UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

August 19, 2009

MEMORANDUM TO: J. Sam Armijo, Chairman
Materials, Metallurgy, and Reactor Fuels Subcommittee

FROM: Michael L. Benson, Staff Engineer ***/RA/***
Reactor Safety Branch A, ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS MATERIALS, METALLURGY, AND REACTOR FUELS SUBCOMMITTEE MEETING, MARCH 3, 2009 - ROCKVILLE, MARYLAND

The minutes of the subject meeting have been certified as the official record of the proceedings for that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc w/o Attachment: E. Hackett
C. Santos
A. Dias

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I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting on March 3, 2009, are an accurate record of the proceedings for that meeting.

/RA/
J. Sam Armijo, Chairman, 08/12/2009
Materials, Metallurgy, and Reactor Fuels Subcommittee

Certified by: J. S. Armijo **Issued: August 4, 2009**
Certified on: August 12, 2009

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF ACRS MATERIALS, METALLURGY, AND REACTOR FUELS SUBCOMMITTEE MEETING
MARCH 3, 2009
ROCKVILLE, MARYLAND

The ACRS Materials, Metallurgy, and Reactor Fuels Subcommittee held a meeting on March 3, 2009, in Room T-2B3, 11545 Rockville Pike, Rockville, MD. The purpose of this meeting was to inform the Subcommittee about staff's plans to address pellet-clad interaction failures during anticipated operational occurrences, especially under power uprate conditions. Michael Benson was the Designated Federal Official for this meeting. The Subcommittee received no written statements or requests from the public for time to make oral statements. Member J. Sam Armijo, the Subcommittee Chairman, convened the meeting on March 3, 2009 at 8:29 a.m. and adjourned it at 12:20 p.m.

ATTENDEES:

ACRS Members
J. Sam Armijo, Chairman
Harold Ray
Jack Sieber
Mario Bonaca
William Shack

ACRS Staff
Michael Benson, Designated Federal Official
Vanice Perin
Chris Brown

ACRS Consultant
John Davies

NRC Staff
Sher Bahadur, NRR
Michelle Flanagan, RES
Bill Ruland, NRR
John Voglewede, RES
Paul Clifford, NRR
Ralph Landry, NRO
Harold Scott, RES
Don Carlson, NRO

Also Present
Doug Crawford, GNF
Ronnie Gardner, AREVA NP, Inc.
Robert Montgomery, ANATECH Corp.
William Slagle, Westinghouse
Tom Galioto, AREVA NP, Inc.
Anne Leidich, Westinghouse
Dmitry Paramonov, Westinghouse
E. S. Tom Tomlinson, RETAQS, Inc.

Other members of the public attended this meeting. A complete list of attendees is in the ACRS Office File and is available upon request. The presentation slides and handouts used during the meeting are attached to the office copy of these minutes.

Opening Remarks and Meeting Objectives

Dr. Sam Armijo, Chairman of the ACRS Materials, Metallurgy, and Reactor Fuels Subcommittee, convened the meeting at 8:29 a.m. The purpose of this meeting was to inform the Subcommittee about staff's plans to address pellet-clad interaction (PCI) failures during anticipated operational occurrences (AOOs), especially under power uprate conditions where non-barrier fuel designs are employed. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee. The rules for participation in the meeting were announced as part of the notice of the meeting previously published in the *Federal Register*. The Subcommittee did not receive written statements or requests for time to make oral statements from members of the public.

ACRS Background and Concerns:

Chairman Armijo stated that the meeting objectives were to assess the risk of PCI in the context of stress corrosion cracking (SCC) and to understand options of mitigating PCI risk through analytical capabilities, fuel designs, and operational options. PCI is a mechanical-chemical phenomenon that influences the reliability of the fuel during AOOs.

This meeting was initiated to follow up on a recommendation regarding PCI risk found in the ACRS letter on the Susquehanna Extended Power Uprate review. Added comments to the letter by some of the ACRS members expressed concern about inadequate protection from PCI. The 1% cladding strain limit is appropriate only in the case of a purely mechanical phenomenon. Finally, the added comments expressed concern that the Nuclear Regulatory Commission (NRC) staff does not have the ability to model PCI phenomenon.

