ATTACHMENT 2 TO AEP:NRC:1291

CURRENT PAGES MARKED-UP TO SHOW
PROPOSED AMENDMENT TO THE TECHNICAL SPECIFICATIONS
DISTRIBUTED IGNITION SYSTEM

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

CONTAINMENT SYSTEMS

ELECTRIC HYDROGEN RECOMBINERS - W

LIMITING CONDITION FOR OPERATION

3.6.4.2 Two independent containment hydrogen recombiner systems shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With one hydrogen recombiner system inoperable, restore the inoperable system to OPERABLE status within 30 days or be in at least HOT STANDBY within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.2 Each hydrogen recombiner system shall be demonstrated OPERABLE:

a. At least once per 18 months by verifying during a recombiner system functional test that the minimum heater sheath temperature increases to $\geq 700^{\circ}F$ within 90 minutes and is maintained for at least 2 hours.

b. At least once per 18 months by:

1. Performing a CHANNEL CALIBRATION of all recombiner instrumentation and control circuits.

2. Verifying through a visual examination that there is no evidence of abnormal conditions within the recombiners (i.e., loose wiring or structural connections, deposits of foreign materials, etc.)

INSERT EXISTING SURVEILLANCE REQUIREMENTS 3. AND 4. FROM PAGE 3/4 6-25.

~~SURVEILLANCE REQUIREMENTS (Continued)~~ 2

3. Verifying during a recombiner system functional test that the heater sheath temperature increases to ≥ 1200°F within 5 hours and is maintained for at least 4 hours.

4. Verifying the integrity of all heater electrical circuits by performing a continuity and resistance to ground test following the above required functional test. The resistance to ground for any heater phase shall be ≥ 10,000 ohms.

1 2

NEW UNIT 1 T/S

→ MOVE TO PAGE 3/4 6-34 AFTER SURVEILLANCE REQUIREMENTS 1. AND 2.

DISTRIBUTED IGNITION SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.4.3 Both trains of the Distributed Ignition System shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With one train of the Distributed Ignition System inoperable:

a. Restore the inoperable train to OPERABLE status within 7 days, or

b. Perform surveillance requirement 4.6.4.3a once per 7 days on the OPERABLE train until the inoperable train is restored to OPERABLE status.

With no OPERABLE hydrogen igniter in one containment region, restore one hydrogen igniter in the affected containment region to OPERABLE status within 7 days, or be in HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.3 Each train of the Distributed Ignition System shall be demonstrated OPERABLE:

a. Once per 92 days by energizing the supply breakers and verifying that at least 34 of 35 igniters are energized.

b. Once per 92 days, verify at least one hydrogen igniter is OPERABLE in each containment region.

c. Once per 18 months by verifying the temperature of each igniter is a minimum 1700°F.

← MOVE TO PAGE 3/4 6-24

3/4.6.2 DEPRESSURIZATION AND COOLING SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

3/4.6.2.2 SPRAY ADDITIVE SYSTEM

The OPERABILITY of the spray additive system ensures that sufficient NaOH is added to the containment spray in the event of a LOCA. The limits on NaOH minimum volume and concentration, ensure that 1) the iodine removal efficiency of the spray water is maintained because of the increase in pH value, and 2) corrosion effects on components within containment are minimized. These assumptions are consistent with the iodine removal efficiency assumed in the accident analyses.

3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA.

The opening of containment purge and exhaust valves and locked ... sealed closed containment isolation valves on an intermittent basis under administrative control includes the following considerations: (1) stationing a qualified individual, who is in constant communication with control room, at the valve controls, (2) instructing this individual to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside the containment.

3/4.6.4 COMBUSTIBLE GAS CONTROL

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with: 1) zirconium-water reactions; 2) radiolytic decomposition of water; and 3) corrosion of metals within containment.

The acceptance criterion of 10,000 ohms is based on the test being performed with the heater element at an ambient temperature, but can be conservatively applied when the element is at a temperature above ambient.

Hydrogen Analyzers and Recombiners

INSERT A

(INSERT A WILL CONTINUE TO NEW PAGE B 3/4 6-3a)

INSERT A

Distributed Ignition System (DIS)

The DIS permits controlled burning of the excessive hydrogen generated during degraded core LOCAs postulated by 10CFR50.44 "Standards for combustible gas control system in light-water-cooled power reactors." The postulated amount of hydrogen is equivalent to that generated from the reaction of 75% of the fuel cladding with water. Controlled burning at low hydrogen concentrations precludes containment damage that could result from random ignition at high concentrations. An extensive program of testing and analysis has demonstrated that a system of strategically placed hydrogen igniters (the DIS) can be relied upon for controlled burns of the hydrogen gas postulated for degraded cores. Furthermore, it has been shown that this can be accomplished at combustion temperatures and pressures that will not challenge the integrity of the containment structure or the operability of containment equipment necessary to shutdown (and maintain shutdown) the reactor.

