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49 CFR Parts 229 and 238
Locomotive Safety Standards; Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

49 CFR Parts 229 and 238

[Docket No. FR–2009–0095; Notice No. 3]

RIN 2130–AC16

Locomotive Safety Standards

AGENCY: Federal Railroad Administration (FRA), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: FRA is revising the existing regulations containing Railroad Locomotive Safety Standards. The revisions update, consolidate, and clarify the existing regulations. The final rule incorporates existing industry and engineering best practices related to locomotives and locomotive electronics. This includes the development of a safety analysis for new locomotive electronic systems. FRA believes this final rule will modernize and improve its safety regulatory program related to locomotives. In accordance with the requirements of the Executive Order 13563 (E.O. 13563), this final rule also modifies the existing locomotive safety standards based on what has been learned from FRA's retrospective review of the regulation. As a result, FRA is reducing the burden on the industry by modifying the regulations related to periodic locomotive inspection and headlights.

DATES: This final rule is effective June 8, 2012. Petitions for reconsideration must be received on or before June 8, 2012. Petitions for reconsideration will be posted in the docket for this proceeding. Comments on any submitted petition for reconsideration must be received on or before July 23, 2012.

ADDRESSES: Petitions for reconsideration or comments on such petitions: Any petitions and any comments to petitions related to Docket No. FRA–2009–0095, may be submitted by any of the following methods: Web site: Federal eRulemaking Portal, *http://www.regulations.gov.* Follow the online instructions for submitting comments.

- *Fax:* 202–493–2251.
- *Mail:* Docket Management Facility, U.S. Department of Transportation, 1200 New Jersey Avenue SE., W12–140, Washington, DC 20590.
- *Hand Delivery:* Room W12–140 on the Ground level of the West Building, 1200 New Jersey Avenue SE., W12–140, Washington, DC between 9 a.m. and 5 p.m. Monday through Friday, except Federal holidays.
- *Federal eRulemaking Portal:* Go to *http://www.regulations.gov.* Follow the online instructions for submitting comments.

Instructions: All submissions must include the agency name and docket number or Regulatory Identification Number (RIN) for this rulemaking. Note that all comments received will be posted without change to *http://www.regulations.gov* including any personal information. Please see the Privacy Act heading in the **SUPPLEMENTARY INFORMATION** section of this document for Privacy Act information related to any submitted comments or materials.

Docket: For access to the docket to read background documents or comments received, go to *http://www.regulations.gov* at any time or to Room W12–140 on the Ground level of the West Building, 1200 New Jersey Avenue SE., Washington, DC between 9 a.m. and 5 p.m. Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Charles Bielitz, Office of Safety Assurance and Compliance, Motive Power & Equipment Division, RRS–14, Federal Railroad Administration, 1200 New Jersey Avenue SE., Washington, DC (telephone 202–493–6314, email *charles.bielitz@dot.gov*), or Michael Masci, Trial Attorney, Office of Chief Counsel, Federal Railroad Administration, 1200 New Jersey Avenue SE., Washington, DC (telephone 202–493–6037).

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I. Executive Summary

The requirements that are being established by this final rule are based on: existing waivers that have been granted by FRA's Safety Board; existing clarifications of requirements that are currently being enforced; new developments in technology related to locomotives; and in part, on a Railroad Safety Advisory Committee recommendation. On February 22, 2006, FRA presented, and the RSAC accepted, the task of reviewing existing locomotive safety needs and recommending consideration of specific actions useful to advance the safety of rail operations. The RSAC established the Locomotive Safety Standards Working Group (Working Group) to handle this task. The Working Group met twelve times between October 30, 2006, and April 16, 2009. The Working Group successfully reached consensus on the following locomotive safety issues: locomotive brake maintenance, pilot height, headlight operation, danger markings placement, load meter settings, reorganization of steam generator requirements, and the establishment locomotive electronics requirements based on industry best practices. The full RSAC voted to recommend the consensus issues to FRA on September 10, 2009.

The Working Group did not reach consensus on several locomotive safety issues. Thus, FRA independently developed a proposal containing requirements related to: remote control locomotives, alerters, locomotive cab securement, equipping new and remanufactured locomotive cabs with air conditioning units, and a minimum permissible locomotive cab temperature. FRA also independently developed a proposal for locomotive securement. FRA has incorporated the Working Group's views to the extent possible.

In accordance with the requirements of E.O. 13563, this final rule also modifies the existing locomotive safety standards based on what has been learned from FRA's retrospective review of the regulation. E.O. 13563 requires agencies to review existing regulations to identify rules that are overly burdensome, and when possible, modify them to reduce the burden. As a result its retrospective review, FRA is reducing the burden on the industry by

modifying the regulations related to periodic locomotive inspection and headlights. FRA believes that the modifications related to periodic locomotive inspection and headlights in this final rule will not reduce safety.

Overview of Final Rule Requirements

Remote Control Locomotives

The rule related to remote control locomotives includes design and operation requirements, as well as, inspection, testing, and repair requirements. FRA's Remote Control Locomotive Safety Advisory, published in 2001, is the basis for the requirements. All of the major railroads have adopted the recommendations contained in the advisory, with only slight modifications to suit their individual operations, and the Association of American Railroads (AAR) issued an industry standard that adopted the most significant requirements of the Safety Advisory. During several productive meetings, the Working Group identified many areas of agreement regarding the regulation of remote control locomotive equipment. On issues that produced disagreement, FRA gathered useful information. Informed by the Working Group discussions and the comments to the NPRM related to this proceeding, this final rule will codify the industry's best practices related to the use and operation of remote control locomotives.

Electronic Recordkeeping

The development and improved capability of electronic recordkeeping systems has led to the potential for safe electronic maintenance of records required by part 229. Since April 3, 2002, FRA has granted a series of waivers permitting electronic recordkeeping with certain conditions intended to ensure the safety, security and accessibility of such systems. *See* FRA–2001–11014. Based on the information gathered under the experiences of utilizing the electronic records permitted under these existing waivers, the Working Group discussed, and agreed to, generally applicable requirements for electronic recordkeeping systems. This final rule will establish generally applicable requirements based on the Working Group's recommendation.

Brake Maintenance

The revisions to locomotive air brake maintenance are based on this extensive history of study and testing. Over the last several decades, FRA has granted several conditional waivers extending the air brake cleaning, repair, and test requirements of §§ 229.27 and 229.29. These extensions were designed to accommodate testing of the reliability of electronic brake systems and other brake system components, with the intent of moving toward performance based test criterion with components being replaced or repaired based upon their reliability. This final rule will establish generally applicable requirements based on the Working Group's recommendation.

Brakes, General

At a MP&E Technical Resolution Committee (TRC) meeting in December of 1999, the representatives from NYAB Corporation, a brake manufacturer, asserted that a problem with a faulty automatic or independent brake valve will not create an unsafe condition when the locomotive is operating in the trail position, provided the locomotive consist has a successful brake test (application and release) from the lead unit. The reason offered was that in order for a locomotive to operate in the trailing position, the automatic and independent brake valves must be cut-out. FRA agrees, and currently applies this rationale in regards to performing a calendar day inspection. The calendar day inspection does not require that the operation of the automatic and independent brake controls be verified on trailing locomotives. The Working Group agreed, and recommended adding a tagging requirement to prevent a trailing, non-controlling locomotive with defective independent or automatic brakes from being used as a controlling locomotive. FRA adopted this recommendation in the NPRM and retains it in this final rule.

Locomotive Cab Temperature

In 1998, FRA led an RSAC Working Group to address various cab working condition issues. To aid the Working Group discussions, FRA conducted a study to determine the average temperature in each type of locomotive cab commonly used at the time. The study concluded that at the location where the engineer operates the locomotive, each locomotive maintained an average temperature of at least 60 degrees. The window and door gaskets were maintained in proper condition on the locomotives that were studied. Now that the locomotive safety standards are in the process of being revised, FRA is incorporating existing industry practice into the regulation in an effort to maintain the current conditions. In addition to increasing the minimum cab temperature from 50 °F to 60 °F, FRA believes that requiring railroads to continue their current practice of equipping new locomotives with air conditioning units inside the locomotive cab and maintaining those units during the periodic inspection required by § 229.23, will maintain the existing level of railroad safety.

Headlights

The revisions to the headlight requirements incorporate waiver FRA 2005–23107 into part 229. The waiver permits a locomotive with one failed 350-watt incandescent lamp to operate in the lead until the next daily inspection, if the auxiliary lights remain continuously illuminated. Under the existing requirements, a headlight with only one functioning 200-watt lamp is not defective and its condition does not affect the permissible movement of a locomotive. However, the existing requirements are more restrictive for a 350-watt lamp. A locomotive with only one functioning 350-watt lamp in the headlight can be properly moved only under the conditions of § 229.9. This final rule modifies the treatment of locomotives with a failed 350-watt lamp to allow flexibility, and be consistent with the current treatment of 200-watt lamps. In accordance with E.O. 13563, this modification will reduce the downtime for locomotives with certain headlight defects, and thereby, reduce the burden on the rail industry.

Alerters

An alerter is a common safety device that is intended to verify that the locomotive engineer remains vigilant and capable of accomplishing the tasks that he or she must perform while operating a locomotive. An alerter will initiate a penalty brake application to stop the train if it does not receive the proper response from the engineer. As an appurtenance to the locomotive, an alerter must operate as intended when present on a locomotive. Section 20701 of Title 49 of the United States Code prohibits the use of a locomotive unless the entire locomotive and its appurtenances are in proper condition and safe to operate in the service to which they are placed. Under this authority, FRA has issued many violations against railroads for operating locomotives equipped with a non-functioning alerter. Alerters are currently required on passenger locomotives pursuant to § 238.237 (67 FR 19991), and are present on most freight locomotives. A long-standing industry standard currently contains various requirements for locomotive alerters. *See* AAR Standard S–5513, ''Locomotive Alerter Requirements,'' (November 26, 2007). FRA believes that the requirements proposed in the NPRM

and retained in this final rule related to alerters incorporate existing railroad practices and locomotive design, and address each of the National Transportation Safety Board (NTSB) recommendations discussed below in section v., ''General Overview of the Final Rule Requirements.''

Locomotive Electronics

This final rule retains requirements proposed in the NPRM that prescribe safety standards for safety-critical electronic locomotive control systems, subsystems, and components including requirements to ensure that the development, installation, implementation, inspection, testing, operation, maintenance, repair, and modification of those products will achieve and maintain an acceptable level of safety. This final rule is also establishing standards to ensure that personnel working with safety-critical products receive appropriate training. Of course, each railroad would be able to prescribe additional or more stringent rules, and other special instructions, provided they are consistent with the proposed standards.

Periodic Locomotive Inspection

The Working Group was unable to reach consensus on whether current locomotive inspection intervals and procedures are appropriate to current conditions. On June 22, 2009, FRA granted the Burlington Northern Santa Fe's (BNSF) request for waiver from compliance with the periodic locomotive inspection requirements. *See* Docket FRA–2008–0157. BNSF stated in their request that each of the subject locomotives are equipped with new self-diagnostic technology and advanced computer control, and that the locomotives were designed by the manufacturer to be maintained at a six month interval.

Based on the initial results of the waiver, FRA identified the periodic locomotive inspection as a potential candidate for reducing the regulatory burden on the rail industry, as required by E.O. 13563. FRA's continued observations of test during joint inspections of the brake systems shows that the waiver has been successful. As there is no material difference between the locomotive models covered by the BNSF waiver and other self diagnostic microprocessor-based locomotives, FRA is modifying the existing periodic inspection requirements to provide for a 184-day inspection interval for all locomotives equipped with microprocessor-based control systems with self-diagnostic capabilities.

Locomotive Cab Securement

By letter dated September 22, 2010, in response to a conductor being shot and killed during an attempted robbery on June 20, 2010, the Brotherhood of Locomotive Engineers and Trainmen (BLET) requested that FRA require door locks on locomotive cab doors. Under current industry practice, many locomotive cab doors are not locked. According to BLET's letter, requiring the use of door locks would impede unauthorized access to the locomotive cab and reduce the risk of violence to the train crew when confronted by a potential intruder.

In the NPRM, FRA requested comments on the various securement options that are currently available on locomotive cab doors, and whether equipping the locomotive cab with a securement device would improve safety. Based on its review of comments received, FRA believes that locomotive cab securement can potentially prevent unauthorized access to the locomotive cab, and thereby increase train crew safety. Consequently, FRA is establishing in this final rule a requirement for new and remanufactured locomotives to be equipped with a securement device.

Expected Benefits

This final rule includes numerous regulatory clarifications and adoption of most current part 229 waivers. The primary costs or burdens in this final rule are from the alerters, periodic inspection change and revised minimum (*i.e.,* cold weather) cab temperature requirements. The savings will accrue from fewer train accidents, fewer future waivers, and waiver renewals. In addition, savings would also accrue from a reduction in downtime for locomotives due to changes to headlight and brake requirements. Finally the railroad industry will accrue significant cost savings from a change in the periodic inspection requirement for micro-processor based locomotives. For the 20-year period analyzed, the estimated quantified costs total $56.2 million, and the present value (PV) (7 percent) of the estimated costs is $27.7 million. The uniform adoption of some waivers will provide cost savings from a reduction in locomotive downtime. For example, the headlight and brake maintenance waiver incorporations will reduce future industry-wide locomotive downtime, because locomotives that are not currently covered by the waivers will be permitted to continue in use. FRA also anticipates a small reduction in future accidents from the proposed alerter requirements. For the 20-year period, the estimated quantified benefits total $806.8 million, and the PV (7 percent) of the estimated quantified benefits is $385 million.

COSTS FOR FINAL RULE

[Note dollars are discounted (7%) and all costs are for a 20-year period]

Periodic Inspection	$20,820,604
AFM Calibration	136,335
Alerters—Requirement and Trip Test	4,495,455
Cab Temperature: Heaters, Maintenance & Insulation	889,503
Locomotive Electronics: File Notice & Training Documents	1,338,763
End Plates	21,187
Total	27,701,846

BENEFITS FOR FINAL RULE

[Note dollars are discounted (7%) and all benefits are for a 20-year period]

Reduction in Locomotive Downtime—Headlights	$1,588,995
Reduction in Locomotive Downtime—Brakes	2,118,660
Reduced Train Accidents—Due to Alerter Requirement	2,318,972
Cost Savings—Reduction in Waivers	975,325
Savings: High Voltage Danger Signs/Markings	317,799
Periodic Inspection: Increased Time Interval	377,825,552
Total	385,145,303

II. Statutory and Regulatory Background

FRA has broad statutory authority to regulate railroad safety. The Federal railroad safety laws (formerly the Locomotive Boiler Inspection Act at 45 U.S.C. 22–34, repealed and recodified at 49 U.S.C. 20701–20703) prohibit the use of unsafe locomotives and authorize FRA to issue standards for locomotive maintenance and testing. In order to further FRA's ability to respond effectively to contemporary safety problems and hazards as they arise in the railroad industry, Congress enacted the Federal Railroad Safety Act of 1970 (Safety Act) (formerly 45 U.S.C. 421, 431 et seq., now found primarily in chapter 201 of Title 49). The Safety Act grants the Secretary of Transportation rulemaking authority over all areas of railroad safety (49 U.S.C. 20103(a)) and confers all powers necessary to detect and penalize violations of any rail safety law. This authority was subsequently delegated to the FRA Administrator (49 CFR 1.49). Until July 5, 1994, the

Federal railroad safety statutes existed as separate acts found primarily in title 45 of the United States Code. On that date, all of the acts were repealed, and their provisions were recodified into title 49 of the United States Code. All references to parts and sections in this document shall be to parts and sections located in Title 49 of the Code of Federal Regulations.