Examples of successful PCI mitigation actions include implementation of operating constraints known as Preconditioning Interim Operating Management Recommendations (PCIOMRs), development of fuel bundles with increased number of rods (i.e., from 8 x 8 to 10 x 10), and the introduction of barrier fuel with zirconium liner. Mitigation of PCI during AOOs requires operator action or PCI-resistant designs.

PCI damage manifests as axial cracks on the cladding surface at plastic strains much less than 1%, which is typical of brittle fracture of a ductile material. In cross-section, the PCI crack initiates at an area of high local stress where the pellet is cracked. The crack may branch as it penetrates the cladding. High-magnification fractographic images indicate intergranular fracture, which is evidence that PCI is a brittle failure mechanism and that it is not purely a mechanical phenomenon. The chemical effects degrade the mechanical properties significantly, such that an acceptable strain level under solely mechanical loading is unacceptable under SCC conditions.

Visual inspection of the inner diameter of PCI-failed cladding shows that cracks appear in locations where there is deposition of fission products. The concentration of deposited fission products was found to be much higher than that expected from normal fuel duty. The cladding deposits were analyzed for iodine and cadmium, because these chemical species embrittle the zirconium cladding both in reactors and laboratory experiments.

At normal operating powers, there is not sufficient stress on the cladding or high enough concentration of fission products on the cladding to cause PCI. If power rises rapidly above some threshold, then the fuel temperature rises and fission products deposit on the cladding. The expansion of the pellet applies a localized stress on the cladding. While the local stress relaxes with time, a combination of aggressive chemical environment and mechanical loading exists during the power ramp, creating conditions conducive to PCI failure.

With rising power, the pellets expand and crack, forming an hourglass shape. Maximum cladding stress is observed at pellet-pellet interfaces, where the maximum concentrations of iodine and cadmium occur. Additionally, axial locking of the pellets occurs within the fuel column because of thermal expansion. The biaxial stress state and high concentration of fission products produces a material that is inherently susceptible to SCC.

The PCI threshold is believed to be 7-8 kW/ft for boiling water reactor (BWR) fuel. Above this level, the risk increases with power. When operating at higher powers, the fuel is often preconditioned by changing power very slowly. The PCI threshold is shown to decrease as a function of burnup until around 15 MWd/kgU, when the threshold becomes independent of burnup. At high burnup, high concentrations of deposited fission products and radiation embrittlement create an environment conducive to PCI.

The power levels of concern are above that expected for normal operation. Data from ramp testing shows that the failure probability increases as power increases. In particular, failure is almost certain at 16 kW/ft. One example of an event that can lead to PCI failure is loss of feedwater heater.

Mitigation options for normal operation include increasing the 8x8 fuel assembly to 10x10, thereby distributing power among more fuel rods. However, the margin introduced by increasing the number of fuel pins was erased by increasing power and using more enrichment. Preconditioning techniques are effective for normal operation. Barrier fuel demonstrates PCI resistance with or without preconditioning.

For AOOs in which there is no scram, reactor power can go as high as 120 to 125 percent of the rated power, a power regime where PCI is a threat. The transient can be stopped only within a limited amount of time. Prompt operator action becomes necessary if the design is not PCI resistant. If operator action is slower than the PCI time to failure, then the fuel will fail.

The zirconium barrier cladding design has been shown experimentally to be resistant to PCI. The barrier cladding provides protection during the AOOs by design, as opposed to operator action. The real concern is not with a PCI-resistant design but with the conventional fuel cladding.

Chairman Armijo summarized the major concerns. The use of non-PCI resistant fuel in BWRs is growing. The PCI failure times are very short at AOO power levels. Margin is lost as power is increased in the 10x10 fuel assemblies. The number of fuel elements at risk during AOOs increases in proportion to the magnitude of the extended power uprate. Finally, the NRC does not have adequate analytical capability to quantify the risk of PCI failure.

NRC Staff Position:

Challenges in Addressing PCI

Mr. William Ruland, NRR, gave a general introduction for the staff’s presentations.

