. The OBE has a maximum horizontal peak ground acceleration of 0.1g vs. 0.15g for the DBE. Plant equipment is designed to remain functional during and after the OBE. The following is the NRC definition from Appendix S to Part 50: “The Operating Basis Earthquake Ground Motion (OBE) is the vibratory ground motion for which those features of the nuclear power plant necessary for continued operation without undue risk to the health and safety of the public will remain functional.”
How is seismic activity monitored?	IPEC monitors seismic activity at the site using seismic recorders located in the IP3 containment building. The recorders are set to alarm in the IP3 control building when seismic activity is recorded at a level well below the operating basis earthquake. The Nuclear Regulatory Commission Guide 1.12 – “Nuclear Power Plant Instrumentation For Earthquakes” (link to: www.nrc.gov/reading-rm/doc-collections/reg-guides/power-reactors/active/01-012/), provides further details on seismic monitoring criteria. Regulatory Guide 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-Earthquake Actions" (link to: www.nrc.gov/reading-rm/doc-collections/reg-guides/power-reactors/active/01-166/) provides criteria for plant shutdown after an earthquake.
Could rockslides cause the casks to fall over and roll into the Hudson River?	No.
Could hydrogen build up in the storage casks and create an explosive situation?	The NRC has mandated that all dry cask storage systems be evaluated for the potential to generate hydrogen. The canisters at IPEC are stainless steel rather than carbon steel and have no ability to generate H2 gas.
Are there any quality assurance issues with the casks?	Quality assurance and control systems are in place to ensure non-conformances are identified, evaluated and dispositioned, and multiple layers of checks are required for certification of a cask. For example, Entergy observes the Holtec fabrication process through inspections and assessments at the fabrication facility. Final product acceptance and placement in service, requires verification that casks meet their design criteria. If a defect is discovered, it is fixed and re-checked. Not until the cask meets all of its requirements will it be used. The Holtec system is used at 27 plants, with no record of structural failures or radioactive releases. There have been no substantiated quality issues with the Holtec Hi-Storm system. An alleged quality issue has been addressed by the NRC, which concluded there was no technical merit to the issue. The highly regulated nature of the cask system design and ISFSI construction provides multiple layers of redundancy in safety. Entergy will verify compliance with the cask Certificate of Compliance through a quality assurance

	program and operational checks and inspections as required by 10CFR72. In the 20-year history of their use, no cask has failed or had to be reopened for remediation.
Will older fuel assemblies that have indications of damage be placed in dry cask storage?	Fuel will be loaded in accordance with the FSAR and the Certificate of Compliance. All fuel assemblies will be categorized according to NRC criteria. Fuel that has been identified to have damage will remain in the spent fuel pool.
How much heat will be emitted from the dry cask canisters when loaded?	The canisters are rated for heat loads of approximately 24 kilowatts, which is the heat produced by a dozen hair dryers (typical loads are 20 kilowatts). The license requirements limit the air outlet temperature to no more than 30 degrees above ambient air inlet temperature.
Why wouldn't Entergy bury the casks or put them in silos, as opposed to leaving them above ground?	The Hi-Storm structure is a hardened structure with over two feet of concrete surrounding a stainless steel canister. The casks need to be free standing to radiate heat and take advantage of a passive cooling system which does not need to rely on power sources as an active cooling system would. Another advantage of the Hi Storm design is that the casks remain in full view at all times.
What would happen if a radiation leak were detected in a cask? Would the cask have to be re-opened?	Such a leak would be detected through a change in temperature of the cask, but is extremely unlikely. No cask has been "reopened" in the 20-year history of their use. Nevertheless, there are procedures available to return fuel to the spent fuel pool, if necessary.