Pursuant to its general statutory rulemaking authority, FRA promulgates and enforces rules as part of a comprehensive regulatory program to address the safety of, inter alia, railroad track, signal systems, communications, rolling stock, operating practices, passenger train emergency preparedness, alcohol and drug testing, locomotive engineer certification, and workplace safety. In 1980, FRA issued the majority of the regulatory provisions currently found at 49 CFR part 229 addressing various locomotive related topics including: inspections and tests; safety requirements for brake, draft, suspension, and electrical systems, and locomotive cabs; and locomotive cab equipment. Since 1980, various provisions currently contained in part 229 have been added or revised on an ad hoc basis to address specific safety concerns or in response to specific statutory mandates.

Topics for new regulation typically arise from several sources. FRA continually reviews its regulations and revises them as needed to address emerging technology, changing operational realities, and to bolster existing standards as new safety concerns are identified. It is also common for the railroad industry to introduce regulatory issues through FRA's waiver process. Several of FRA's requirements contained in this final rule have been partially or previously addressed through FRA's waiver process. As detailed in part 211, FRA's Railroad Safety Board (Safety Board) reviews, and approves or denies, waiver petitions submitted by railroads and other parties subject to the regulations. Petitions granted by the Safety Board can be utilized only by the petitioning party. By incorporating existing relevant regulatory waivers into part 229, FRA intends to extend the reach of the regulatory flexibilities permitted under those waivers. Although, FRA is altering a number of regulatory requirements, the comprehensive safety regulatory structure remains unchanged.

The requirement that a locomotive be safe to operate in the service in which it is placed remains the cornerstone of Federal regulation. Title 49 U.S.C. 20701 provides that ''[a] railroad carrier may use or allow to be used a locomotive or tender on its railroad line only when the locomotive or tender and its parts and appurtenances: (1) are in proper condition and safe to operate without unnecessary danger of personal injury; (2) have been inspected as required under this chapter and regulations prescribed by the Secretary of Transportation under this chapter; and (3) can withstand every test prescribed by the Secretary under this chapter.''

The statute is extremely broad in scope and makes clear that each railroad is responsible for ensuring that locomotives used on its line are safe. Even the extensive requirements of part 229 are not intended to be exhaustive in scope, and with or without that regulatory structure, the railroads remain directly responsible for finding and correcting all hazardous conditions. For example, even without these regulations, a railroad would be responsible for repairing an inoperative alerter and an improperly functioning remote control transmitter, if the locomotive is equipped with these devices.

On July 12, 2004, the AAR, on behalf of itself and its member railroads, petitioned FRA to delete the requirement contained in 49 CFR 229.131 related to locomotive sanders. The petition and supporting documentation asserted that contrary to popular belief, depositing sand on the rail in front of the locomotive wheels will not have any significant influence on the emergency stopping distance of a train. While contemplating the petition, FRA and interested industry members began identifying other issues related to the locomotive safety standards. The purpose of this task was to develop information so that FRA could potentially address the issues through the RSAC.

The locomotive sanders final rule was published on October 19, 2007 (72 *FR* 59216). FRA continued to utilize the RSAC process to address additional locomotive safety issues. On September 10, 2009, after a series of detailed discussions, the RSAC approved and provided recommendations on a wide range of locomotive safety issues including, locomotive brake maintenance, pilot height, headlight operation, danger markings, and locomotive electronics. FRA generally proposed the consensus rule text for these issues with minor clarifying modifications on January 12, 2011. *See* 76 FR 2199. The RSAC was unable to reach consensus on the issues related to remote control locomotives, cab temperature, and locomotive alerters. Based on its consideration of the information and views provided by the RSAC Locomotive Safety Standards Working Group, FRA also proposed rule text related to the non-consensus items. *Id.* Many comments were submitted to the public docket in response to the NPRM. The comment period closed on March 14, 2011. FRA is issuing this final rule after considering the comments.

III. RSAC Overview

In March 1996, FRA established the RSAC, which provides a forum for developing consensus recommendations on rulemakings and other safety program issues. The Committee includes representation from interested parties, including railroads, labor organizations, suppliers and manufacturers, and other interested parties. A list of member groups follows:

American Association of Private Railroad Car Owners (AAPRCO)
American Association of State Highway & Transportation Officials (AASHTO)
American Public Transportation Association (APTA)
American Short Line and Regional Railroad Association (ASLRRA)
American Train Dispatchers Association (ATDA)
Amtrak
AAR
Association of Railway Museums (ARM)
Association of State Rail Safety Managers (ASRSM)
BLET
Brotherhood of Maintenance of Way Employes Division (BMWED)
Brotherhood of Railroad Signalmen (BRS)
Federal Transit Administration (FTA) *
High Speed Ground Transportation Association (HSGTA)
International Association of Machinists and Aerospace Workers
International Brotherhood of Electrical Workers (IBEW)
Labor Council for Latin American Advancement (LCLAA) *
League of Railway Industry Women *
National Association of Railroad Passengers (NARP)
National Association of Railway Business Women *
National Conference of Firemen & Oilers
National Railroad Construction and Maintenance Association
National Railroad Passenger Corporation (Amtrak)
NTSB *
Railway Supply Institute (RSI)
Safe Travel America (STA)
Secretaria de Communicaciones y Transporte *
Sheet Metal Workers International Association (SMWIA)
Tourist Railway Association Inc.
Transport Canada*
Transport Workers Union of America (TWU)
Transportation Communications International Union/BRC (TCIU/BRC)
United Transportation Union (UTU)

* Indicates associate membership.

When appropriate, FRA assigns a task to the RSAC, and after consideration and debate, the RSAC may accept or reject the task. If accepted, the RSAC establishes a working group that possesses the appropriate expertise and representation of interests to develop recommendations to FRA for action on the task. These recommendations are developed by consensus. A working group may establish one or more task forces to develop facts and options on a particular aspect of a given task. The task force then provides that information to the working group for consideration. If a working group comes to unanimous consensus on recommendations for action, the package is presented to the RSAC for a vote. If the proposal is accepted by a simple majority of the RSAC, the proposal is formally recommended to FRA. FRA then determines what action to take on the recommendation. Because FRA staff has played an active role at the working group level in discussing the issues and options and in drafting the language of the consensus proposal, FRA is often favorably inclined toward the RSAC recommendation. However, FRA is in no way bound to follow the recommendation and the agency exercises its independent judgment on whether the recommended rule achieves the agency's regulatory goal, is soundly supported, and is in accordance with policy and legal requirements. Often, FRA varies in some respects from the RSAC recommendation in developing the actual regulatory proposal. If the working group or the RSAC is unable to reach consensus on recommendations for action, FRA moves ahead to resolve the issue through conventional practices including traditional rulemaking proceedings.

IV. Proceedings to Date

On February 22, 2006, FRA presented, and the RSAC accepted, the task of reviewing existing locomotive safety needs and recommending consideration of specific actions useful to advance the safety of rail operations. The RSAC established the Working Group to handle this task and develop recommendations for the full RSAC to consider. Members of the Working Group, in addition to FRA, included the following:

APTA
ASLRRA
Amtrak
AAR
ASRSM
BLET
BMWE
BRS
BNSF Railway Company (BNSF)
California Department of Transportation
Canadian National Railway (CN)
Canadian Pacific Railway (CP)
Conrail
CSX Transportation (CSXT)
Florida East Coast Railroad
General Electric (GE)
Genesee & Wyoming Inc.
International Association of Machinists and Aerospace Workers
IBEW
Kansas City Southern Railway (KCS)
Long Island Rail Road
Metro-North Railroad
MTA Long Island
National Conference of Firemen and Oilers
Norfolk Southern Corporation (NS)
Public Service Commission of West Virginia
Rail America, Inc.
Southeastern Pennsylvania Transportation Agency
SMWIA
STV, Inc.
Tourist Railway Association Inc.
Transport Canada
Union Pacific Railroad (UP)
UTU
Volpe Center
Wabtec Corporation
Watco Companies

The task statement approved by the full RSAC sought immediate action from the Working Group regarding the need for, and usefulness of, the existing regulation related to locomotive sanders. The task statement established a target date of 90 days for the Working Group to report back to the RSAC with recommendations to revise the existing regulatory sander provision. The Working Group conducted two meetings that focused almost exclusively on the sander requirement. The meetings were held on May 8–10, 2006, in St. Louis, Missouri, and on August 9–10, 2006, in Fort Worth, Texas. Minutes of these meetings have been made part of the docket in this proceeding. After broad and meaningful discussion related to the potential safety and operational benefits provided by equipping locomotives with operative sanders, the Working Group reached consensus on a recommendation for the full RSAC.

On September 21, 2006, the full RSAC unanimously adopted the Working Group's recommendation on locomotive sanders as its recommendation to FRA. The next twelve Working Group meeting addressed a wide range of locomotive safety issues. The meetings were held at the following locations on the following days:

Kansas City, MO, October 30 & 31, 2006;
Raleigh, NC, January 9 & 10, 2007;
Orlando, FL, March 6 & 7, 2007;
Chicago, IL, June 6 & 7, 2007;
Las Vegas, NV, September 18 & 19, 2007;
New Orleans, LA, November 27 & 28, 2007;
Fort Lauderdale, FL, February 5 & 6, 2008;
Grapevine, TX, May 20 & 21, 2008;
Silver Spring, MD, August 5 & 6, 2008;
Overland Park, KS, October 22 & 23, 2008;
Washington, DC, January 6 & 7, 2009; and
Arlington, VA, April 15 & 16, 2009.

At the above listed meetings, the Working Group successfully reached consensus on the following locomotive safety issues: locomotive brake maintenance, pilot height, headlight operation, danger markings placement, load meter settings, reorganization of steam generator requirements, and the establishment locomotive electronics requirements. Throughout the preamble discussion in the NPRM and this final rule, FRA refers to commentsviews, suggestions, or recommendations made by members of the Working Group. When using this terminology, FRA is referring to views, statements, discussions, or positions identified or contained in the minutes of the Working Group meetings. These documents have been made part of the docket in this proceeding and are available for public inspection as discussed in the **ADDRESSES** portion of this document. These points are discussed to show the origin of certain issues and the course of discussions on those issues at the task force or working group level. We believe this helps illuminate factors FRA has weighed in making its regulatory decisions, and the logic behind those decisions.

The reader should keep in mind, of course, that only the full RSAC makes recommendations to FRA, and it is the consensus recommendation of the full RSAC on which FRA is primarily acting in this proceeding. As discussed above, the Working Group reported its findings and recommendations to the RSAC at its September 10, 2009 meeting. The RSAC approved the recommended consensus regulatory text proposed by the Working Group, which accounts for the majority of the NPRM issued in this proceeding. 76 FR 2199. The specific regulatory language recommended by the RSAC was amended slightly for clarity and consistency. FRA independently developed proposals related to remote control locomotives, alerters, and locomotive cab temperature, issues that the Working Group discussed, but ultimately did not reach consensus. *Id.* Many comments were submitted to the public docket in response to the NPRM. The comment period closed on March 14, 2011. FRA is issuing this final rule after considering the comments.

V. General Overview of Final Rule Requirements

The retrospective review requirements of E.O. 13563, trends in locomotive operation, concern about the safe design of electronics, technology advances, and experience applying Federal regulations provide the main impetus for the revisions to FRA's existing standards related to locomotive safety. An overview of some of the major areas addressed in this final rule is provided below.

A. Remote Control Locomotives

Remote control devices have been used to operate locomotives at various locations in the United States for many years, primarily within yards and certain industrial sites. Railroads in Canada have extensively used remote control locomotives for more than a decade. FRA began investigating remote control operations in 1994 and held its first public hearing on the subject in mid-1990s to gather information and examine the safety issues relating to this new technology. On July 19, 2000, FRA conducted a technical conference in which interested parties, including rail unions, remote control systems suppliers, and railroad representatives, shared their views and described their experiences with remote control operations.

On February 14, 2001, FRA published a Safety Advisory in which FRA issued recommended guidelines for conducting remote control locomotive operations. *See* 66 *FR* 10340, Notice of Safety Advisory 2001–01, Docket No. FRA–2000–7325. By issuing these recommendations, FRA sought to identify a set of ''best practices'' to guide the rail industry when implementing this technology. As this was an emerging technology, FRA believed the approach served the railroad industry by providing flexibility to both manufacturers designing the equipment and to railroads using the technology in their operations, while reinforcing the importance of complying with all existing railroad safety regulations. All of the major railroads have adopted the recommendations contained in the advisory, with only slight modifications to suit their individual operations.

In the Safety Advisory, FRA addressed the application and enforcement of the Federal regulations to remote control locomotives. FRA discussed the existing Federal locomotive inspection requirements and the application of those broad requirements to remote control locomotive technology. The Safety Advisory explains that: ''although compliance with this Safety Advisory is voluntary, nothing in this Safety Advisory is meant to relieve a railroad from compliance with all existing railroad safety regulations [and] [t]herefore, when procedures required by regulation are cited in this Safety Advisory, compliance is mandatory.'' *Id.* at 10343. For example, the Safety Advisory states that the remote control locomotive ''system must be included as part of the calendar day inspection required by section 229.21, since this equipment becomes an appurtenance to the locomotive.'' *Id.* at 10344. Another example of a mandatory requirement mentioned in the Safety Advisory is that the remote control locomotive ''system components that interface with the mechanical devices of the locomotive, e.g., air pressure monitoring devices, pressure switches, speed sensors, etc., should be inspected and calibrated as often as necessary, but not less than the locomotive's periodic (92-day) inspection.'' *Id.; see also* 49 CFR 229.23. Thus, the Safety Advisory made clear that the existing Federal regulations require inspection of the remote control locomotive equipment.

The Safety Advisory also addressed the application of various requirements related to the operators of remote control locomotives. The Safety Advisory states that ''each person operating an RCL [remote control locomotive] must be certified and qualified in accordance with part 240 [FRA's locomotive engineer rule] if conventional operation of a locomotive under the same circumstances would require certification under that regulation.'' *Id.* at 10344. In 2006, FRA codified additional requirements to address specific operational issues such as situational awareness. *See* 71 *FR* 60372.

During several productive meetings, the Working Group identified many areas of agreement regarding the regulation of remote control locomotive equipment. On issues that produced disagreement, FRA gathered useful information. Informed by the Working Group discussions and the comments to the NPRM related to this proceeding, this final rule will codify the industry's best practices related to the use and operation of remote control locomotives.

B. Electronic Recordkeeping

The development and improved capability of electronic recordkeeping systems has led to the potential for safe electronic maintenance of records required by part 229. Since April 3, 2002, FRA has granted a series of waivers permitting electronic recordkeeping with certain conditions intended to ensure the safety, security and accessibility of such systems. *See* FRA–2001–11014. Based on the information gathered under the experiences of utilizing the electronic records permitted under these existing waivers, the Working Group discussed, and agreed to, generally applicable requirements for electronic recordkeeping systems. This final rule establishes generally applicable requirements based on the Working Group's recommendation.

C. Brake Maintenance

Advances in technology have increased the longevity of locomotive brake system components. In conjunction with several railroads and the AAR, FRA has monitored the performance of new brake systems since the Locomotive Safety Standards regulation was first published in 1980. *See* 45 *FR* 21092. The revisions to locomotive air brake maintenance are based on this extensive history of study and testing. Over the last several decades, FRA has granted several conditional waivers extending the air brake cleaning, repair, and test requirements of §§ 229.27 and 229.29. These extensions were designed to accommodate testing of the reliability of electronic brake systems and other brake system components, with the intent of moving toward performance based test criterion with components being replaced or repaired based upon their reliability.