The hydrogen igniters are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners.

The DIS consists of two independent trains of 35 igniters located throughout containment. The igniters in each train are further divided into six groups per train powered from different phases of two separate three phase transformers. It is the transformer phase that uniquely defines a group.

Operation in Modes 1 and 2 with both trains available ensures the capability for controlled burning of hydrogen gas inside containment during degraded core LOCA events.

In Modes 3 and 4 both the hydrogen production rate and the total hydrogen production after a LOCA would be significantly less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the DIS is low. Therefore the DIS is not required in Modes 3 and 4.

In Modes 5 and 6, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations of these Modes. Therefore, the DIS is not required to be OPERABLE in Modes 5 and 6.

The 7 day Completion Time for restoration of an inoperable DIS train in Modes 1 or 2 is based on the low probability of occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding and the low probability of failure of the OPERABLE DIS train. This justification also applies to the 7 day Completion Time allowed for redundant igniters being inoperable in the same containment region. For this case there would also be ignition capability from adjacent containment regions by flame propagation to the region with no OPERABLE igniters.

Confidence in system OPERABILITY is demonstrated by surveillance testing. Since many igniters are inaccessible at power, surveillance testing in Mode 1 is limited to measurement of igniter current when the DIS is energized by groups. Measured currents are compared with baseline data for the group.

Igniter temperature measurements for all igniters can only be performed during shutdown and is performed every 18 months. This testing energizes all igniters and confirms the ability of each igniter to obtain a surface temperature of at least 1700°F. This temperature is conservatively above the temperature necessary to ignite hydrogen mixtures at concentrations near the lower flammability limit. Test experience indicates that individual igniter failures are generally total failures and do not involve the inability to reach the required temperature when an igniter is drawing normal amperage. This observed failure mode provides reasonable confidence that an igniter failing to reach the required temperature would also be detected by reduced group current measurements during the Mode 1 surveillances. Therefore the 18 month frequency for actual temperature measurements is acceptable.

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LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

DISTRIBUTED IGNITION SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.4.3 Both trains of the Distributed Ignition System shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With one train of the Distributed Ignition System inoperable:

a. Restore the inoperable train to OPERABLE status within 7 days, or

b. Perform surveillance requirement 4.6.4.3a once per 7 days on the OPERABLE train until the inoperable train is restored to OPERABLE status.

With no OPERABLE hydrogen igniter in one containment region, restore one hydrogen igniter in the affected containment region to OPERABLE status within 7 days, or be in HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.3 Each train of the Distributed Ignition System shall be demonstrated OPERABLE:

a. Once per 92 days by energizing the supply breakers and verifying that at least 34 of 35 igniters are energized.

b. Once per 92 days, verify at least one hydrogen igniter is OPERABLE in each containment region.

c. Once per 18 months by verifying the temperature of each igniter is a minimum 1700°F.

NEW UNIT 2 T/S

NEW PAGE

3/4.6.4 COMBUSTIBLE GAS CONTROL

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with: 1) zirconium-water reactions; 2) radiolytic decomposition of water; and 3) corrosion of metals within containment. These hydrogen control systems are consistent with the recommendations of Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a LOCA," March 1971.

The acceptance criterion of 10,000 ohms is based on the test being performed with the heater element at an ambient temperature, but can be conservatively applied when the heater element is at a temperature above ambient.

3/4.6.5 ICE CONDENSER

The requirements associated with each of the components of the ice condenser ensure that the overall system will be available to provide sufficient pressure suppression capability to limit the containment peak pressure transient to less than 12 psig during LOCA conditions.

3/4.6.5.1 ICE BED

The OPERABILITY of the ice bed ensures that the required ice inventory will 1) be distributed evenly through the containment bays, 2) contain sufficient boron to preclude dilution of the containment sump following the LOCA and 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA. These conditions are consistent with the assumptions used in the accident analyses.

The minimum weight figure of 1333 pounds of ice per basket contains a 5% conservative allowance for ice loss through sublimation. In the event that observed sublimation rates are equal to or lower than design predictions after three years of operation, the minimum ice baskets weight may be adjusted downward. In addition, the number of ice baskets required to be weighed each 18 months may be reduced after 3 years of operation if such a reduction is supported by observed sublimation data.

3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM

The OPERABILITY of the ice bed temperature monitoring system ensures that the capability is available for monitoring the ice temperature. In the event the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.