SECURITY

Will there be increased security at the dry cask storage site?	Yes, the storage site will be included in the Protected Area. It will be continuously monitored (24/7/365), including the use of close circuit TV, and microwave intrusion detection systems.
What other security precautions are in place at the storage site?	The nuclear energy industry has always had the highest security standards of any American industry. The industry is required to meet Nuclear Regulatory Commission regulations for security and exceeds these requirements in many areas. IPEC has well-armed and highly trained security forces that are routinely drilled and tested. Since Sept. 11, 2001, security has been significantly strengthened. Access to the plants has been tightened and security officers search all entering vehicles and people. All workers entering plant operating areas must also pass through sensitive metal and explosive detection equipment. Additional vehicle barrier systems have been installed to protect against vehicle bombs. IPEC Security coordinates with the Department of Homeland Security and intelligence agencies on the assessment of potential threats and the specific actions by industry security forces in the event of a credible threat. IPEC also has emergency response procedures and contingency plans in the event of a plant accident or terrorist event. These procedures, reviewed and improved following Sept. 11, are evaluated every two years during extensive drills involving plant personnel, local police, fire and emergency management organizations. NRC and Federal Emergency Management Agency expert teams evaluate these drills.
Could terrorists attack the casks with explosive weapons and release lethal amounts of radiation into the environment?	Numerous analyses, including terrorist scenarios, have been conducted on the ruggedness of the various dry storage containers used in the United States. One such study, conducted by Sandia National Laboratory, subjected a steel and concrete cask similar in design to the Holtec Hi-Storm, to a device 30 times more powerful than a typical anti-tank weapon. Another study illustrated the effects of a large commercial aircraft traveling low to the ground at 350mph, precisely hitting nuclear plant containment structures, used fuel storage pools and dry cask storage containers of the type chosen for IPEC. In other analyses, hypothetical F-16 strikes were launched on the Holtec casks.

	In all of these analyses, it has been concluded that the robust system of concentric steel and concrete cylindrical containers will prevent radioactive material from being released to the environment. In fact, for the first two scenarios, there was no release. The NRC staff filed 9 reports on the F-16 scenario, concluding that an accidental aircraft or ordnance impact on similar casks at a proposed facility in Utah (NRC Docket 72-22-ISFSI) does not pose a credible hazard to public health and safety. Holtec's simulated F-16 strikes showed that MPC confinement will be maintained intact. (www.nei.org/documents/SafeShipBrochure1.pdf)
Could a bomb be used to blow up a cask?	Given the many layers of security involved, it is highly unlikely that a terrorist would have access to perpetrate this kind of act. However, this scenario has received considerable attention and analysis, in the event that multiple security barriers failed simultaneously. For example, Sandia National Laboratory subjected a container to a device 30 times more powerful than a typical anti-tank weapon. The result left the inner container intact and left a ¼" hole in the outer cylinder. The NRC determined that a large-scale release of radioactivity would be prevented. (www.nei.org/documents/SafeShipBrochure1.pdf)

PERMANENT STORAGE

How did IPEC select which fuel assemblies were loaded into the casks?	Fuel loaded in the casks will be selected in accordance with the cask license and cask system Final Safety Analysis Report. An IPEC procedure is being developed to select which fuel assemblies will be loaded into the casks. This procedure includes all regulations and requirements. In general, the most important factors involved in fuel selection include the amount of time the fuel has been decaying in the spent fuel pool and the degree of its utilization in the reactor. The cask system FSAR is a very lengthy document and can be found in the NRC on-line public reading room.
How long does Entergy plan to store the fuel in casks at IPEC prior to shipping it to Yucca Mountain?	In 2002 the President and Congress approved the Yucca Mountain site in Nevada for development as a national repository. DOE is expected to begin storing fuel at Yucca Mountain by 2010-2015. IPEC will begin shipping fuel as soon as DOE begins this process. Depending on the pace at which this is done, it may be necessary to store fuel on-site for 30-40 years.
Is it true that Yucca Mountain does not have the capacity to accept all of IPEC's spent fuel?	The capacity of the repository at Yucca Mountain has been determined politically, not scientifically. Congress limited the capacity of the Yucca Mountain repository to 70,000 metric tons of heavy metal or equivalent, in the 1982 Nuclear Waste Policy Act. As of 2002, there were about 44,000 metric tons of commercial used nuclear fuel and about 12,000 metric tons of defense high-level radioactive waste awaiting disposal at Yucca Mountain. An additional 2,000 metric tons is generated each year. Given that DOE expects to begin receiving up to 3,000 metric tons a year of used fuel beginning in 2010, the 70,000 metric ton political limit will not be reached until at least 2036. Scientific analysis demonstrates that the Yucca Mountain site is physically capable of holding much more used fuel. DOE's Environmental Impact Statement showed that the site could safely dispose of 120,000 metric tons. Some scientists believe that repository capacity could be as high as 200,000 metric tons.
What if Yucca Mountain never opens?	Eventually the federal government will have to meet its obligations to store the fuel, however in the event of further delay, the casks are designed to hold the spent fuel for extended periods of time.