In 1981, FRA granted a test waiver (H–80–7) to eight railroads, permitting them to extend the annual and biennial testing requirements contained in §§ 229.27 and 229.29, in order to conduct a study of the safe service life and reliability of the locomotive brake components. On January 29, 1985, FRA expanded the waiver to permit all railroads to inspect the 26–L type brake equipment on a triennial basis. In the 1990's, the Canadian Pacific Railroad (CP) and the Canadian National Railroad (CN) petitioned the FRA to allow them to operate locomotives into the United States that received periodic attention every four years. The requests were based on a decision by Transport Canada to institute a four-year inspection program following a thorough test program in Canada. In November 2000, FRA granted conditional waivers to both the CN and CP, extending the testing interval to four years for Canadian-based locomotives equipped with 26–L type brake systems and air dryers. The waiver also requires all air brake filtering devices to be changed annually and the air

compressor to be overhauled not less than every six years. In 2005, this waiver was extended industry-wide. *See* FRA–2005–21325.

In 2009, AAR petitioned for a waiver that would permit four year testing and maintenance intervals for locomotives that are equipped with 26–L type brake equipment and not equipped with air dryers. The petition assumed that the testing and maintenance intervals that are appropriate for locomotives equipped with air dryers are also appropriate for locomotives without air dryers. FRA denied the request, but granted a limited test program to determine whether the addition of operative air dryers on a locomotive merits different maintenance and testing requirements. FRA recognizes that the results of the test plan may indicate that locomotives that are not equipped with air dryers merit the same treatment as locomotives that operate without air dryers.

The New York Air Brake Corporation (NYAB) sought by waiver, and was granted, an extension of the cleaning, repairing, and testing requirements for pneumatic components of the CCBI and CCBII brake systems (FRA–2000–7367, formerly H–95–3), and then modification of that waiver to include its new CCB–26 electronic airbrake system. The initial waiver, which was first granted on September 13, 1996, extended the interval for cleaning, repairing, and testing pneumatic components of the NYAB Computer Controlled Brake (CCB, now referred to as CCB–I) locomotive air brake system under 49 CFR 229.27(a)(2) and 49 CFR 229.29(a) from 736 days to five years. The waiver was modified to include NYAB's CCB–II electronic air brake system on August 20, 1998.

To confirm that the extended brake maintenance interval did not have a negative effect on safety, FRA required quarterly reports listing air brake failures, both pneumatic and electrical, of all locomotives operating under the waiver including: Locomotive reporting marks; and the cause and resolution of the problem. All verified failures were required to be reported to FRA prior to disassembly, so that NYAB, the railroad, and FRA could jointly witness the disassembly of the failed component to determine the cause. The last quarterly submission to FRA listed 1,889 CCBI and 1,806 CCBII equipped locomotives in the United States, all of which were operating at high levels of reliability and demonstrated safety. All past tests and teardown inspections confirm the safety and reliability of the five year interval.

Based on successful performance of the two NYAB electronic air brake systems under the conditions of the 1996 and 1998 waivers, the waiver was extended for another five years on September 10, 2001 and the conditions of the waiver were modified on September 22, 2003. NYAB described the new CCB–26 electronic air brake system as an adaptation of the CCB–II system designed to be used on locomotives without integrated cab electronics. It used many of the same sub-assemblies of pneumatic valves, electronic controls and software (referred to as line replaceable units or LRUs) as the CCB–II. Some changes were made to simplify the system while maintaining or increasing the level of safety. For example, the penalty brake interface was changed to mimic the 26L system interface, allowing for a fully pneumatic penalty brake application. Also, the brake cylinder pilot pressure development has been simplified from an electronic control to a fully pneumatic version based on proven components.

Much of the software and diagnostic logic which detects critical failures and takes appropriate action to effect a safe stop has been carried over from CCB–II. Overall, NYAB characterized the CCB–26 as being more similar to CCB–II than CCB–II is to CCB–I. As a final check on the performance of the CCB–26 system, it was included in the existing NYAB failure monitoring and recording systems. For the reasons above, FRA extended the waiver of compliance with brake maintenance requirements to locomotives equipped with CCB–26 brake systems.

Similarly, WABCO Locomotive Products (WABCO), a Wabtec company, sought and was granted an extension of the cleaning, repairing, and testing requirements for pneumatic components of the EPIC brake systems (FRA–2002–13397, formerly H–92–3), and then modification of that waiver to include its new FastBrake line of electronic airbrake systems. The initial waiver conditionally extended to five years the clean, repair and test intervals for certain pneumatic air brake components contained in §§ 229.27(a)(2) and 229.29(a) for WABCO's EPIC electronic air brake equipment. WABCO complied with all of the conditions of the waiver. Specifically, WABCO provided regular reports to FRA including summaries of locomotives equipped with EPIC brake systems and all pneumatic and electronic failures. FRA participated in two joint teardown inspections of EPIC equipment after five years of service in June 2000 and May 2002. After five years of service, the EPIC brake systems were found to function normally. No faults were found during locomotive tests, and the teardown revealed that the parts were clean and in working condition.

In support of its proposal to extend brake maintenance for FastBrake brake systems, WABCO stated that virtually all of the core pneumatic technology that has been service proven in EPIC from the time of its introduction and documented as such under the provisions of the above waiver and were transferred into FastBrake with little or no change. They asserted that a further reduction of pneumatic logic devices had been made possible by the substitution of computer based logic. WABCO also provided a discussion of the similarities between the EPIC and FastBrake systems as well as the differences, which are primarily in the area of electronics rather than pneumatics. In conclusion, WABCO stated that the waiver could be amended without compromising safety. For the reasons above, FRA granted the waiver petition.

Over time, several brake systems have been brought into a performance based standard. FRA, along with railroads and brake valve manufacturers, has participated in a series of brake valve evaluations. Each evaluation was performed after extended use of a particular brake valve system to determine whether it can perform safely when used beyond the number of days currently permitted by part 229. The Working Group agreed with the evidence of success and the overall approach taken by FRA. As a result, the Working Group reached consensus on the brake maintenance standards. That consensus recommendation was included in the NPRM and is retained in this final rule.

D. Brakes, General

In December of 1999, a TRC, consisting of FRA and industry experts, met in Kansas City to consider the proper application of the phrase ''operate as intended'' contained in § 229.46 when applied to trailing, non-controlling locomotives. Extensive discussion failed to reach consensus on this issue, but revealed valuable insight into the technical underpinnings and operational realities surrounding the issue. The Working Group revived this issue, and after lengthy discussion, reached consensus.

Generally, even if a locomotive has a defective brake valve that prevents it from functioning as a lead locomotive, its brakes will still properly apply and release when it is placed and operated as a trailing locomotive. This situation can apply on either a pneumatic 26–L application or on the electronic versions

of the locomotive brake. The electronic brake often will have the breaker turned off, thus making the brake inoperative unless it is being controlled by another locomotive.

Based on reading the plain language of the existing regulation, it is not clear under what conditions a trailing, non-controlling locomotive operates as intended. The existing regulation provides that ''the carrier shall know before each trip that the locomotive brakes and devices for regulating all pressures, including but not limited to the automatic and independent brake valves, operate as intended * * *'' *See* 49 CFR 229.46. One could reasonably argue that a trailing non-controlling locomotive is operating as intended when the brakes are able to apply and release in response to a command from a controlling locomotive, because the locomotive is not intended to control the brakes when it is used in the trailing position. It could also be argued that the trailing, non-controlling locomotive's automatic and independent brake valves must be able to control the brakes whenever it is called on to do so. Under this reading, a trailing, non-controlling locomotive does not operate as intended when it is not able to control the brakes.

At the TRC meeting, the representatives from NYAB Corporation, a brake manufacturer, asserted that a problem with a faulty automatic or independent brake valve will not create an unsafe condition when the locomotive is operating in the trail position, provided the locomotive consist has a successful brake test (application and release) from the lead unit. The reason offered was that, in order for a locomotive to operate in the trailing position, the automatic and independent brake valves must be cut-out. FRA agrees, and currently applies this rationale in regards to performing a calendar day inspection. The calendar day inspection does not require that the operation of the automatic and independent brake controls be verified on trailing locomotives. The Working Group agreed, and recommended adding a tagging requirement to prevent a trailing, non-controlling locomotive with defective independent or automatic brakes from being used as a controlling locomotive. FRA adopted this recommendation in the NPRM and retains it in this final rule.

E. Locomotive Cab Temperature

In 1998, FRA led an RSAC Working Group to address various cab working condition issues. To aid the Working Group discussions, FRA conducted a cold weather study to determine the average temperature in each type of locomotive cab commonly used at the time. The study concluded that at the location where the engineer operates the locomotive, each locomotive maintained an average temperature of at least 60 degrees. The window and door gaskets were maintained in proper condition on the locomotives that were studied. Now that the locomotive safety standards are in the process of being revised, FRA is incorporating existing industry practice into the regulation in an effort to maintain the current conditions. For review, the 1998 study has been included in the public docket related to this proceeding.

In addition to increasing the minimum cab temperature from 50 °F to 60 °F, FRA believes that requiring railroads to continue their current practice of equipping new locomotives with air conditioning units inside the locomotive cab and maintaining those units during the periodic inspection required by § 229.23, will maintain the existing level of railroad safety. Current literature regarding the effect of low temperature on human performance indicates that performance decreases when the temperature decreases below 60 °F. Similarly, the literature regarding the effect of high temperature and humidity indicates that performance decreases when temperatures increase above 80 °F, and that performance decreases to an even greater extent when the temperature increases above 90 °F. *Ergonomics,* 2002 vol. 45, no. 10, 682–698. Please note that when discussing high temperatures in the research about the effects on human performance, the term temperature means the Wet Bulb Globe temperature or WBGT. When discussing accident statistics the temperatures reported were ambient not accounting for humidity and radiant heat sources.

In many occupational settings, it is desirable to minimize the health and safety effects of temperature extremes. Depending upon the workplace, engineering controls may be employed as well as the management of employee exposure to excess cold or heat using such methods as work-rest regimens. Because of the unique nature of the railroad operating environment, the locomotive cab can be viewed as a captive workplace where the continuous work of the locomotive crew takes place in a relatively small space. For this reason, in an excessively hot cab, a locomotive crew member may have no escape from extreme temperatures, since they cannot be expected to readily disembark the train and rest in a cooler environment as part of a work-rest regimen without prior planning by the railroad. As such, FRA expects reliance upon engineering controls to limit temperature extremes. When FRA considered controls for cold and hot temperature cab environments, FRA learned that there is a range of engineering controls available that can be employed. Some of these controls are presently employed to affect the cab temperature environment. Controls include isolation from heat sources such as the prime mover; reduced emissivity of hot surfaces; insulation from hot or cold ambient environments; heat radiation shielding including reflective shields, absorptive shielding, transparent shielding, and flexible shielding; localized workstation heating or cooling; general and spot (fan) ventilation; evaporative cooling; chilled coil cooling systems.

Locomotive crew performance is directly linked to railroad safety through the safe operation of trains. Locomotive engineers are responsible for operating trains in a safe and efficient manner. This requires the performance of cognitive tasks, including the mathematical information processing required for train handling, constant vigilance, and accurate perception of the train and outside environment. Conductors are responsible for maintaining accurate train consists, including the contents and position of hazardous materials cars, for confirming the aspects and indications of signals, and for ensuring compliance with written orders and instructions. A decrease in performance of any of these tasks that can be anticipated from relevant scientific findings should be avoided where amelioration can be applied.

Based on the preceding discussion and its review of existing literature on the subject, FRA believes it is appropriate to limit minimum locomotive cab temperature and also require that new locomotives be equipped with an air conditioning unit inside the locomotive cab. To ensure that an air conditioning unit is properly maintained, the unit should be inspected and maintained so that it works properly and meets or exceeds the manufacturer's minimum operating specifications during the periodic inspection that is required by § 229.23. Comments by AAR indicate that this is consistent with the current industry schedule. FRA believes that requiring the railroads to maintain their air conditioning units in a manner that meets or exceeds the manufacturer's minimum operating specifications should result in the sufficient maintenance of the units. FRA will monitor air conditioning maintenance performed by railroads to ensure that it

is being properly an adequately performed. If FRA determines that the prescribed level of maintenance is insufficient to ensure the proper functioning of the air conditioning units, FRA will consider taking regulatory action to address the issue in a future rulemaking.

AAR submitted comments stating that new locomotives have been ordered with air conditioning units for many years and that they are maintained at the periodic inspection, and that these practices are expected to continue. FRA believes that requiring railroads to continue to equip new locomotives with air conditioning units inside the locomotive cab and maintaining those units during the periodic inspection required by § 229.23, will maintain the existing level of railroad safety.

AAR and the U.S. Army's Joint Munitions Command submitted comments stating that a maximum temperature requirement that is intended to prevent excessive heat stress from affecting locomotive crew performance inside the locomotive cab: would not address a safety issue; would be difficult to accurately measure inside the locomotive cab; and, would be overly burdensome. The UTU and the BLET submitted comments supporting the establishment of a maximum temperature requirement. The comments stated that such a requirement would improve locomotive crew performance during operation of the locomotive. FRA believes that the issues need to be considered further before a determination can be made as to whether a maximum temperature requirement would be appropriate. The RSAC has recently tasked a working group with addressing issues related to fatigue management. FRA believes that the fatigue management working group is an appropriate forum for further exploring issues related to the potential benefits that could result from requiring a limit to the permissible maximum locomotive cab temperature.

F. Headlights

The revisions to the headlight requirements incorporate waiver FRA 2005–23107 into part 229. The waiver permits a locomotive with one failed 350-watt incandescent lamp to operate in the lead until the next daily inspection, if the auxiliary lights remain continuously illuminated. Under the existing requirements, a headlight with only one functioning 200-watt lamp is not defective and its condition does not affect the permissible movement of a locomotive. However, the existing requirements are more restrictive for a 350-watt lamp. A locomotive with only one functioning 350-watt lamp in the headlight can be properly moved only under the conditions of section 229.9. This final rule modifies the treatment of locomotives with a failed 350-watt lamp to allow flexibility, and be consistent with the current treatment of 200-watt lamps. In accordance with E.O. 13563, this modification will reduce the downtime for locomotives with certain headlight defects, and thereby, reduce the burden on the rail industry.

Testing showed that production tolerances for the 350-watt incandescent lamp cause most individual lamps to fall below the 200,000 candela requirement at the center of the beam. As such, two working 350-watt lamps are required to ensure 200,000 candela at the center of the beam. Testing also showed that the 350-watt incandescent lamp produced well over 100,000 candela at the center of the beam, and its high power and the position of the filament within the reflector causes the lamp to be brighter than the 200-watt incandescent lamp at all angles greater than approximately 2.5 degrees off the centerline. In other words, the only area in which the 350-watt lamp produces insufficient illumination is within 2.5 degrees of the centerline. The new requirement compensates for the reduced amount of illumination by requiring the auxiliary lights to be aimed parallel to the centerline of the locomotive and illuminate continuously.

Significantly, in 1980, when FRA promulgated the 200,000 candela requirement it could not take into consideration the light produced by auxiliary lights, because they were not required and not often used. Today, there is light in front of a locomotive produced by both the headlight and the auxiliary lights. When discussing AAR's request that the final rule permit locomotives with a nonfunctioning 350-watt lamp to operate without restriction, FRA stated that AAR's comments ''may have merit when considering locomotives with auxiliary lights aimed parallel to the centerline of the locomotive.'' *See* 69 FR 12533. While the auxiliary lights on some locomotives are aimed parallel to the centerline, on many others the auxiliary lights are aimed so that their light will cross 400 feet in front of the locomotive. The regulations only require auxiliary lights to be aimed within 15 degrees of the centerline. FRA is not aware of a basis for assuming that the light from two auxiliary lights complying with the regulations in any fashion would be insufficient, when combined with a 350-watt headlight lamp.