Michelle Flanagan, Office of Research, discussed the challenges in addressing PCI by highlighting four reports documenting work from the 1970s and '80s. A compendium written by Mike Tokar documented the rise in PCI fuel failures in the 1970s, the NRC response, and attempts to understand and model PCI. The second report documents an attempt to develop an empirical model that predicts operational PCI failures based upon data from Canadian reactors and online refueling operations. The database was found to be insufficient for developing an empirical model. The third report documents an experimental program to test operational transients that lead to larger power excursions. None of these tests demonstrated radiological release, and the conclusion was that the NRC should not further regulate PCI. The final report documents an effort to develop a mechanistic model for predicting PCI failure under a wide range of conditions, including the effects of power history and design differences. The report concluded that a comprehensive mechanistic understanding about PCI damage had not yet been achieved.

The current regulatory approach involves introducing operating limits to prevent PCI failures. Stress and stain are accounted for by modeling fuel thermal expansion, fuel gaseous and solid swelling, and irradiation effects on mechanical properties. The industry is addressing PCI through fuel design, including liner cladding, doped fuel pellets, large grain pellets, and chamfered pellet ends. More recent documents on PCI failures and fuel safety criteria reflect the approach that was taken in developing NRC's regulatory approach to PCI.

The NRC participates in international research programs on fuel integrity, including the Studsvik Cladding Integrity Project (SCIP). NRC will likely participate in the second phase, SCIP II. Ms. Flanagan concluded by stating that NRC staff participates in international research programs, engages in dialogue with the international research community, and monitors new developments concerning PCI failures.

Current Fuel Reliability Criteria from the SRP

Mr. Paul Clifford, Office of Nuclear Reactor Regulation, stated that, while the staff agrees that the SCC phenomenon has the potential to produce fuel cladding failures during an AOO, the regulations must specify performance requirements as opposed to specific design features. Regulations must also apply universally, not simply to conventional fuel. Since all fuel designs demonstrate some degree of susceptibility to SCC, there is a need to fully understand the amount of protection offered by different design options.

Additional staff concerns include the fact that SCC is neither strictly an EPU issue nor a BWR issue. For instance, the power distribution can be flattened to mitigate power peaking. While power-maneuvering and blade-movement events that occurred 20 years ago were BWR-specific, criteria addressing PCI during AOOs could potentially affect PWR's, as well. While the Susquehanna letter states that "...operator actions will assure an acceptably low number of failures," no fuel failures are allowed during moderate frequent AOOs. A specific number of failures based upon dose are allowed during infrequent AOOs, according to General Design Criteria (GDC) 10.

During PCI failures, a crack propagates through the wall, leading to the potential for fission gas release. There is no challenge to core coolable geometry, pressure vessel integrity, containment integrity, or systems designed to mitigate a transient and offsite activity release. As such, PCI failures are judged to be of low safety significance.

Two issues contribute to the low probability of occurrence of PCI failures. While the power increase must be high enough and long enough to propagate a crack, it must not be high enough to initiate a reactor trip. The power level must also remain below a level that results in predicted fuel failure according to conservative analytical methods. Finally, the duration of the event must be below reasonable timing of operator response. SSES in fact showed that operators responded very rapidly to a loss of feedwater heater event, even though the analysis does not credit operator actions until 10 minutes after the initiation of the transient. Mr. Clifford summarized by stating that there are limited staff resources to devote to PCI and that PCI is of low safety significance.

Experimental Studies of PCI Failures

Dr. John Davies, ACRS consultant from Durham University, stated that his research program involved performing ramp tests on barrier fuel that had been irradiated in power reactors at less than 6 kW/ft. The ramp testing campaign, which involved subjecting the fuel rods to LHGR's at the Studsvik R2 test reactor, occurred over six years. The test rods were pre-irradiated in low-power locations, so that the rods were not preconditioned to be less susceptible to PCI.

Pre-ramp characterization of the test rods included obtaining diameter profilometry data for determining cladding strains after the ramp test. Gamma scans measured axial burnup distribution and fissile isotope profiles, allowing accurate prediction of power profiles during the ramp test.

Ramp sequence A started at 9 kW/ft and ended at a maximum of 18 kW/ft with a ramp rate of 2 kW/ft/min. Ramp sequences B and C' were similar with ramp rates of 5.5 and 100 kW/ft/min, respectively. Ramp sequence C involved repositioning a rod after a successful A-ramp test such that a different node on the rod experienced a larger neutron flux. Performing a C sequence after an A sequence provided a method to obtain more data with a single fuel rod. Typically, the conventional nonbarrier cladding failed during the first ramp, while the barrier fuel survived through the second ramp.