Hydrogen Analyzers and Recombiners

INSERT B

(INSERT B and existing sections 3/4.6.5 ICE CONDENSER, 3/4.6.5.1 ICE BED and 3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM, are continued on new page B3/4 6-4a)

INSERT B

Distributed Ignition System (DIS)

The DIS permits controlled burning of the excessive hydrogen generated during degraded core LOCAs postulated by 10CFR50.44 "Standards for combustible gas control system in light-water-cooled power reactors." The postulated amount of hydrogen is equivalent to that generated from the reaction of 75% of the fuel cladding with water. Controlled burning at low hydrogen concentrations precludes containment damage that could result from random ignition at high concentrations. An extensive program of testing and analysis has demonstrated that a system of strategically placed hydrogen igniters (the DIS) can be relied upon for controlled burns of the hydrogen gas postulated for degraded cores. Furthermore, it has been shown that this can be accomplished at combustion temperatures and pressures that will not challenge the integrity of the containment structure or the operability of containment equipment necessary to shutdown (and maintain shutdown) the reactor.

The hydrogen igniters are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners.

The DIS consists of two independent trains of 35 igniters located throughout containment. The igniters in each train are further divided into six groups per train powered from different phases of two separate three phase transformers. It is the transformer phase that uniquely defines a group.

Operation in Modes 1 and 2 with both trains available ensures the capability for controlled burning of hydrogen gas inside containment during degraded core LOCA events.

In Modes 3 and 4 both the hydrogen production rate and the total hydrogen production after a LOCA would be significantly less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the DIS is low. Therefore the DIS is not required in Modes 3 and 4.

In Modes 5 and 6, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations of these Modes. Therefore, the DIS is not required to be OPERABLE in Modes 5 and 6.

The 7 day Completion Time for restoration of an inoperable DIS train in Modes 1 or 2 is based on the low probability of occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding and the low probability of failure of the OPERABLE DIS train. This justification also applies to the 7 day Completion Time allowed for redundant igniters being inoperable in the same containment region. For this case there would also be ignition capability from adjacent containment regions by flame propagation to the region with no OPERABLE igniters.

Confidence in system OPERABILITY is demonstrated by surveillance testing. Since many igniters are inaccessible at power, surveillance testing in Mode 1 is limited to measurement of igniter current when the DIS is energized by groups. Measured currents are compared with baseline data for the group.

Igniter temperature measurements for all igniters can only be performed during shutdown and is performed every 18 months. This testing energizes all igniters and confirms the ability of each igniter to obtain a surface temperature of at least 1700°F. This temperature is conservatively above the temperature necessary to ignite hydrogen mixtures at concentrations near the lower flammability limit. Test experience indicates that individual igniter failures are generally total failures and do not involve the inability to reach the required temperature when an igniter is drawing normal amperage. This observed failure mode provides reasonable confidence that an igniter failing to reach the required temperature would also be detected by reduced group current measurements during the Mode 1 surveillances. Therefore the 18 month frequency for actual temperature measurements is acceptable.

ATTACHMENT 3 TO AEP:NRC:1291

PROPOSED AMENDMENT TO THE TECHNICAL SPECIFICATIONS
DISTRIBUTED IGNITION SYSTEM

UNIT 1

ELECTRIC HYDROGEN RECOMBINERS - W

LIMITING CONDITION FOR OPERATION

3.6.4.2 Two independent containment hydrogen recombiner systems shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With one hydrogen recombiner system inoperable, restore the inoperable system to OPERABLE status within 30 days or be in at least HOT STANDBY within the next 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.2 Each hydrogen recombiner system shall be demonstrated OPERABLE:

a. At least once per 18 months by verifying during a recombiner system functional test that the minimum heater sheath temperature increases to ≥ 700°F within 90 minutes and is maintained for at least 2 hours.

b. At least once per 18 months by:

1. Performing a CHANNEL CALIBRATION of all recombiner instrumentation and control circuits.

2. Verifying through a visual examination that there is no evidence of abnormal conditions within the recombiners (i.e., loose wiring or structural connections, deposits of foreign materials, etc.)

3. Verifying during a recombiner system functional test that the heater sheath temperature increases to ≥ 1200°F within 5 hours and is maintained for at least 4 hours.

4. Verifying the integrity of all heater electrical circuits by performing a continuity and resistance to ground test following the above required functional test. The resistance to ground for any heater phase shall be ≥ 10,000 ohms.

DISTRIBUTED IGNITION SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.4.3 Both trains of the Distributed Ignition System shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

With one train of the Distributed Ignition System inoperable:

a. Restore the inoperable train to OPERABLE status within 7 days, or

b. Perform surveillance requirement 4.6.4.3a once per 7 days on the OPERABLE train until the inoperable train is restored to OPERABLE status.

With no OPERABLE hydrogen igniter in one containment region, restore one hydrogen igniter in the affected containment region to OPERABLE status within 7 days, or be in HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.6.4.3 Each train of the Distributed Ignition System shall be demonstrated OPERABLE:

a. Once per 92 days by energizing the supply breakers and verifying that at least 34 of 35 igniters are energized.

b. Once per 92 days, verify at least one hydrogen igniter is OPERABLE in each containment region.

c. Once per 18 months by verifying the temperature of each igniter is a minimum 1700°F.