G. Alerters

An alerter is a common safety device that is intended to verify that the locomotive engineer remains vigilant and capable of accomplishing the tasks that he or she must perform while operating a locomotive. An alerter will initiate a penalty brake application to stop the train if it does not receive the proper response from the engineer. As an appurtenance to the locomotive, an alerter must operate as intended when present on a locomotive. Section 20701 of Title 49 of the United States Code prohibits the use of a locomotive unless the entire locomotive and its appurtenances are in proper condition and safe to operate in the service to which they are placed. Under this authority, FRA has issued many violations against railroads for operating locomotives equipped with a non-functioning alerter. Alerters are currently required on passenger locomotives pursuant to § 238.237 (67 FR 19991), and are present on most freight locomotives. A long-standing industry standard currently contains various requirements for locomotive alerters. *See* AAR Standard S–5513, ''Locomotive Alerter Requirements,'' (November 26, 2007).

After several productive meetings, the Working Group reached partial consensus on requirements related to the regulation of alerters. For those areas where agreement could not be reached, FRA has fully considered the information and views of the Working Group members and the recommendations made by the NTSB in developing the requirements related to locomotive alerters.

On July 10, 2005, at about 4:15 a.m., two Canadian National (CN) freight trains collided head-on in Anding, Mississippi. The collision occurred on the CN Yazoo Subdivision, where the trains were being operated under a centralized traffic control signal system on single track. Signal data indicated that the northbound train, IC 1013 North, continued past a stop (red) signal at North Anding and collided with the southbound train, IC 1023 South, about ¼ mile beyond the signal. The collision resulted in the derailment of six locomotives and 17 cars. Approximately 15,000 gallons of diesel fuel were released from the locomotives and resulted in a fire that burned for roughly 15 hours. Two crewmembers were on each train; all four were killed. As a precaution, about 100 Anding residents were evacuated; fortunately, they did not report any injuries. Property damages exceeded $9.5 million and

clearing and environmental cleanup costs totaled approximately $616,800.

The NTSB has issued a series of safety recommendations that would require freight locomotives to be equipped with an alerter. On April 25, 2007, the NTSB determined that a contributing cause of the head-on collision in Anding, Mississippi, was the lack of an alerter on the lead locomotive, which if present, could have prompted the crew to be more attentive to their operation of the train. *See* Recommendation R–07–1. That recommendation provides as follows: ''[r]equire railroads to ensure that the lead locomotives used to operate trains on tracks not equipped with a positive train control system are equipped with an alerter.''

Another NTSB recommendation relating to locomotive alerters was issued as a result of an investigation into the collision of two Norfolk Southern Railway freight trains at Sugar Valley, Georgia, on August 9, 1990. In that incident, the crew of one of the trains failed to stop at a signal. The NTSB concluded that the engineer of that train was probably experiencing a micro-sleep or was distracted. Based on testing, it was determined that as the train approached the stop signal, the alerter would have initiated an alarm cycle. The NTSB concluded that the engineer ''could have cancelled the alerter system while he was asleep by a simple reflex action that he performed without conscious thought.'' As a result of the investigation, the NTSB made the following recommendation to the FRA: ''[i]n conjunction with the study of fatigue of train crewmembers, explore the parameters of an optimum alerter system for locomotives. *See* NTSB Recommendation R–91–26.

Typically, alerter alarms occur more frequently as train speed increases. Unlike the Sugar Valley, Georgia, accident in which the train had slowed and entered a siding before overrunning a signal, the northbound train in the Anding, Mississippi, remained on the main track at higher speeds. Had an alerter been installed, there was a four minute time period after passing the approach signal during which the alerter would have activated four to five times. It seems unlikely that the engineer could have reset the alerter multiple times by reflex action without any increase in his awareness. Therefore, the NTSB determined that an alerter likely would have detected the lack of activity by the engineer and sounded an alarm that could have alerted one or both crewmembers. Had the crew been incapacitated or not responded to the alarm, the alerter would have automatically applied the brakes and brought the train to a stop. The NTSB concluded that had an alerter been installed on the lead locomotive of the northbound train, it may have prevented the collision.

The NTSB also closely examined the use of locomotive alerters when investigating the sideswipe collision between two Union Pacific Railroad (UP) freight trains in Delia, Kansas, on July 2, 1997. In that accident, a train entered a siding but did not stop at the other end, and it collided with a passing train on the main track. The NTSB concluded that ''had the striking locomotive been equipped with an alerter, it may have helped the engineer stay awake while his train traveled through the siding.'' As a result of its investigation, the NTSB made the following recommendation to the FRA: ''[r]evise the Federal regulations to require that all locomotives operating on lines that do not have a positive train separation system be equipped with a cognitive alerter system that cannot be reset by reflex action.'' *See* NTSB Recommendation R–99–53.

FRA believes that the requirements proposed in the NPRM and retained in this final rule related to alerters incorporate existing railroad practices and locomotive design, and address each of the NTSB recommendations discussed above. As with all of FRA's regulatory requirements, the requirements related to alerters are minimum Federal safety requirements that do not prohibit railroads from doing more to improve railroad safety. Based on industry meetings, FRA understands that the industry is considering establishing industry requirements that would be more restrictive than the Federal requirements. FRA fully supports such an effort by the industry.

H. Locomotive Electronics

After extensive discussion, the Working Group reached consensus on the requirements related to locomotive electronic systems that were proposed in the NPRM. Advances in electronics and software technology have resulted in changes to the implementation of locomotive control systems. Technology changes have allowed the introduction of new functional capabilities as well as the integration of different functions in ways that advance the building, operation, and maintenance of locomotive control systems. FRA encourages the use of these advanced technologies to improve safe, efficient, and economical operations. However, the increased complexities and interactions associated with these technologies increase the potential for unintentional and unplanned consequences, which could adversely affect the safety of rail operations.

The NPRM proposed requirements that would prescribe safety standards for safety-critical electronic locomotive control systems, subsystems, and components including requirements to ensure that the development, installation, implementation, inspection, testing, operation, maintenance, repair, and modification of those products will achieve and maintain an acceptable level of safety. The NPRM also proposed standards to ensure that personnel working with safety-critical products receive appropriate training. Of course, each railroad would be able to prescribe additional or more stringent rules, and other special instructions, provided they are consistent with the final rule.

FRA also recognizes that advances in technology may further eliminate the traditional distinctions between locomotive control and train control functionalities. Indeed, technology advances may provide for opportunities for increased or improved functionalities in train control systems that run concurrent with locomotive control. Train control and locomotive control, however, remain two fundamentally different operations with different objectives. FRA does not want to restrict the adoption of new locomotive control functions and technologies by establishing regulations for locomotive control systems intended to address safety issues associated with train control.

I. Periodic Locomotive Inspection

The Locomotive Safety Standards Working Group was unable to reach consensus on whether current locomotive inspection intervals and procedures are appropriate to current conditions. On June 22, 2009, FRA granted the BNSF request for waiver from compliance with the periodic locomotive inspection requirements. *See* Docket FRA–2008–0157. BNSF stated in their request that each of the subject locomotives are equipped with new self-diagnostic technology and advanced computer control, and that the locomotives were designed by the manufacturer to be maintained at a six month interval.

The modern locomotive equipped with microprocessor-based controls has diagnostics that monitor the functioning of locomotive equipment and record faults, particularly with respect to features relevant to the periodic inspection. Major faults are instantly addressed. Minor faults are addressed through later data analysis. In some cases, railroads have the capability of

analyzing the data remotely, without the need for the locomotive to be shopped. Among the features addressed by the self-diagnostic equipment on the locomotive models covered by this petition are the ground relay, locked power axle, slipped pinion, and traction motor flashover. Other faults monitored include contactor faults, electrical feedback signal faults, and electronic air brake faults. If the system detects an air brake system failure, the system goes into fail-safe mode. Another feature of these models is that the maintenance interval recommended by the manufacturers is 184 days. In 1980, the 92-day periodic-inspection interval instituted by FRA reflected the maintenance intervals recommended by the manufacturers at that time.

The model locomotives that are the subject of the above noted waiver use a very viscous oil instead of grease to lubricate the pinions and bull gears on traction-motor wheel assemblies. The oil does not degrade with age or thicken or thin as ambient temperature varies. Years of use have demonstrated that there is no need to check oil levels or replenish the lubricant frequently. Other relevant features of the modern locomotive include:

- Traction motor brushes last well over 184 days (most last one year);
- Improved seals and gaskets, greatly reducing the occurrence of fluid leaks and the need to inspect gusseted and sealed joints;
- Improved insulation protecting against the deterioration of locomotive wiring (microprocessors have reduced the generation of heat, which also enhances wiring life); and,
- The traction motor support bearings are completely sealed roller bearings, with lubrication only required when wheels are changed.

In the waiver petition, BNSF requested that the required 92-day periodic inspection be performed at 184-day intervals on subject locomotives, if qualified mechanical forces perform at least one of the required daily inspections every 31 days and FRA non-complying conditions that are discovered en-route or during any daily inspection are moved to a mechanical facility capable of making required repairs. Pursuant to the conditions of the waiver, data were collected on the locomotives' performance and joint FRA/BNSF inspections were conducted. The data show that safety was not impacted by extending the periodic inspection interval to 184 days. Based on the initial results of the waiver, FRA identified the periodic locomotive inspection as a potential candidate for reducing the regulatory burden on the rail industry, as required by E.O. 13563. FRA's continued observations of tests during joint inspections of the brake systems shows that the waiver has been successful. As there is no material difference between the locomotive models covered by the BNSF waiver and other self diagnostic microprocessor-based locomotives, FRA is modifying the existing periodic inspection requirements to provide for a 184-day inspection interval for all locomotives equipped with microprocessor-based control systems with self-diagnostic capabilities.

J. Rear End Markers

In 2003, the U.S. DOT's Office of Governmental Affairs received a letter from Senator Feinstein on behalf of one of her constituents. The individual suggested a revision to FRA's rear end marker regulation, which is found in part 221. Specifically, the constituent suggested that Federal regulations should require trains with distributive power on the rear to have a red marker, because a red marker would make for a safer operating environment by giving a rail worker a better indication of whether he or she is looking at the rear or front end of the train. The individual made reference to a recent fatality involving a BNSF conductor who jumped from his train because he observed a headlight that he mistakenly believed was a train on the same track, directly ahead of his train. As FRA is currently reviewing its existing requirements for locomotive safety standards, FRA requested comments on this rear end marker issue. AAR submitted the only comment related to this issue, stating that no changes should be made to the existing requirements based on the single incident mentioned above. FRA agrees that at this time there is not enough evidence to merit a change to the existing requirements.

K. Locomotive Horn

In the NPRM, FRA solicited comments regarding methods currently being used by railroads to test locomotive horns as required by § 229.129. More than one method of testing could satisfy the current testing requirements. AAR submitted the only comment on this issue, stating that an accepted ANSI or SAE standard should satisfy the requirement. However, based on AAR's comment, it is unclear which specific ANSI and SAE standards would be applicable to locomotive horn testing. FRA has been considering whether certain current methods of testing should be preferred, or additional methods should be permitted. AAR's comment did not provide enough specific information to justify modifying the existing locomotive horn requirements. At this point, the great majority of initial locomotive horn testing has been performed, and there is no clear need to modify the requirements.

L. Risk Analysis Standardization and Harmonization

FRA notes that it has been actively implementing, whenever practical, performance regulations based on the management of risk. In the process of doing so, a number of different system safety requirements, each unique to a particular regulation, have been promulgated. While this approach is consistent with the widely, and deeply, held conviction that risk management efforts should be specifically tailored for individual situations, it has resulted in confusion regarding the applicable regulatory requirements. This, in turn, has defeated one of the primary objectives of using performance based regulations, reduction in costs from simplifying regulations.

The problem is not the concept of tailoring, but the lack of standard terms, basic tools, and techniques. Numerous directives, standards, regulations, and regulatory guides establish the authority for system safety engineering requirements in the acquisition, development, and maintenance of hardware and software-based systems. The lack of commonality makes extremely difficult the task of training system safety personnel, evaluating and comparing programs, and effectively monitoring and controlling system safety efforts for the railroads, their vendors, and the government. Even though tailoring will continue to be an important system safety concept, at some point FRA believes the proliferation of techniques, worksheets, definitions, formats, and approaches has to end, or at least some common ground has to be established.

To accomplish this, FRA is harmonizing risk management process requirements across all regulations that have been promulgated by the agency. This will implement a systematic approach to hardware and software safety analysis as an integral part of a project's overall system safety program for protecting the public, the worker, and the environment. Harmonization enhances compliance and improves the efficiency of the transportation system by minimizing the regulatory burden. Harmonization also facilitates interoperability among products and systems, which benefits all

stakeholders. By overcoming institutional and financial barriers to technology harmonization, stakeholders could realize lower life-cycle costs for the acquisition and maintenance of systems. FRA will pursue appropriate, cost effective, performance based standards containing precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for purpose, and present an acceptable level of risk that are applicable across all elements of the railroad industry. FRA believes that establishing a safety analysis requirement in this final rule that is based on best engineering practices and standards in section 237.307 is consistent with goal of standardization and harmonization.

M. Locomotive Cab Securement

On June 20, 2010, a CSX Conductor was shot and killed in the cab of the controlling locomotive of his standing train in New Orleans, during an attempted robbery. The Locomotive Engineer assigned to that train was also wounded by gunfire during the incident. This incident was particularly tragic, because it resulted in a fatality. By letter dated September 22, 2010, in response to this incident, the BLET requested that FRA require door locks on locomotive cab doors. Under current industry practice, many locomotive cab doors are not locked. According to BLET's letter, requiring the use of door locks would impede unauthorized access to the locomotive cab and reduce the risk of violence to the train crew when confronted by a potential intruder.

In the NPRM, FRA requested comments on the various securement options that are currently available on locomotive cab doors, and whether equipping the locomotive cab with a securement device would improve safety. Based on its review of comments received, FRA believes that locomotive cab securement can potentially prevent unauthorized access to the locomotive cab, and thereby increase train crew safety.

The BLET and UTU submitted comments stating that locks should be designed to open from within the locomotive cab without the use of a key. Locomotive cab securement demands a careful and balanced approach, because when emergencies requiring emergency egress or rescue access occur, securement systems must not hinder rapid and easy egress by train crews or access by emergency responders without undue delay. A latching device (e.g., a dead-bolt arrangement) is sufficient to satisfy this requirement. This final rule requires that each locomotive or remanufactured locomotives ordered on or after the effective date of the final rule, or placed in service for the first time on or after six months from the effective date of the rule, be equipped with a securement device. However, FRA believes that the decision whether to use the securement device is best left to the discretion of each railroad.

AAR submitted comments stating that the railroad industry is currently developing a securement standard that will address safety concerns. Based on information gathered while attending industry meetings, FRA understands that the railroad industry is working on producing a standard that will require a securement device on the outside of an unattended locomotive cab. FRA believes that the industry is moving in the right direction on this issue and will continue to monitor the development of a new standard. If FRA determines that the actions currently being undertaken by the industry are not sufficient to ensure the proper securement of locomotive cabs from the outside, FRA will consider taking regulatory action to address this issue in a future rulemaking.

A Battalion Fire Chief from Fairfax County, Virginia, submitted comments stating that a rapid-entry box system (similar to a realtor's lock-box system) would ensure access by emergency responders into a locked locomotive cab. FRA believes that a rapid-entry box system could improve emergency responder access into the locomotive cab. However, at this time, FRA believes it would be impractical to require such a system, due to the potential cost of equipping all locomotives with the locks, the significant logistic challenges involved with distributing keys to emergency responders throughout the country, and the inability of FRA to ensure that those keys are secure.