The data recorded during the ramp tests included activity, power, and rod elongation as a function of time. Upon increasing the power, the data shows that the rod elongated axially, as the fuel pellet stressed the cladding upon a rise in fuel temperature. At high powers, secondary strains resulting from fission gas release were observed. Krypton and Xenon entered the gap, thereby altering the gap conductivity. The changing gap conductivity resulted in an apparent power spike. Since the pressure outside the cladding was greater than inside the cladding, the release of radioactivity was delayed from the initial formation of the PCI crack. The apparent power spike and associated secondary strains were the initial indications of PCI failure.

Finally, Consultant Davies showed metallurgical examinations of PCI cracking. Multiple cracks may initiate, and a PCI crack may demonstrate branching. PCI cracking may occur with very little strain on the cladding.

Chairman Armijo discussed the time-to-failure data resulting from Consultant Davies work. At low burnup, failure occurred at 18 kW/ft within 9 minutes. Failure times of 1 to 4 minutes were observed at high burnups (i.e., 15.5 – 28.4 MWd/kgU). Operator action may not be possible during an AOO that reaches 16 – 18 kW/ft. Without a PCI-resistant design, failure of the fuel is likely. Failure to act upon this knowledge is in violation of the General Design Criteria (GDC).

Roundtable Discussion

Mr. Clifford asked whether the six-hour preconditioning was enough time to bring the fuel gap size to values expected during operation. Consultant Davies stated that he and his research group were convinced that the gap size at the start of the experiment was typical. Mr. Clifford stated that an unexpected gap size would affect how quickly the cladding experienced strain. The uncertainty in the gap size could be a factor in benchmarking an analytical model.

Dr. Shack asked if the results of Consultant Davies' experiments were comparable to the work at the Power Burst facility. Ms. Flanagan said that the tests in the Power Burst Facility were much shorter in duration and at larger power excursion. Fuel failure was measured by radiological release.

Chairman Armijo explained that a wealth of data exists from various research programs. The NRC could have an enormous database demonstrating that PCI is an unreviewed fuel failure mechanism. The regulatory structure should demonstrate a high assurance of fuel integrity even in these low-safety significance events. Ms. Flanagan stated that one goal of the SCIP II program is to review previous experiments that have been done. Chairman Armijo stated that the staff should concentrate on time-to-failure data.

Mr. Clifford asked about the CANDU-700 graphite-lined fuel that may survive 18 kW/ft. Chairman Armijo stated that the graphite liner was an early candidate to address the PCI problem. Differences in design between Canadian and American reactors cause the graphite liner to be inadequate for use in the United States.

Mr. Clifford asked if there is a contributing factor of the fission gas release during the transient. Dr. Armijo stated that the fission gas release is important. Laboratory tests have demonstrated that cesium iodide in contact with cladding does not lead to cracked cladding. Free iodine may be the aggressive species.

Mr. Clifford offered three possible alternatives for regulating PCI failures. The first alternative, Rigid Chapter 15 Safety Analysis, ensures that there is no predicted fuel failure. This approach demonstrates a high-confidence compliance with GDC 10. Uncertainties in the analytical model may result in a situation were fuel failure is always predicted. Implementation of this approach may be expensive and time-consuming due to the development of high-confidence models. Chairman Armijo acknowledged that most fuel vendors do not run testing at high powers, which are representative of AOOs. Testing only within the fuel duty envelope may not be adequate. Alternative 2 involves using a best-estimate approach to ensure adequate operator response times and to modify plant protection systems, thereby limiting transient times. Differences in fuel design could change the requirements on operator training and plant modification. Alternative 3 is requiring physical protection, as opposed to analytical margin. Chairman Armijo stated that design solutions are preferable to operational solutions. SSES chose not to use a PCI-resistant fuel, and the potential for future EPU applicants to follow SSES's lead is cause for concern.

Member Sieber asked about the current requirements for licensees. Mr. Clifford stated that the SRP acknowledges PCI as a fuel failure mechanism, but does not specify requirements to mitigate failure by PCI. The requirements in the SRP are to avoid fuel centerline melting and 1% strain. Chairman Armijo stated that the NRC should not simply ignore the PCI issue. Members Sieber and Ray stated that the only manner in which to address this issue is to modify the 1% strain criterion. Mr. Clifford stated that efforts were underway to develop more relevant criteria for PCI, but that developing an analytical solution became more difficult than originally expected. The introduction of barrier fuel caused fuel failures to decline, and the incentive to develop new regulatory positions on PCI disappeared.