Will Entergy roads need to be modified to handle on-site transportation of	The roadway out of the IP2 Fuel Storage Building is being modified, however Entergy does not envision other significant roadway modifications.

the casks?	
How will the empty casks be transported to IPEC for use at the ISFSI?	Only the cask shell will be shipped to IPEC and concrete will be added to fill it onsite. The shell will be transported by truck over local roads. The cask shell weighs considerably less than a fully loaded cask.
Is transport of loaded casks safe?	Over 3000 shipments of used nuclear fuel (> 10,000 assemblies) have been safely transported over 1.7 million miles, during the past 35 years with no injuries, no fatalities and no environmental damage due to the radioactivity of the cargo. The combination of robust shipping containers, exacting procedures, tight security, government cooperation, and strict regulatory standards has produced this outstanding safety record. (www.nei.org/documents/SafeShipBrochure1.pdf)
What are some of the procedures that protect fuel from terrorist attacks and accidents during shipping?	Used nuclear fuel is transported only along highway or train routes that have been pre-approved and pre-inspected by the U.S. Department of Transportation. Approved truck routes use highway bypasses around populated areas and avoid tunnels. Trains use alternate routes wherever possible to avoid tunnels. Trains shipping used nuclear fuel from commercial power plants in the future will likely use dedicated trains, that is, trains carrying only used nuclear fuel. The U.S. Federal Railway Administration and the individual railroad companies check the rails of a train route before shipment. The U.S. Nuclear Regulatory Commission checks all routes for law enforcement and emergency response capability as well as secure facilities for emergency stops. Additionally, drivers are specially trained and certified and must be accompanied by at least one escort. The NRC has a special set of rules in place to address the physical protection of spent nuclear fuel in transit. These rules are designed to minimize the possibility of sabotage, and require the following: • Notification of the NRC and relevant governors prior to transport • Current safeguard procedures for the shipper to follow in emergencies • At least one escort to maintain visual surveillance of the shipment • Escort training on threat recognition and management • Advance arrangements with law enforcement agencies along the route • Advance route approval by the NRC • Status reporting every 2 hours by the escort(s) • The capability to immobilize the cab or cargo-carrying portion of the vehicle (for highway shipments) • Armed escorts for any shipment through heavily populated areas • Protection of specific information about any shipment • Continuous monitoring and tracking by satellite. www.nei.org/doc.asp?catnum=3&catid=900
Could a terrorist blow up or crash an airplane into a fuel container during shipping?	Striking a truck or train with an airplane would be almost impossible, given the small size of the target and the fact that it would most likely be moving. Even if this were to occur, studies indicate the container would not be appreciably damaged and there would be no release of radiation. www.nei.org/index.asp?catnum=3&catid=725
Has there ever been an accident involving spent fuel during transit?	Eight accidents involving used fuel containers have occurred, four on highways and four during rail transport. None of these accidents caused any injuries, fatalities or environmental damage due to the radioactive nature of the cargo. In some cases the containers have suffered minor damage, but always functioned to prevent the release of radioactive material. Note that used fuel is a solid, not a liquid or a gas, and therefore cannot drain out of a container. www.ocrwm.doe.gov/wat/pdf/snf_trans.pdf

ENVIRONMENT

Has an environmental impact assessment been done for dry cask storage at IPEC?	A Generic Environmental Impact Statement (EIS) was performed for Independent Spent Fuel Storage Installations by the NRC. 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Function” (www.nrc.gov/reading-rm/doc-collections/cfr/part051/). Specifically Part 51.23, “Temporary storage of spent fuel after cessation of reactor operation--generic determination of no significant environmental impact” states that the NRC has made a generic determination that spent fuel can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed reactor life at the independent spent fuel storage installation.
In general, what are the environmental impacts resulting from dry cask storage at IPEC?	Environmental impacts resulting from the Independent Spent fuel Storage Installation ISFSI, are minimal both for construction (placement of an approximately 100' X 200' concrete pad) and use of the facility. It is important to note that there is no radiologically contaminated storm water runoff, since the canisters holding the fuel are seal-welded shut.
Has an environmental impact assessment been performed for the transport of spent fuel?	Yes, the NRC completed that study and issued the Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes in 1977 (NUREG-0170). USNRC (U.S. Nuclear Regulatory Commission). 1977.