N. Diesel Exhaust in Locomotive Cabs

In response to the NPRM, AAR submitted comments requesting that FRA clarify the meaning of existing § 229.43. Section 229.43 requires that locomotives be built with exhaust systems that are properly designed to convey engine exhaust from the engine and release it outside of the locomotive, and to ensure that the exhaust system is maintained to prevent leaks of exhaust into an occupied locomotive cab. FRA has been consistent in its enforcement of this requirement. FRA has not discovered locomotive exhaust systems that have noncompliant designs. However, FRA has found mechanical defects (*e.g.,* a cracked exhaust manifold) in locomotive exhaust systems that permit exhaust to be released into an occupied locomotive cab, and has routinely issued violations for the railroads' failure to comply with § 229.43.

Diesel exhaust from the locomotive engine that is released into an occupied locomotive cab causes a safety risk. The exhaust can adversely affect the train crew and their ability to operate the locomotive safely. Inside the locomotive cab, the exhaust causes an inhalation hazard and will reduce the train crew's vision and comfort. However, FRA did not intend for § 229.43 to prevent any and all diesel exhaust from being present in an occupied locomotive cab. It would be impracticable to try to eliminate all diesel exhaust in the locomotive cab. A locomotive that is standing with its windows open and its engine not running next to an active highway will most likely be found to have some measurable quantity of diesel exhaust in the cab, due to the traffic from the highway. The same would be found if the locomotive were located in a similar circumstance in an active marine port. Similarly, FRA does not believe that it is possible to prevent the re-entry of diesel exhaust into the locomotive cab through windows or ventilation system intakes, and has never enforced the existing regulation in such a manner.

O. Federalism Implications

One commenter suggested that FRA should add language to its discussion of the federalism implications of this final rule to clarify the pre-emptive effect of the rule. The discussion of federalism contained in the NPRM explains the federalism implications of the Locomotive Inspection Act and the existing Locomotive Safety Standards. *See* 76 FR 2224. FRA believes that the discussion of federalism implications is clear, and that changes to the final rule regarding the pre-emptive effect of the rule are not necessary.

P. E.O. 13563 Retrospective Review

In accordance with the requirements of E.O. 13563, this final rule modifies the existing locomotive safety standards based on what has been learned from FRA's retrospective review of the regulation. E.O. 13563 requires agencies to review existing regulations to identify rules that are overly burdensome, and when possible, modify them to reduce the burden. As a result of its retrospective review, FRA is reducing the burden on the industry by modifying the regulations related to periodic locomotive inspection and

headlights. FRA believes that the modifications related to periodic locomotive inspection and headlights in this final rule will not reduce safety.

VI. Section-by-Section Analysis

This section-by section analysis of the final rule is intended to explain the rationale for each section of the final rule. The analysis includes the requirements of the rule, the purpose that the rule will serve in enhancing locomotive safety, the current industry practice, and other pertinent information. The regulatory changes are organized by section number. FRA sought comments on all proposals made in the NPRM and considered the comments in issuing this final rule.

A. Amendments to Part 229 Subparts A, B, and C

Section 229.5 Definitions

This section contains a set of definitions that are being introduced into the regulation. FRA intends these definitions to clarify the meaning of important terms as they are used in the text of the final rule. The definitions are carefully worded in an attempt to minimize the potential for misinterpretation of the rule. The definition of alerter introduces an unfamiliar term which requires further discussion.

''Alerter'' means a device or system installed in the locomotive cab to promote continuous, active locomotive engineer attentiveness by monitoring select locomotive engineer-induced control activities. If fluctuation of a monitored locomotive engineer-induced control activity is not detected within a predetermined time, a sequence of audible and visual alarms is activated so as to progressively prompt a response by the locomotive engineer. Failure by the locomotive engineer to institute a change of state in a monitored control, or acknowledge the alerter alarm activity through a manual reset provision, results in a penalty brake application that brings the locomotive or train to a stop. For regulatory consistency FRA is utilizing the same definition as the one provided in part 238. FRA intends for a device or system that satisfies an accepted industry standard including, but not limited to, AAR Standard S–5513, ''Locomotive Alerter Requirements,'' dated November 26, 2007, to constitute an alerter under this definition.

New definitions for terms related to remote control locomotives are also being established. The terms, ''Assignment Address,'' ''Locomotive Control Unit,'' ''Operator Control Unit,'' ''Remote Control Locomotive,'' ''Remote Control Operator,'' and ''Remote Control Pullback Protection'' are common to the industry. FRA notes that new technology may lead to new systems that fit these definitions. For example, ''Remote Control Pullback Protection'' is currently a form of global positioning system containment system that uses automated equipment identifier tags to either stop the RCL or limit its speed so that the RCL remains within its work zone. A system that utilizes new technology that either stops the RCL or limits its speed so that the RCL remains within its work zone could also satisfy the definition. On February 14, 2001, FRA published a Safety Advisory in which FRA issued recommended guidelines for conducting remote control locomotive operations. *See* 66 FR 10340, Notice of Safety Advisory 2001–01, Docket No. FRA–2000–7325. The Safety Advisory includes definitions for each of the terms. FRA's definitions for these terms are informed by the Safety Advisory and Working Group discussions.

''Controlling locomotive'' means a locomotive from where the operator controls the traction and braking functions of the locomotive or locomotive consist, normally the lead locomotive. This definition is being added to help identify which locomotives are required to be equipped with an alerter, and when the alerter is required to be tested.

Section 229.7 Prohibited Acts and Penalties

Minimal changes are being made in this section to update the statutory reference and the statutory penalty information.

Section 229.15 Remote Control Locomotives

After working with the railroad industry for many years to provide a framework for the safe use, development, and operation of remote control devices, FRA is formally codifying safety standards for remote control operated locomotives. For convenience, this section is being divided into two headings: design and operation; and inspection and testing.

Generally, the design and operation requirements are intended to prevent interference with the remote control system, maintain critical safety functions if a crew is conducting a movement that involves the pitch and catch of control between more than one operator, tag the equipment to notify anyone who would board the cab that the locomotive is operating in remote control, and bring the train to a stop if certain safety hazards arise. The inspection and testing requirements are intended to ensure that each remote control locomotive would be tested each time it is placed in use, and ensure that the operator is aware of the testing and repair history of the locomotive. It is FRA's understanding that virtually all railroads that operate remote control locomotives have already adopted similar standards, and that they have proven to provide consistent safety for a number of years.

A comment was received suggesting that FRA should add an introductory paragraph to proposed § 229.15 to address the applicability of the section. FRA believes that the applicability of this section is clear based on the description of applicability contained in § 229.6. FRA does not intend to apply the requirements of § 229.15 differently than other requirements contained in part 229.

Another comment was received stating that the language of proposed § 229.15, if it remains unchanged in the final rule, would establish requirements that result in existing legacy configurations becoming noncompliant. According to the commentor, the legacy systems that they identify have been operating safely and to the railroads' satisfaction for years, and therefore, should be permitted to continue in operation as compliant systems under the requirements contained in § 229.15. It is not clear which requirements would affect these legacy systems, but FRA does not intend this final rule to make any specific legacy configurations noncompliant.

BLET and UTU submitted comments stating that FRA should replace the proposed language of paragraph § 229.15(a)(12)(ii), ''throttle or speed control,'' with ''speed selector.'' FRA is not adopting this suggestion. FRA believes that the suggested language change would exclude throttle/brake units. In the proposed rule, FRA did not intend to exclude throttle/brake units. The Working Group reached consensus on this specific issue, and FRA continues to believe that an OCU should have throttle capabilities in order to safely operate throttle/brake units.

AAR and HCRQ submitted comments stating that FRA should clarify proposed paragraph § 229.15(a)(7). Proposed paragraph § 229.15(a)(7) requires an RCL to initiate a full service application of the locomotive and train brakes, and eliminate locomotive tractive effort, when main reservoir pressure drops below 90 psi. The proposed language did not specifically exclude an RCL that is stationary. Under specific conditions, such as charging a lengthy cut of cars in

winter conditions, it is not uncommon for the main reservoir pressure to drop marginally. In such cases when the main reservoir pressure drops below 90 psi, it's not a sign of a system failure. Instead, the drop in pressure is an acceptable consequence given the conditions. FRA intended paragraph § 229.15(a)(7) to apply to moving RCLs and not stationary RCLs. To clarify FRA's intent, the language of this paragraph has been amended to include the words ''while RCL is moving.''

AAR also submitted comments stating that there is no wheel slide issue on RCLs, and that currently wheel slip is often indicated by the RCL equipment and not by the OCU. FRA's proposal, in paragraph § 229.15(a)(12)(xi), would have required the OCU to provide an audio/visual indication of wheel slip/slide. FRA agrees with AAR's comment and is amending the final rule by removing the wheel slide requirement that was in the proposal, and by permitting wheel slip to be indicated by the RCL as well as the OCU.

HCRQ submitted comments stating that FRA should permit the OCU to provide either an audio or visual indication of RCL movement. Proposed § 229.15(a)(12)(xii) would require an audio indication of RCL movement. HCRQ asserts that a visual notification should be sufficient, because it is equally effective. The Working Group reached consensus on this specific issue, and FRA continues to believe that an audio indication is the most effective method for indicating RCL movement. People, who are present in the yard where the RCL movement is taking place, are more likely to hear a warning than they are to see a warning. In a yard, vision can be obstructed by equipment or structures. Thus, FRA is retaining the proposed provision in this final rule.

In § 229.15(a)(13)(iii)(B) of the NPRM, FRA proposed requiring primary OCUs to be equipped with a 15 second tilt bypass feature, and secondary OCUs to be equipped with a 60 second tilt bypass feature. Based on its review of comments received, FRA is modifying the proposed provision in this final rule and is requiring the tilt bypass on both OCUs to be set at 60 seconds. AAR and HCRQ submitted comments stating that the requirement for the length of the tilt bypass should be 60 seconds, because all but one of the existing OCU models have a tilt bypass feature that is set to 60 seconds and some actions commonly performed by OCU operators exhaust more than 15 seconds and up to 60 seconds. An OCU operator may take longer than 15 seconds to throw a switch, set brakes, or lace together brake hoses. FRA agrees that 15 seconds may not be enough time for an OCU operator to complete certain actions, but also understands that in most instances the operator of the secondary OCU will be the one who is responsible for those actions and that in general pushing a button on an OCU will extend the length of the tilt bypass for an additional 15 seconds. However, in the proposal FRA did not consider the fact that the majority of OCUs are set at 60 seconds, and that it would add a cost to the industry to modify some OCUs to 15 seconds. FRA also recognizes that during a RCL operation, a crew member may switch from operating the primary OCU to operating the secondary OCU, and vice versa. Allowing both the primary and secondary OCUs to be set to 60 seconds, consistent with the great majority of existing models, will avoid confusion during such a switch.

Section 229.19 Prior Waivers

FRA is updating the language in § 229.19 to address the handling of prior waivers of requirements in part 229 under the final rule. A number of existing waivers are incorporated into the final rule and others may no longer be necessary in light of the rule. The NPRM allowed railroads the opportunity to assert that their existing waiver is necessary, and should be effective after the final rule is adopted. No comments were received related to this section, and FRA is retaining the language as proposed. As a result, waivers from any requirement of this part, issued prior to effective date of this final rule will terminate on the date specified in the letter granting the waiver, and if no date is specified, then the waiver will automatically terminate 5 years from the effective date of the rule.

On February 28, 2007, in a notice, FRA proposed the sunset of certain waivers granted for the existing locomotive safety standards. 72 *FR* 9059. The proposal urged grantees to submit existing waivers for consideration for renewal in light of potential revisions to the regulation, and explained FRA's interest in treating older waivers consistently with newer waivers that were limited to five years. The five-year limitations were issued as far back as March of 2000. The notice also established a docket to receive waivers for consideration.

In addition, the notice discussed the possibility of requiring current grantees to re-register waivers. To streamline the process, FRA did not include a re-registration requirement.

Section 229.20 Electronic Recordkeeping

As explained in paragraph (a), FRA is establishing standards for electronic recordkeeping that a railroad may elect to utilize to comply with many of the recordkeeping provisions contained in this part. As with any records, replacing a paper system that requires the physical filing of records with an electronic system and the large and convenient storage capabilities of computers, will result in greater efficiency. Increased safety will also result, as railroads will be able to access and share records with appropriate employees and FRA quicker than with a paper system. To be acceptable, electronic recordkeeping systems must satisfy all applicable regulatory requirements for records maintenance with the same degree of confidence as is provided with paper systems. The requirements are consistent with a series of waivers that FRA has granted since April 3, 2002 (Docket Number FRA–2001–11014), permitting electronic recordkeeping with certain conditions intended to ensure safety. In this section, FRA is adopting the Working Group's consensus regulatory text for electronic recordkeeping that was approved and recommended to FRA by the RSAC on September 10, 2009. The standards are organized into three categories: (1) Design requirements, (2) operational requirements, and (3) availability and accessibility requirements.

To properly serve the interest of safety, records must be accurate. Inspection of accurate records will reveal compliance or non-compliance with Federal regulations and general rail safety practices. To ensure the authenticity and integrity of electronic records, it is important that security measures be in place to prevent unauthorized access to the data in the electronic record and to the electronic system. Paragraphs (b)(1) through (5) are intended to help secure the accuracy of the electronic records and the electronic system by preventing tampering, and other forms of interference, abuse, or neglect.

Paragraphs (c)(1) and (2) are intended to utilize the improved safety capabilities of electronic systems. The requirements of paragraph (c)(1) cover both inspection and repair records. AAR submitted comments in response to the NPRM stating that the person who is performing the activity, and therefore required to make the record within 24 hours as required by paragraph (c)(1), may be prevented from making the record by Hours of Service laws. FRA

believes that the proposal addressed this issue. In the proposal, for situations when the Hours of Service laws would potentially be violated, the electronic system would be required to prompt the person to input the data as soon as he or she returns to duty. Because the issue was addressed in the proposal, FRA does not believe that any changes related to the issue are warranted.

To properly serve the interest of safety, the electronic records and the electronic recordkeeping system must be made available and accessible to the appropriate people. FRA must have access to the railroads' electronic records and limited access to the electronic recordkeeping systems to carry out its investigative responsibilities. During Working Group discussions, a member representing railroad management explained that his railroad currently can produce an electronic record within ten minutes, but that a paper record may take up to two weeks. As such, the rule provides up to fifteen days to produce paper copies and requires that the electronic records will be provided upon request.

Section 229.23 Periodic Inspection: General

This section requires railroads that choose to maintain and transfer records as provided for in § 229.20, to print the name of the person who performed the inspections, repairs, or certified work on the Form FRA F 6180–49A that is displayed in the cab of each locomotive. This will allow the train crew to know who did the previous inspection when they board the locomotive cab. This requirement was proposed in the NPRM and is being retained in the final rule. As discussed above in section I., ''Periodic Locomotive Inspection,'' FRA is also modifying the existing periodic inspection requirements contained in this section to provide for a 184-day inspection interval for all locomotives equipped with microprocessor-based control systems with self-diagnostic capabilities.

Section 229.25 Test: Every Periodic Inspection

Paragraphs (e) and (f) are added to this section to include inspection requirements for remote control locomotives and locomotive alerters during the periodic inspection. As discussed above, FRA is establishing new regulations for remote control locomotives, *see* § 229.15, and locomotive alerters, *see* § 229.140. For convenience, the maintenance for remote control locomotives and locomotive alerters that would properly be conducted at intervals matching the periodic inspection are being incorporated into this section. As proposed in the NPRM, the existing paragraph (d) related to steam generators has been removed from this section and added to § 229.114. As discussed below, FRA is consolidating all of the requirements related to steam generators into § 229.114. The other paragraphs in this section are also being reorganized to accommodate the removal of paragraph (d).