Mr. Clifford said that the staff would need to develop an independent mechanistic tool capable of predicting PCI failure, define the new SAFDL's, and develop the regulatory guidance and potential testing requirement. Workshops for the public and the industry would be necessary. Finally, the standard review plan, Section 4.2, would be revised.

Member Armijo stated that the model could be empirical, as opposed to analytical. The burden should be on licensees using marginal fuel designs. Member Seiber stated that a change would have to be cost beneficial or demanded by public health and safety.

Members Ray and Sieber discussed whether fuel design was part of the licensing basis. Mr. Clifford stated that requiring a licensee to change their fuel design, which they have used for an extended period of time, creates a backfit situation. Chairman Armijo stated that those who have been using non-PCI resistant fuel designs should not be excused so easily. Member Sieber pointed out that a reload safety analysis is required when a licensee changes the type of fuel used. If the analysis shows no fuel melting and less than 1% strain, then no additional information (such as design specifics of the new fuel) is needed. Member Ray disagreed, in the case that new vulnerabilities were introduced by the reload. Chairman Armijo stated that the GDC provides the regulatory basis to address an issue with existing requirements. The PCI issue should be addressed in a manner that does not require intensive resources.

Mr. Clifford mentioned that the SRP exists to ensure regulatory consistency. Chairman Armijo agreed that regulatory consistency is important, but stated that changes should be made if the existing requirements are not adequate. Member Ray argued that, since the use of barrier fuel was adequate to solve a technical issue, ceasing to use that design option gives the staff basis on which to act.

Mr. Thomas Galliato, AREVA, stated that their conventional fuel product is not marginal. The conventional fuel meets regulatory requirements and AREVA's expectations for fuel performance. Since 2000, there have been a similar number of failures in both liner and nonliner cladding. AREVA customers have experienced AOOs with no fuel failures. Chairman Armijo stated that other failure mechanisms, most likely fretting, could be causing the failures. Previous events should be properly analyzed in order to definitively say that the fuel was exceptionally resistant to a particular failure mechanism. Mr. Galliato pointed out that uncertainties can degrade the expected benefit of liner cladding. Chairman Armijo maintained that barrier fuels were much more PCI resistant than nonbarrier designs. Mr. Galliato stated that, due to the many factors that influence PCI vulnerability, the bundles with the highest stress levels at the start of the transient are the most susceptible to PCI failures. As such, an AOO is not a core-wide event.

Mr. David Mitchell, Westinghouse, expressed concern that, although the meeting has focused on PCI failures in BWRs, the new requirements may be enforced for pressurized water reactors, as well. Chairman Armijo responded that, if the staff determined that PCI was not a factor during AOOs, then the requirements could be BWR-specific.

Chairman Armijo stated that, while the industry has developed operating restrictions for limiting the risk of PCI during normal operation, the only mitigation for PCI during an AOO is the cladding design.

Mr. Robert Montgomery, ANATECH, stated that meeting new requirements for PCI would necessitate a large number of experiments and intensive analytical work. Member Armijo pointed out that the staff should have tools for analyzing PCI risk that are independent of industry analyses.

Mr. Montgomery pointed out that simply defining a minimum time during which PCI failure is empirically demonstrated not to occur is inadequate, since the PCI mechanism is dependent upon both time and stress in a complex manner.

Mr. Tom Tomlinson, RETAQS, cautioned that barrier fuel has been demonstrating unexpected duty-related failures. Chairman Armijo stated that failures in barrier fuel have been attributed to missing pellet surface. Pellet quality is a key factor for fuel performance in any design.

Member Comments:

ACRS Background and Concerns

Member Ray asked if cladding stresses ever result from rapid down powers, such as a reactor trip. Chairman Armijo stated that no such phenomenon has been observed.

Challenges in Addressing PCI

Chairman Armijo expressed concern that the NRC is tolerating the use of non-PCI resistant fuel designs, thereby creating a risk environment that had previously been addressed. Developing regulatory criteria does not need to be mechanistic, since a wealth of empirical data exists. Mr. Clifford stated that he recognizes the Chairman's concerns and agrees in concept.