3/4.6.2 DEPRESSURIZATION AND COOLING SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

3/4.6.2.2 SPRAY ADDITIVE SYSTEM

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The opening of containment purge and exhaust valves and locked or sealed closed containment isolation valves on an intermittent basis under administrative control includes the following considerations: (1) stationing a qualified individual, who is in constant communication with control room, at the valve controls, (2) instructing this individual to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside the containment.

3/4.6.4 COMBUSTIBLE GAS CONTROL

Hydrogen Analyzers and Recombiners

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with 1) zirconium-water reactions, 2) radiolytic decomposition of water and 3) corrosion of metals within containment.

The acceptance criteria of 10,000 ohms is based on the test being performed with the heater element at an ambient temperature, but can be conservatively applied when the heater element is at a temperature above ambient.

Distributed Ignition System (DIS)

The DIS permits controlled burning of the excessive hydrogen generated during degraded core LOCAs postulated by 10CFR50.44, "Standards for combustible gas control system in light-water-cooled power reactors." The postulated amount of hydrogen is equivalent to that generated from the reaction of 75% of the fuel cladding with water. Controlled burning at low hydrogen concentrations precludes containment damage that could result from random ignition at high concentrations. An extensive program of testing and analysis has demonstrated that a system of strategically placed hydrogen igniters (the DIS) can be relied upon for controlled burns of the hydrogen gas postulated

3/4.6.4 COMBUSTIBLE GAS CONTROL (continued)

for degraded cores. Furthermore, it has been shown that this can be accomplished at combustion temperatures and pressures that will not challenge the integrity of the containment structure or the operability of containment equipment necessary to shutdown (and maintain shutdown) the reactor.

The hydrogen igniters are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA can be maintained less than the flammability limit using the hydrogen recombiners.

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Operation in MODES 1 and 2 with both trains available ensures the capability for controlled burning of hydrogen gas inside containment during degraded core LOCA events.

In MODES 3 and 4 both the hydrogen production rate and the total hydrogen production after a LOCA would be significantly less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the DIS is low. Therefore the DIS is not required in MODES 3 and 4.

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The 7 day Completion Time for restoration of an inoperable DIS train in MODES 1 or 2 is based on the low probability of occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding and the low probability of failure of the OPERABLE DIS train. This justification also applies to the 7 day Completion Time allowed for redundant igniters being inoperable in the same containment region. For this case there would also be ignition capability from adjacent containment regions by flame propagation to the region with no OPERABLE igniters.

Confidence in system OPERABILITY is demonstrated by surveillance testing. Since many igniters are inaccessible at power, surveillance testing in MODE 1 is limited to measurement of igniter current when the DIS is energized by groups. Measured currents are compared with baseline data for the group.

Igniter temperature measurements for all igniters can only be performed during shutdown and is performed every 18 months. This testing energizes all igniters and confirms the ability of each igniter to obtain a surface temperature of at least 1700°F. This temperature is conservatively above the temperature necessary to ignite hydrogen mixtures at concentrations near the lower flammability limit. Test experience indicates that individual igniter failures are generally total failures and do not involve the inability to reach the required temperature when an igniter is drawing normal amperage. This observed failure mode provides reasonable confidence that an igniter failing to reach the required temperature would also be detected by reduced group current measurements during the MODE 1 surveillances. Therefore the 18 month frequency for actual temperature measurements is acceptable.

DISTRIBUTED IGNITION SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.4.3 Both trains of the Distributed Ignition System shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTION:

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3/4.6.4 COMBUSTIBLE GAS CONTROL

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3/4.6.4 COMBUSTIBLE GAS CONTROL (continued)

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3/4.6.5 ICE CONDENSER

The requirements associated with each of the components of the ice condenser ensure that the overall system will be available to provide sufficient pressure suppression capability to limit the containment peak pressure transient to less than 12 psig during LOCA conditions.

3/4.6.5.1 ICE BED

The OPERABILITY of the ice bed ensures that the required ice inventory will 1) be distributed evenly through the containment bays, 2) contain sufficient boron to preclude dilution of the containment sump following the LOCA and 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA. These conditions are consistent with the assumptions used in the accident analyses.

The minimum weight figure of 1333 pounds of ice per basket contains a 5% conservative allowance for ice loss through sublimation. In the event that observed sublimation rates are equal to or lower than design predictions after three years of operation, the minimum ice baskets weight may be adjusted downward. In addition, the number of ice baskets required to be weighed each 18 months may be reduced after 3 years of operation if such a reduction is supported by observed sublimation data.

3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM

The OPERABILITY of the ice bed temperature monitoring system ensures that the capability is available for monitoring the ice temperature. In the event the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.