Section 229.27 Annual Tests

FRA is amending paragraph (b) of this section by deleting the following previous language: ''The load meters shall be tested'' from the paragraph. The modification clarifies the regulatory language to reflect the current understanding and application of the load meter requirement. FRA issued a clarification for load meters on AC locomotives on June 15, 1998. In a letter to GE Transportation Systems in March 2005, FRA issued a similar clarification of the requirements related to testing load meters on DC locomotives. The letter explained that on locomotives that are not equipped with load meters there are no testing requirements. Similarly, if a locomotive is equipped with a load meter but is using a proven alternative method for providing safety, and no longer needs to ascertain the current or amperage that is being applied to the traction motors, there are no testing requirements for the dormant load meter. Load meters have been eliminated or deactivated on many locomotives because the locomotives are equipped with thermal protection for traction motors and no longer require the operator to monitor locomotive traction motor load amps.

FRA is also removing the existing paragraph (a) from this section and merging it into the brake requirements contained in § 229.29 of this final rule. Section 229.29 concerns brake maintenance, and as discussed below, is being reorganized by this final rule to consolidate all existing locomotive brake maintenance into one regulation.

Section 229.29 Air Brake System Calibration, Maintenance, and Testing

This section is re-titled by this final rule, and existing requirements are now consolidated and better organized to improve clarity. Because § 229.29 concerns only brakes, it is be re-titled, ''Air Brake System Calibration, Maintenance, and Testing'' to more accurately reflect the section's content. Existing § 229.27(a), which also addresses brake maintenance is being integrated into this section for convenience and clarity. Recordkeeping requirements for this section are being moved from existing paragraphs (a) and (b), and merged into a single new paragraph (g). The date of air flow method (AFM) indicator calibration is being added to this section and will be required to be recorded and certified in the remarks section of Form F6180–49A under paragraph (g) of this final rule.

The brake maintenance requirements contained in this section of the final rule extend the intervals at which required brake maintenance is performed for several types of locomotive brake systems. The length of the intervals reflects the results of studies and performance evaluations related to a series of waivers that have been granted by FRA, starting in 1981 and continuing to present day. Overall, the type of brake maintenance that is required remains the same. The existing regulation provides for two levels of brake maintenance. Existing § 229.27(a) required routine maintenance for filters and dirt collectors, and brake valves and existing § 229.29(a) requires maintenance for certain brake components including parts that can deteriorate quickly and pieces of equipment that contain moving parts. To better tailor the maintenance requirements to the equipment needs and based on information ascertained from various studies and performance evaluations conducted by FRA over the last decade, filters and dirt collector maintenance are now being required more frequently than brake valve maintenance. As a result, this final rule establishes three levels of brake maintenance instead of two.

In the NPRM, FRA stated that it was studying the effect, if any, that air dryers have on the maintenance of brake systems, and FRA sought comment. AAR submitted comments stating that there is no safety reason to treat the air dryer equipped locomotives differently than locomotives that are not equipped with air dryers. As evidence, AAR cites the results of the joint teardown tests that railroads have conducted with FRA as a condition to existing brake maintenance waivers. FRA believes that early indications from teardown testing of electronic air brake systems beyond five years in service support AAR's comments. However, because many tests and teardowns remain to be done, FRA believes that it is premature to discount the potential positive effects of air dryers on extending the life of certain brake components.

Paragraph (f)(2) sets maintenance intervals at four years for slug units that are semi-permanently attached to a host locomotive. Slugs are used in situations where high tractive effort is more

important than extra power, such as switching operations in yards. A railroad slug is an accessory to a diesel-electric locomotive. It has trucks with traction motors but is unable to move about under its own power, as it does not contain a prime mover to produce electricity. Instead, it is connected to a locomotive, called the host, which provides current to operate the traction motors.

In this final rule, FRA is incorporating locomotive brake maintenance requirements from part 238 into this section for convenience. FRA believes that there is some benefit to moving all of the locomotive brake maintenance requirements, including MU locomotives, from part 238 to part 229. Amtrak submitted comments stating that moving the requirements into part 229 would force them to remove entire Acela trainsets from service when any defects are found on a power car. In addition, Amtrak requested that Acela power cars be reclassified so that requirements from part 229 do not apply to Acela power cars. FRA believes that the reclassification of power cars would be outside of the scope of this rulemaking proceeding, and therefore, cannot be properly addressed in this final rule. However, FRA is open to discussing this issue further, outside of this rulemaking proceeding. FRA does not believe that moving the brake maintenance requirements into part 229 results in any change to the treatment of Acela power cars under the Federal railroad safety laws. It appears that Amtrak's concern is based on a misinterpretation of FRA's proposal. Contrary to Amtrak's assertion, FRA is not changing the existing Inspection, Testing, and Maintenance (ITM) requirements for Tier II passenger equipment under part 238. Only brake maintenance requirements are being moved to part 229, and their movement does not affect the Tier II ITM.

Paragraph (g)(1) requires that the date of AFM indicator calibration shall be recorded and certified in the remarks section of Form F6180–49A. AAR submitted comments stating that there is no need to keep a separate record of the AFM calibration date, because the date would be the same as the date of the periodic inspection. FRA understands that, although the frequency of the periodic inspection and the AFM indicator calibration may be the same for some locomotives, they may not be conducted on the same day, because the AFM indicator calibration is not part of the periodic inspection. FRA recognizes that many railroads choose to perform the AFM indicator calibration and the periodic inspection at the same time, but other railroads may choose to schedule the AFM calibration on a date other than the date of the periodic inspection. Therefore, FRA believes a separate record of the AFM indicator calibration date is necessary and is retaining paragraph (g)(2) of the final rule as proposed.

Section 229.46 Brakes: General

FRA is clarifying this section, and establishing standards for the safe use of a locomotive with an inoperative or ineffective automatic or independent brake control system. The section permits a locomotive with a defective air brake control valve to run until the next periodic inspection that is required by § 229.23. However, the requirement to place a tag on the isolation switch will notify the crew that the locomotive can be used only if it complies with the conditions contained in paragraph 229.46(b) until it is repaired.

The conditions contained in paragraphs (b)(2) through (6) clarify what it means for the brakes to operate as intended, as required by this section. Some Working Group members stated that the automatic and independent brake valves are not intended to function on a trailing unit that is isolated from the train's air brake system, therefore they were ''operating as intended'' when not operating at all. Generally, when a unit is found with an automatic or independent brake defect, the railroad may choose to move the unit to a trailing position, and because it is in a trailing position, it may be dispatched without record of the need for maintenance. Paragraph (b)(1) explicitly permits units with inoperative or ineffective automatic and/or independent brake valves to be used in the trailing position. Generally, paragraphs (b)(2) through (6) ensure that the trailing unit is handled safely, and that appropriate records are kept and repairs are made. Paragraph (b)(2) requires that the railroad and the locomotive, and/or air brake manufacturer determine that the control locomotive can safely operate with the defective unit in the trailing position.

AAR submitted comments stating that the railroad should not be required to consult with the locomotive or air brake manufacturer, because the railroad is capable of making the safety determination on its own. FRA believes that input from the manufacturers will improve the safety determination. The manufacturers are experts on the sophisticated electronically controlled air brake systems that are currently in use in the railroad industry (e.g. air brake systems that contain forced lead software). It is only prudent to consult with the manufacturer when assessing the capabilities of the air brake system.

GE submitted comments asking what kind of documentation will be required from the locomotive manufacturer in support of the determination required by paragraph (b)(2). The requirement contained in (b)(2) is intended to ensure that a proper safety determination is made based on the relevant knowledge of the manufacturer and the railroad. The locomotive and/or airbrake manufacturer should provide the railroad with technical information that is sufficient to establish the proper means for isolating or disabling the inoperative or ineffective automatic and/or independent air brake control valve, explaining how it does not pose a risk to the safe control of the automatic and independent brake systems by the controlling locomotive and, any other information that the manufacturer believes is relevant.

Section 229.61 Draft System

FRA is removing the requirement related to MCB contour 1904 couplers currently contained in paragraph (a)(1), because it is out dated. The existing requirement prohibits the use of a MCB contour 1904 coupler, if the distance between the guard arm and the knuckle nose is more than 5⅛ inches. FRA understands that the MCB contour 1904 coupler design has not been used in the railroad industry since the 1930s. Most, if not all, of the current locomotive fleet are equipped with Type E couplers. For these couplers, the maximum distance permitted between the guard arm and the knuckle nose is 5⁵⁄₁₆ inches, as identified in existing paragraph (a)(1). In the NPRM, FRA sought comments as to whether any locomotives are currently being operated with MCB contour 1904 couplers, and whether the requirement related to MCB contour 1904 couplers should be removed from the locomotive safety standards. FRA also proposed the reorganize the remaining paragraphs in this section to accommodate the removal of paragraph (a)(1). AAR submitted the only comment on this issue, stating that it is unaware of any locomotives that are currently operating with MCB contour 1904 couplers, and AAR suggested removing the requirement from the locomotive safety standards. FRA agrees with AAR's comment and believes that the MCB contour 1904 coupler design is no longer being used in the railroad industry, and therefore, the requirement is no longer needed. Consequently, the final rule adopts the provision as proposed.

Section 229.85 High Voltage Markings: Doors, Cover Plates, or Barriers

FRA is clarifying this section. The purpose of this section is to warn people of a potential shock hazard before the high voltage equipment is exposed. A conspicuous marking on the last cover, door, or barrier guarding the high voltage equipment satisfies the purpose of this section. Many locomotives have multiple doors in front of high voltage equipment. Often there is a door on the car body that provides access to the interior of the car body which contains high voltage equipment that is guarded by an additional door, for example, main generator covers and electrical lockers. FRA's intent has been to require the danger marking only on the last door that guards the high voltage equipment. Thus, FRA has slightly modified the language currently contained in this section to make this intent clear and unambiguous. To further clarify the intent of this section, FRA is also changing the title.

MTA submitted comments stating that the proposed wording did not make clear the intent of the change, which as noted in the preamble, is to require the warning marking on the last object before accessing the high voltage equipment. According to MTA, if one did not read the preamble, it would not be apparent that ''direct'' was meant to convey this intent and the wording would be too subjective. MTA did not explain why it believes that the word ''direct'' is too subjective or provide language that would better clarify the intent of this section. FRA continues to believe that the word ''direct,'' as used in the proposed language, sufficiently identifies the cover, door, or barrier that is located immediately in front of the high voltage equipment. The Working Group reached consensus on the proposed language with agreement that the proposed language would require the danger marking only on the last door that guards the high voltage equipment. Based on the Working Group's consensus, and without alternative language to consider, FRA is adopting the proposed language in the final rule without change. If needed, FRA believes that the explanation of the intent of the requirement that is contained in this preamble will add clarity to the rule text.

Section 229.114 Steam Generator Inspections and Tests

FRA is adding this section in order to consolidate the steam generator requirements contained in various sections of part 229 into a single section. Current requirements related to steam generators could be found in §§ 229.23, 229.25, and 229.27. Consolidating the requirements into one section makes them easier to find for the regulated community, and helps simplify and clarify each of the sections that currently include a requirement related to steam generators. The requirements contained in this section are not intended to change the substance of any of the existing requirements.

Section 229.119 Cabs, Floors, and Passageways

In paragraph (d), FRA is raising the minimum allowable temperature in an occupied locomotive cab from 50 degrees to 60 degrees. Each occupied locomotive cab would be required to maintain a minimum temperature of 60 degrees Fahrenheit when the locomotive is in use. FRA recognizes that it takes some time for the cab to heat up when the locomotive is first turned on, and that some crew members may prefer to work in slightly cooler temperatures and temporarily turn off the heater. Thus, this requirement will only be applicable in situations where the locomotive has had sufficient time to warm-up and where the crew has not adjusted that temperature to a personal setting.

In paragraph (e), FRA is clarifying the existing requirement related to the continuous barrier on an open-end platform by adding a hyphen between words ''open'' and ''end.'' In the old part 230, issued in 1968, paragraph 230.229 (g) addressing the required continuous barrier, contains the wording ''Safe and suitable means shall be provided for passage between units with open-end platforms.'' The hyphen makes clear that the requirement is referring to locomotive platforms that are open at the end, and not locomotive platforms that are open to the sky. In 1980, when the Locomotive Safety Standards were revised, the hyphen was inadvertently removed without explanation, and without intention to change the meaning of the existing requirement. FRA believes that reinserting the hyphen clarifies the requirement without changing it.

In paragraphs (g) and (h), FRA is establishing requirements related to air conditioning units inside of locomotive cabs. Paragraph (g) will require all new locomotives to be equipped with an air conditioning unit. The requirement will only apply to locomotives ordered after the effective date of the rule and to any locomotive placed in service after the effective date of the final rule. Paragraph (h) will require air conditioning units on such locomotives to be maintained during the periodic inspection that is required by § 229.23. FRA expects the maintenance to be sufficient to sustain or restore proper functionality of the air conditioning unit, meeting or exceeding the manufacturer's minimum operating specifications. FRA believes that requiring the railroads to maintain their air conditioning units in a manner that meets or exceeds the manufacturer's minimum operating specifications should result in the sufficient maintenance of the units. FRA will monitor air conditioning maintenance performed by railroads to ensure that it is being properly and adequately performed. If FRA determines that the prescribed level of maintenance is insufficient to ensure the proper functioning of the air conditioning units, FRA will consider taking regulatory action to address the issue in a future rulemaking.

FRA understands that railroad's often replace defective air conditioning units, rather than make repairs. If a railroad elects to replace its air conditioning unit during the periodic inspection, the replacement will be considered appropriate maintenance.

In paragraph (i), FRA is requiring new locomotives to be equipped with a securement device that will secure each locomotive cab from the inside. The locomotive cab is secured when the door cannot be opened from the outside by an unauthorized person, unless broken by force. A dead-bolt type arrangement can satisfy this requirement, but FRA expects that other designs may also satisfy this requirement. The requirement will apply only to locomotives ordered after the effective date of the rule and to any locomotive placed in service 6 months after the effective date of the final rule to allow railroads a reasonable amount of time to comply. However, FRA does expect all new locomotives, as of the implementation date of paragraph § 229.119(i), to fully comply with the new requirements.

Section 229.123 Pilots, Snowplows, End Plates

FRA is clarifying paragraph (a) of this section. Based on experience applying the regulation, FRA recognizes that a reasonable, but improper, reading of the existing language could lead to the incorrect impression that a pilot or snowplow is not required to extend across both rails. To prevent this misunderstanding and to clarify the existing requirement, the phrase ''pilot, snowplow or end plate that extends across both rails'' is substituted for ''end plate which extends across both rails, a pilot, or a snowplow.'' FRA believes this language makes clear that any of the

above mentioned items must extend across both rails.

Due to the height of retarders in hump yards, it is not uncommon for the pilot, snowplow, or endplate to strike the retarder during ordinary hump yard operations. To accommodate the retarders and prevent unnecessary damage, FRA has issued waivers to permit more clearance (the amount of vertical space between the bottom of the pilot, snowplow, or endplate and the top of the rail) in hump yards, if certain conditions are met. FRA is adding paragraph (b) to this section to obviate the need for individual waivers by incorporating these conditions into the revised regulation. The conditions that were included in the waivers are reflected in paragraphs (b)(1) through (5).

The clearance requirement is intended to ensure that obstructions are cleared from in front of the locomotive and to prevent the locomotive from climbing and derailing. In FRA's experience, hump yards contain few obstructions that present this potential risk. The protections provided by a pilot, snowplow, or endplate are most desirable at grade crossings where the requirement would remain without change. This section also establishes various requirements to ensure that the train crew is notified of the increased amount of clearance and to prevent the improper use of the locomotive. Locomotives with additional clearance are required to be stenciled at two locations; the train crew must be notified of any restrictions being placed on the locomotive; and, the amount of clearance must be noted on the Form FRA 6180–49a that is maintained in the cab of the locomotive.