Member Shack asked if there is recognition that the regulations are inadequate to address PCI, but there's no real problem because the situation is being handled through other means, like economic factors. Mr. Clifford stated that, when fuel failures occurred at a higher frequency during the 1970's and 80's, the industry assumed the burden to drastically reduce fuel failures without regulatory action. The success of that effort decreased the need for the NRC to codify specific criteria addressing PCI. Chairman Armijo expressed concern that, while the staff does not rely on the 1% criterion, they do rely on the design solution. When the industry does not choose the PCI-resistant design, then the inadequate criterion is relied upon.

Chairman Armijo suggested an approach that required licensees to demonstrate that the designs in use are PCI resistant, as opposed to specifying a specific design. Mr. Clifford stated that such an approach would not be legally enforceable. Member Shack and Mr. Clifford then discussed the fact that the performance requirements have to be specific enough to be enforceable. Chairman Armijo stated that appropriate performance during a ramp test could be specified as criterion. Mr. Clifford agreed.

Chairman Armijo and Mr. Clifford discussed the fact that a regulation addressing PCI would be applicable whether or not an EPU had been implemented.

Member Ray and Mr. Clifford discussed the roles uncertainty and conservatism play in developing regulatory criteria.

Chairman Armijo stated that enough experimental data exists such that NRC staff could formulate an empirical criterion, while considering how fast a transient occurred and whether operator actions mitigated the initiating event. Mr. Clifford stated that differences in fuel design must be accounted for. Chairman Armijo maintained that these differences are amenable to design analysis. Additional insights may also be gained from developing the capability to address PCI failures.

Member Sieber asked what regulation comes closest to addressing PCI. Mr. Clifford stated that no regulations govern PCI, with the possible exception of GDC-10. Member Sieber pointed out that, if licensees operate such that PCI failures occur frequently, then their own investment is jeopardized. Regulating PCI failures requires an overriding principle found in the regulations.

Member Sieber stated that the basis for regulating PCI failures is not clear. Mr. Clifford agreed, stating that an action on PCI would be a change in regulatory policy, which is different than a rulemaking action. A change in regulatory policy requires a backfit analysis.

Chairman Armijo argued that PCI should be treated in a manner similar to other fuel failure mechanisms, such as exceeding the critical power ratio, that currently are addressed by regulatory criteria. If an event occurs wherein many fuel rods fail, the industry and the NRC may suffer negative consequences.

Chairman Armijo stated that, even though no fuel was damaged during the SSES loss of feedwater event, many details of the transient are unknown, causing difficulty in making sound judgments as to why the fuel survived.

Chairman Armijo asked about the staff's plans to upgrade computer codes. Mr. Clifford stated that the staff is currently watching the developments in the international community before they modify codes. Ms. Flanagan mentioned that data from international research programs is used to benchmark FRAPCON and FRAPTRAN.

Experimental Studies of PCI Failures

Chairman Armijo stated that the fuel used in the ramp tests were fabricated in the factory, so they were production quality as opposed to laboratory quality.

Member Sieber asked about indications of fuel failure in operating plants. Chairman Armijo stated that activity increase was the only indication, but Consultant Davies' data shows that the actual failure time was shorter than the time to activity release.

Member Shack, Member Sieber, and Chairman Armijo discussed the amount of time available for operator actions. Chairman Armijo stated that the operator action must occur before the apparent power spike.

SUBCOMMITTEE DECISIONS AND ACTIONS:

Following the presentations and discussions, Chairman Armijo asked if anyone had any further questions, thanked everyone for their presentations and participation, and then adjourned the meeting at 12:20 a.m.

BACKGROUND MATERIALS PROVIDED TO THE SUBCOMMITTEE PRIOR TO THIS MEETING:

1. Status Report dated February 12, 2009 (ML090430342)
2. ACRS Letter, ACRSR-2277, dated December 20, 2007 (ML073440114)

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Note: Additional details of this meeting can be obtained from a transcript of this meeting available for downloading or viewing on the Internet at http://www.nrc.gov/reading-rm/doc-collections/acrs/tr/subcommittee/2009/ or purchase from Neal R. Gross and Co., Inc., (Court Reporters and Transcribers) 1323 Rhode Island Avenue, NW, Washington, DC 20005 (202) 234-4433.