AAR submitted comments stating that FRA should not require the increased amount of clearance to be noted on the Form FRA 6180–49a that is maintained in the cab of the locomotive. AAR believes that stenciling the increased amount of clearance on both ends of the locomotive will provide sufficient notice of the clearance height. FRA continues to believe that noting the increased amount of clearance on the Form FRA 6180–49a that is maintained in the cab of the locomotive will benefit safety. The Form FRA 6180–49a provides a routinely used, centralized location for the railroad to record important information about the locomotive. As a result, the information is made easily accessible to train crew members and to FRA inspectors inside the locomotive cab. The stenciling will provide additional notification to train crew members and FRA inspectors who are on the ground during the movement of the locomotive.

Section 229.125 Headlights and Auxiliary Lights

To incorporate an existing waiver, this section permits a locomotive to remain in the lead position until the next calendar day inspection after an en route failure of one incandescent PAR 56, 74 Volt, 350 Watt lamp, if certain safety conditions are satisfied. FRA is also extending the existing auxiliary intensity requirements at 7.5 degrees and 20 degrees to the headlight to clarify the criteria by which equivalence of new design head-light lamps will be evaluated to achieve the same safety benefit.

When one of two lamps in a headlight utilizing PAR–56, 350-watt, 74 volt lamps is inoperative, the center beam illumination for that headlight often drops below 200,000 candela due to manufacturing tolerances. FRA issued a waiver that allowed a locomotive equipped with these lamps to continue in service as a lead unit until the next calendar day inspection, when one of the two lamps becomes inoperative. Alternatively, when locomotives are handled under the general movement for repair provision of § 229.9, they are required to be repaired or switched to a trailing position at the next forward location where either could be accomplished. Paragraph (a)(2)(i) of this section, incorporates the waiver into the regulation. Conditions listed in paragraphs (a)(2)(i)(A), (B), and (C) ensure that neither locomotive conspicuity at grade crossings, nor the illumination of the right of way will be compromised.

Section 229.133 Interim Locomotive Conspicuity Measures—Auxiliary External Lights

To update the regulations related to locomotive conspicuity, FRA is removing the ditch light and crossing light requirements contained in § 229.133 that have been superseded by similar requirements in § 229.125. Section 229.133 currently contains interim locomotive conspicuity measures that were incorporated into the regulations in 1993 while the final provisions related to locomotive auxiliary lights were being developed. See 58 FR 6899; 60 FR 44457; and 61 FR 8881. The requirements related to ditch lights and crossing lights in § 229.133 were later superseded by similar requirements in § 229.125, published in 1996, and revised in 2003 and 2004. See 68 FR 49713; and 69 FR 12532. In 1996, locomotives equipped with ditch lights or crossing lights that were in compliance with the requirements of § 229.133 were temporarily deemed to be in compliance with § 229.125 (*i.e.,* grandfathered into the new regulation). However, that provision expired on March 6, 2000. As a result, ditch lights and crossing lights that comply with § 229.133 have not satisfied the requirements of § 229.125 for more than 10 years. No substantive changes to the auxiliary external light requirements were proposed in this section.

Section 229.140 Alerters

This section requires locomotives that operate over 25 mph to be equipped with an alerter and requires the alerters to perform certain functions. Today, a majority of locomotives are equipped with alerters. As an appurtenance to the locomotive, the alerters have been required to function as intended, if installed in the locomotive cab. The requirements contained in this final rule will increase the number of locomotives equipped with an alerter, and provide specific standards to ensure that the alerters are used and maintained in a manner that increases safety.

EMD and AAR submitted comments related to paragraph (a) stating that the implementation period for this section should be 1 year, rather than the 90 days that FRA proposed in the NPRM. FRA agrees that it is reasonable to provide up to 1 year for the railroads to comply, because the manufacturers need sufficient time to complete work on existing orders that were made before the rule became effective and would not comply with the rule. Accordingly, FRA is establishing an implementation period of 1 year in paragraph (a)(1).

During Working Group discussions, all parties agreed that an alerter would be considered non-compliant if it failed to reset in response to at least three of the commands listed in paragraphs (b)(1) through (6) of this section, in addition to the manual reset. It is important that locomotives equipped with an alerter adhere to minimum performance standards to ensure that the alerter serves its intended safety function. Utilizing several different reset options for the warning timing cycle increases the effectiveness of the alerter, as it will require differentiated cognitive actions by the operator. This will help prevent the operator from repeating the same reset many times as a reflex, without having full awareness of the action.

BLET and UTU submitted comments stating that alerter requirements for locomotives that operate at speeds less than 25 MPH would improve safety. FRA believes that tailoring the alerter

standard to a minimum operational speed will permit operational flexibility while maintaining safety. Many freight railroads only operate over small territories. They generally move freight equipment between two industries or interchange traffic with other, larger railroads. For these operations, the advantages of and the ability to move at higher speeds are non-existent. Moreover, movements at these lower speeds greatly reduce the risk of injury to the public and damage to equipment. For these reasons, there is a reduced safety need for requiring alerters on locomotives conducting these shorter, low speed movements. In addition, as an appurtenance to the locomotive, an alerter must operate as intended when present on a locomotive. Section 20701 of Title 49 of the United States Code prohibits the use of a locomotive unless the entire locomotive and its appurtenances are in proper condition and safe to operate in the service to which they are placed. Therefore, if a locomotive that operates at speeds less than 25 MPH is equipped with an alerter, the alerter will be required to function. Under this authority, FRA has issued many violations against railroads for operating locomotives equipped with a non-functioning alerter.

Paragraph (f) will ensure that the locomotive alerter on the controlling locomotive is always tested prior to being used as the controlling locomotive. The test is required during the trip that the locomotive is used as a controlling locomotive. This requirement allows the crew to know the alerter functions as intended each time a locomotive becomes the controlling locomotive.

B. Part 229 Subpart E—Locomotive Electronics

Comments on the proposed part 229 subpart E were received from the AAR, GE, MTA, and CATRON/CHRQ. AAR noted that the requirements of § 229.20 would more comprehensively satisfy the discussion of electronic record keeping in § 229.313(e). FRA agrees, and has revised § 229.213(e) to reference the requirements of § 229.20. FRA has further modified § 229.20 in this final rule to clarify the issue of record accessibility raised by MTA raised in conjunction with § 229.313(e) that was proposed in the NPRM.

AAR also noted that the locomotive electronics section imposes very technical obligations on railroads and that railroads will not possess the technical expertise to carry out these obligations but would have to rely on the suppliers of the equipment FRA believes that AAR and the railroads are being much too modest regarding their technical capabilities, and points to the AAR's own ''Manual of Recommended Standards and Practices'' as an example of the outstanding technical capabilities of the railroads. FRA does appreciate that there may be areas where the railroads' expertise may not fully align with that of their suppliers, and has modified the language in various portions subpart E to reflect this reality.

Both GE and MTA commented that the definition of ''product'' as proposed in the regulatory text of § 229.305 was overly broad, and might be subject to misinterpretation as it could be interpreted to cover locomotive functionality not directly required for the operation of the locomotive, such as prime mover fuel injection, ventilation louver, and fan control. While FRA believes that the intent not to include such functionality is clear in the preamble to the NPRM and the preamble to this final rule, FRA has modified the definition of ''product'' to more narrowly focus on the locomotive functionality which is covered by this part. The final rule definition of ''product'' in § 229.305 clarifies that a product, for the purposes of this subpart, is related to train movement functions and interfaces between man and machine, and it specifically excludes signal and train control functions. The preamble language has also been modified to further clarify applicability.

GE, in its comments to the NPRM, requested additional guidance related to the meaning of the terms ''interfaced,'' ''comingled,'' ''integrated,'' ''loosely coupled,'' and ''primary train control systems'' as used in part 229. FRA has added additional clarification in the preamble to this final rule these terms that are consistent with the RSAC working group discussions as well as Part 236 Subpart I. Specifically, FRA has:

1. Changed § 229.301(b) to delete the term ''interfaces'' and modified the preamble discussion accordingly.

2. Modified the definition of ''new or next generation locomotive control systems'' to include systems under development identified to FRA within six months of date of publication of the final rule, and implemented within 42 months after the date of publication of the final rule.

3. Modified the definition of ''product'' contained in § 229.305, as discussed earlier.

4. Provided a clearer definition of what is meant by ''comingle.'' Comingle is now defined in terms of coupling and cohesion, with new definitions for tightly coupled, loosely coupled, and cohesion added to § 229.305

In its comments, GE recommended the addition of ANSI/GEIA–STD–0010 as a recognized standard in terms of providing appropriate risk analysis processes for incorporation into verification and validation standards in proposed Appendix F. FRA agrees and has added ANSI/GEIA STD 0010 to the list of appropriate risk analysis procedures. CATRON/HCRQ also noted in their comments that ANSI/HFS 100–1988 referenced in Appendix F has been superseded by ANSI 100–2007 and that ANSI 100–2007 accommodates additional new technology (LCD and luminescent displays). FRA agrees and has changed the reference to identify ANSI/HFS 100–2007. CATRON/HCRQ also noted that ''Railway Applications Specification and Demonstration of Reliability Availability, Maintainability and Safety (RAMS); Safety (RAMS) (ii) EN50128 (May 2001), Railway Applications: Software for Railway Control and Protection Systems'' has been adopted by the IEC as ''Railway Applications Specification and Demonstration of Reliability Availability, Maintainability and Safety (RAMS) IEC 62279:2002 (May 2001), Railway Applications: Software for Railway Control and Protection Systems;'' FRA agrees and has retained the applicable CENLEC numbers and added the appropriate IEC numbers where applicable.

CATRON/HCRQ also made a large number of other recommendations regarding the wording of the language in the preamble, the rule text, and Appendix F to add clarity and accuracy. Generally, FRA agreed with the proposed changes, and they have been incorporated in the final rule.

FRA, however, does not agree with some of the recommendations made by CATRON/HCRQ in their comments. CATRON/HCRQ recommended removing the requirement for conducting sensitivity analysis, stating the ''* * * [s]ensitivity analysis places an undue burden on suppliers. It is costly to perform in terms of the software tool and the effort required. It does not comply with the Executive Order of January 18, 2011 which targets Improving Regulation and Regulatory Review.'' FRA believes that the sensitivity analysis is necessary to determine which elements/factors have the greatest impact on the safety of a system if assumptions are incorrect. Sensitivity analysis answers the question. ''[I]f these variables deviate from expectations, what will the effect be (on the business, model, system, or whatever is being analyzed)?'' In more

general terms, uncertainty and sensitivity analysis investigate the robustness of a design. Due to the importance of understanding the potential impact on system safety if design assumptions are incorrect, FRA declines to change the requirement for conducting a sensitivity analysis. Without conducting such an analysis, FRA believes that it would be difficult to assert with any degree of confidence that a presumed risk metric and risk mitigation is appropriate. FRA believes that the use of a sensitivity analysis is consistent with Section 5 of E.O. 13563, issued on January 18, 2011, which requires that ''each agency shall ensure the objectivity of any scientific and technological information and processes used to support the agency's regulatory actions.'' The revised section-by-section analysis for Subpart E reflecting the received comments follows:

Section 229.301 Purpose and Scope

The purpose of this subpart is to promote the safe design, operation, and maintenance of safety-critical electronic locomotive control systems, subsystems, and components. Safety-critical electronic systems identified in proposed paragraph (a) would include, but would not be limited to: directional control, graduated throttle or speed control, graduated locomotive independent brake application and release, train brake application and release, emergency air brake application and release, fuel shut-off and fire suppression, alerters, wheel slip/slide applications, audible and visual warnings, remote control locomotive systems, remote control transmitters, pacing systems, and speed control systems.

In paragraph (b), FRA emphasizes that when a new or proposed locomotive control system function interfaces or comingles with a safety critical train control system covered by 49 CFR 236 Subpart H or I, the locomotive control system functionality would be required to be addressed in the train control systems Product Safety Plan or the Positive Train Control Safety Plan, as appropriate. FRA recognizes that advances in technology may further eliminate the traditional distinctions between locomotive control and train control functionalities. Indeed, technology advances may provide for opportunities for increased or improved functionalities in train control systems that run concurrent with locomotive control. Train control and locomotive control, however, remain two fundamentally different operations with different objectives. FRA does not intend to restrict the adoption of new locomotive control functions and technologies by imposing regulations on locomotive control systems intended to address safety issues associated with train control.

Section 229.303 Applicability

A safety analysis would be required for new electronic equipment that is deployed for locomotives. However, FRA does not intend to impose retroactive safety analysis requirements for existing equipment. FRA recognizes that railroads and vendors may have already invested large sums of time, effort, and money in the development of new products that were envisioned prior to this proposed rule. Accordingly, the requirements of this subpart are not retroactive and do not apply to existing equipment that is currently in use, nor does it apply to new products that are actively under development. For that reason, FRA provides a grace period in paragraphs (a) and (b) to allow the completion of existing new developments. This provides sufficient time for railroads and vendors to realize profits on their investment in new technologies made prior to the adoption of this rule. Any system that has not been placed in use by the end of the grace period would be required to comply with the safety analysis requirements. Vendors are required to identify these projects to FRA within 6 months after the effective date of this rule. FRA believes this will avoid misunderstandings concerning which systems receive the grace period. FRA will consider any systems not identified to FRA within the 6-month window to be a new product start that would require a safety analysis.

In paragraph (c), FRA makes clear that the exemption is limited in scope. Products that result in degradation of safety or a material increase in safety-critical functionality are not exempt. Products with slightly different specifications that are used to allow the gradual enhancement of the product's capabilities do not require a full safety analysis as specified in Appendix F (or equivalent), but do require a formal verification and validation to the extent that the changes involve safety-critical functions.

Section 229.305 Definitions

Generally, this section standardizes similar definitions between 49 CFR part 236 subpart H and I, and this part. Although 49 CFR part 236 subpart H and I addresses train control systems, and this subpart addresses locomotive control systems, both reflect the adoption of a risk-based engineering design and review process. The definition section, however, does introduce several new definitions applicable to locomotive control systems.

''Loosely coupled'' means an attribute of systems, specifically referring to an approach to designing interfaces across systems, subsystems, or components to reduce the interdependencies between them—in particular, reducing the risk that changes within one system, subsystem, or component will create unanticipated changes within other system, subsystem, or component systems. Loosely coupled systems reduce this risk by enforcing standards for behavior at the interfaces of between systems, subsystems, or components while providing a great deal of freedom to modify activity within the systems, subsystems, or components. What happens within any one system, subsystem, or component matters little to the other systems, subsystems, or components as long as each system, subsystem, or component meets the specifications for deliverables at the interface of the systems, subsystems, or components. This is the opposite of ''tightly coupled''.

''New or next-generation locomotive control system'' refers to locomotive control products using technologies or combinations of technologies not in use on the effective date of this regulation, products that are under development as of October 9, 2012, and are placed in service prior to October 9, 2015, or without established histories of safe practice. Traditional, non-microprocessor systems, as well as microprocessor and software based locomotive control systems, are currently in use. These systems have used existing technologies, existing architectures, or combinations of these to implement their functionality. Development of a safety analysis to accomplish the requirements of this part would require reverse engineering these products. Reverse engineering a product is both time consuming and expensive. Requiring the performance of a safety analysis on existing products would present a large economic burden on both the railroads and the original equipment manufacturers (OEM). The economic burden would likely be significantly less for new combinations of technology and architectures that either implement existing functionality, or implement new functionality. These types of systems lack a proven service history and the safety analysis would be accomplished in the normal course of system design to mitigate the lack of a proven service history. The fundamental differences make it necessary to clearly

distinguish between the two classes of locomotive control systems products.

''Product'' means any safety critical locomotive control system processor-based system, subsystem, or component whose functions are directly related to safe movement and stopping of the train as well as the associated man-machine interfaces, regardless of the location of the control system, subsystem, or component. It specifically excludes safety critical processor based signal and train control systems. The definition identifies the covered systems that would require a safety analysis. Generally, locomotive manufacturers consider their product to be the entire locomotive. This includes systems and subsystems. In this situation, the manufacturers' extensive knowledge of the product allows them to conduct a safety analysis on the safety critical elements, including locomotive control systems. Similarly, major suppliers to locomotive manufacturers are also familiar with their own products. They too can clearly identify the safety critical elements and conduct the safety analysis accordingly. However, the same is not necessarily true for suppliers without extensive railroad domain knowledge. These suppliers may not understand that their product requires a safety analysis, or may lack experience to recognize that the subsystems or components of the product are subject to the safety analysis of this part. Accordingly, the definition of ''product'' indentifies the covered systems requiring a safety analysis. The definition of ''product'' also clarifies the location of the functionality. As advanced technologies like a remote control locomotive demonstrates the system, subsystem, or components responsible for the safe movement and stopping of the train need not be physically located on the locomotive.

The definition of ''Safety Analysis'' refers to a formal set of documentation that describes in detail all of the safety aspects of the product, including but not limited to procedures for its development, installation, implementation, operation, maintenance, repair, inspection, testing, and modification, as well as analyses supporting its safety claims. A Safety Analysis (SA) is similar to the Product Safety Plan (PSP) required by 49 CFR part 236 subpart H or the Positive Train Control Safety Plan (PTCSP) required by 49 CFR part 236 subpart I for signal and train control systems. There is, however, a fundamental difference between the PSP or PTCSP safety analysis, and the SA contained in this subpart. The products covered by a PSP and PTCSP require formal FRA approval prior to the product being placed in use, and products covered by a SA do not. This difference is rooted in fundamental differences between functionality of signal and train control and locomotive control. Although developers of an SA and a PSP or PTCSP may merge functions to operate together on a common platform, different safety analyses would be required. In order to ensure that there is no confusion between the safety analyses required by 49 CFR part 236 subparts H or I, and the safety analysis required in this subpart, a different definition is provided for the SA in this part.

The definition of ''Safety-critical,'' as applied to a function, a system, or any portion thereof, means an aspect of the locomotive electronic control system that requires correct performance to provide for the safety of personnel, equipment, environment, or any combination of the three; or the incorrect performance of which could cause a hazardous condition, or allow a hazardous condition which was intended to be prevented by the function or system to exist. This definition is substantially similar to that found in 49 CFR part 236 Subparts H and I. FRA recognizes that functionality differs between locomotive control systems and signal and train control systems, and further recognizes that the failure modes, the probabilities of failure, and the specific consequences of a failure differ. Despite the differences between locomotive control systems and signal and train control systems, the result of a safety critical failure is the same, creation of a hazardous condition that could affect the safety of the personnel, equipment, or the environment. The same is also true for systems designed to prevent adverse hazards in locomotive control systems, signal and train control systems, or both. The failure of these types of systems would either create a new hazard, or allow a system intended to prevent a hazard to occur, regardless of domain.

''Tightly coupled'' is an attribute of systems, referring to an approach to designing interfaces across systems, subsystems, or components to maximize the interdependencies between them—in particular, increasing the risk that changes within one system, subsystem, or component will create unanticipated changes within other system, subsystem, or component. Tightly coupled systems offer the potential for improved operational efficiencies compared to loosely coupled systems because of reduced message and parameter creation, transmission, translation and interpretation overhead and sharing of critical systems, subsystems, and components. However tightly coupled systems tend to exhibit the following characteristics, which are often seen as disadvantages:

1. A change in one system, subsystem, or component usually forces a ripple effect of changes in other systems, subsystems, or components
2. Assembly of system, subsystem, or component might require more effort and/or time due to the increased inter-system, subsystem, or component dependencies.
3. A particular system, subsystem, or component might be harder to reuse and/or test because dependent system, subsystem, or component must be included.

Cohesion is a measure of how strongly-related or focused are the responsibilities of a system, subsystem, or component. There are a number of different degrees of cohesion, of which the most desirable are communicational, sequential cohesion, and functional cohesion. Communicational cohesion is when system, subsystem, or components are grouped because they operate on the same data. Sequential cohesion is when parts of a system, subsystem, or component are grouped because the output from one system, subsystem, or component is the input to another part. It is analogous to an assembly line. Functional cohesion is when systems, subsystems, or components are grouped because they all contribute to a single well-defined task. While functional cohesion is considered the most desirable type of cohesion for a system, subsystem, or component, it may not be achievable. There are cases where communicational cohesion is the highest level of cohesion that can be attained under the circumstances. Low cohesion implies that a system, subsystem, or component performs tasks which are not very related to each other and hence can create problems as the system, subsystem, or component becomes large.

Comingle can be, therefore, expressed in terms the nature of the coupling and cohesion between the relevant systems, subsystems, or components. Comingle refers to the act of creating systems, subsystems, or components where the systems, subsystems, or components are tightly coupled and where the resulting systems, subsystems, or components exhibit a low degree of cohesion.

Section 229.307 Safety Analysis

The SA serves as the principal safety documentation for a safety-critical locomotive control system product. Engineering best practice today

recognizes that elimination of all risk is impossible. It recognizes that the traditional design philosophy that eliminates all risk (risk avoidance) adversely affects a product's cost and performance. Consequently, designers have adopted a philosophy of risk management. Under this philosophy, designers consider both the consequences of a failure and the probability of a failure. Designers then select the appropriate risk mitigation technique. The risk mitigation philosophy reduces cost and improves performance compared to risk avoidance.

Fundamental to the execution of the risk management philosophy is the development and documentation of a SA that closely examines the relationship between consequences of a failure, probability of occurrence, failure modes, and their mitigation strategies. Paragraph (a) of this section clearly recognizes this, and would address this need by requiring the development of the SA documentation. It also recognizes that some developers of SAs may have little experience in risk-based design. Appendix F offers one approach. There are a number of equally effective or better approaches. FRA encourages railroads and OEMs to select an approach best suited to their business model. FRA would consider as acceptable any approach that would be equal to, or more effective than, the one outlined in Appendix F.

Paragraph (b) along with paragraph (a) of this section, further establish a regulatory mandate for risk management design. Railroads that elect to allow a locomotive control system to be placed in use on its property are required to ensure that an appropriate SA is completed first.

Generally, only a single SA would be required for a product. Therefore, FRA would recognize as acceptable any appropriate SA done under the auspices of one railroad, or a consortium of railroads. FRA also recognizes that railroads may lack the necessary product familiarity or technical expertise to prepare the SA. FRA anticipates that vendors will accomplish the bulk of preparing the SA in the course of the product development.

FRA also recognizes that product vendors may develop a product prior to its procurement by a railroad. In this situation, FRA would provide review and comment as requested by the vendor. This review by FRA would not represent an endorsement of the product. FRA expects that the vendor would work with a railroad, or a consortium of railroads, for final review and approval of the SA. FRA also wishes to make clear that the SA would only be required for new or next generation locomotive control systems, as defined in § 229.305, or for substantive changes to an existing product. The latter would include: The addition or deletion of safety critical functionality to the product; significant paradigm shifts in the underlying systems' architecture or implementation technologies; or, significant departures from widely accepted and service proven industry best past practices. The half-life of microprocessor-based hardware is relatively short, and the associated software is subject to change as technical issues are discovered with existing functionality. FRA anticipates that there will be maintenance-related changes of software, as well as replacement of functionally identical hardware components as exiting hardware undergoes repair or reaches the end of its useful service life. These changes, which potentially may be extensive, do not change the safety critical functionality, the underlying implementation paradigm shift, or mark a significant departure from current industry practice. FRA emphasizes that these non-safety critical products would not require a SA.

The railroads and vendors have generally demonstrated, with a high degree of confidence, that existing systems can safely operate. In response to potential liability issues, railroads have shown they carefully examine the safety of a product prior to placing it in use. FRA fully expects that the railroads would continue to apply the same due diligence to new or next generation systems as they review the SA for these more complex products. Paragraph (b) is intended to limit FRA's review of the SAs. This, of course, would not restrict FRA review where it appears that due diligence has not been exercised, there are indications of fraud or malfeasance, or the underlying technology or architecture represent significant departures from existing practice.

In paragraph (b), FRA requires that the SA establish with a high degree of confidence that safety-critical functions of the product will operate in a fail-safe manner in the operating environment in which it will be used. FRA anticipates that the railroad and vendor community would exercise due diligence in the design and review process prior to placing the product in use. Due diligence would typically be demonstrated by the completion, review and internal approval of the SA. The railroad will be required to determine that this standard has been met, prior to a product change, or placing a new or next generation product in use.

Paragraph (b) also requires that the railroads identify appropriate procedures to immediately repair safety-critical functions when they fail. If the procedures are not followed, it would result in a violation for failing to comply with the SA.

Section 229.309 Safety Critical Changes and Failures

Safety critical microprocessors, like any electronics available today, are subject to significant change. It is necessary for railroads to ensure that safe system operations continue in the event of planned changes to the software or hardware maintenance of hardware and software configurations. Failure to maintain hardware and software configurations increases the probability that unintended consequences will occur during system operation. These unintended consequences do not necessarily reveal themselves on initial installation and operation, but may occur much later.

Not all railroads may experience the same software or hardware faults. The SA developer's software and hardware development, configuration management, and fault tracking play an important role in ensuring system safety. Without an effective configuration management and fault reporting system, it is difficult, if not impossible to evaluate the associated risks. The number of failures experienced by one railroad may not exceed the number of failures identified in the SA, but the aggregate from multiple railroads may. The vendor is best positioned to aggregate identified faults, and is best able to determine that the design and failure assumptions exceed those predicted by the safety analysis. An ongoing relationship between a railroad and its vendor is, therefore, essential to ensure that problems encountered by the railroad are promptly reported to the vendor for correction, and that problems encountered and reported by other railroads to the vendor are shared with other railroads. Furthermore, changes to the system developed by the vendor must be promptly provided to all railroads in order to eliminate the reported hazard. A formal, contractual relationship would provide the best vehicle for ensuring this relationship. This section clearly identifies the responsibility of railroads, and car owners, to establish such a relationship for both reporting hazards.

In order to accomplish their responsibilities, FRA expects that each railroad would have a configuration tracking system that will allow for the identification and reporting of hardware

and software issues, as well as promptly implementing changes to the safety critical systems provided by the vendor, regardless of the original reporting source of the problem. This section requires railroads to identify, and create such a system if they have not already done so.

Paragraph (b) requires immediate notification to a railroad of real or potential safety hazards identified by the private car suppliers and private car owners. This allows affected railroads to take appropriate actions to ensure the safety of rail operations.

In paragraph (c), the private car owner's configuration/revision control measures should be accepted by the railroad that would be using the car and implementing the system. The private car owner may have placed safety critical equipment on his car that is unfamiliar to the railroad using that car, and the necessary contractual relationship that would be required in paragraph (a)(3) of this section may not exist because the equipment in question is not part of the railroad's inventory. The private car owners are expected to communicate these issues with the host railroads. This requirement is intended to ensure that the safety-functional and safety-critical hazard mitigation processes are not compromised by unknown changes to software or hardware. Reporting responsibilities, as well as the configuration management, and tracking responsibilities also extend to private car owners.

Section 229.311 Review of SAs

In paragraph (a), FRA requires railroads to notify FRA before covered locomotive electronic products are placed in use. As discussed above, FRA anticipates that review of the SA and amendments would be the exception, rather than the normal practice. However, FRA believes it is appropriate to have the opportunity to review products and product changes to ensure safety. FRA requires that it have the opportunity to have products and product changes identified to it, and the opportunity to elect a review. FRA also realizes that development of these products represents a significant financial investment, and that the railroad would like to utilize the products as soon as possible in order to recover its investment.

Paragraph (b) reflects the expectation that FRA will decide whether to review an SA within 60 days after receipt of the requested information. Based on the information provided to FRA, the Associate Administrator for Safety will evaluate the need and scope of any review. Within 60 days of receipt of the notification required in paragraph (a), FRA will either decline to review or request to review. If FRA has not notified the railroad of its intent to review or audit the SA within the 60 day period, the railroad may assume that FRA does not intend to review or audit, and place the product in use. FRA reserves the right to conduct a review at a later date. Examples of causes for a review or audit prior to placing the product in use would include: Products with unique architectural concepts; products that use design or safety assurance concepts considered outside existing accepted practices; and, products that appear to comingle the locomotive control function with a safety-critical train control processing function. FRA may convene technical consultations, as necessary, to discuss issues related to the design and planned development of the product. Causes for an audit of the SA after a product is placed in service would include, but are not limited to, such circumstances as a credible allegation of error or fraud, SA assumptions determined to be invalid as a result of in-service experience, one or more unsafe events calling into question the safety analysis, or changes to the product.

If FRA elects not to review a product's SA, railroads would be able to put the product immediately in use after notification that FRA elects not to review. In the event that FRA would elect to review, FRA would attempt to complete the review within 120 days. FRA's ability to complete the review within 120 days will depend upon various factors, such as the complexity of the new product or product change, its deviation from current practice, the functionality, the architecture, the extent of interfaces with other systems, and the number of technical consultations required. Products reviewed by FRA under these circumstances may not be placed in use until FRA's review is complete.

Section 229.313 Product Testing Results and Records

This section requires that records of product testing conducted in accordance with this subpart be maintained. To effectively evaluate the degree to which the SA reflects real, as opposed to predicted performance, it is necessary to keep accurate records of performance for the product. In addition to collecting these records, it is also essential for regular comparison of the real performance results with the predicted performance. Thus, in this section, FRA requires such records to be maintained. Where the real performance, as measured by the collected data, exceeds the predicted performance of the SA, FRA requires no action. If the real performance is worse than the predicted performance, this section requires that the railroad take immediate action to improve performance to satisfy the predicted standard. Prompt and effective action would be required to bring the non-compliant system into compliance.

FRA encourages, but does not require a railroad to proactively evaluate their systems, and take corrective action prior to the system becoming non-compliant with the predicted performance standard. If an unpredicted hazard would occur, the system would be required to be immediately evaluated, and the appropriate corrective action would need to be taken. FRA would not expect a railroad to defer any corrective action.

This section establishes a requirement for a railroad to keep detailed records to evaluate the system. However, the railroad may elect to have the system supplier keep these records. There would be many advantages to the later approach, primarily that the vendor would receive an aggregate of the technical issues, making them better positioned to analyze the system performance. Although a railroad may delegate recordkeeping, the railroad would retain the responsibility for keeping records of performance on their property. The railroads would be responsible for ensuring the safe operation of systems on their property, and would be required to have access to the performance data if they are to carry out their responsibilities under this proposed section.

This section also requires detailed handling requirements for required records. Paragraph (a) requires specific content in the record. FRA will accept paper records or electronic records. Electronic recordkeeping is encouraged, as it reduces storage costs, simplifies collection of information, and allows data mining of the collected information. However, to ensure that the electronic records provide all required information, approval by the Associate Administrator for Safety is required.

Signatures on paper records are required to uniquely identify the person certifying the information contained in the record in such a manner that would enable detection of a forgery. Paragraph (a) ensures that an electronic signature could be attributable to single individual as reliably as paper records. It will be possible to meet the storage requirement in several different ways. Physical paper records will be expected to be kept at the physical location of the supervising official. Electronic records

will be permitted to be either stored locally, or remotely. FRA has no preference as long as the records are promptly accessible for FRA review.

Paragraph (b) specifies the required retention period for the records. FRA recognizes that retaining records involves a cost to railroads, and appreciates their desire to minimize both the number, and the required retention period. To this end, FRA has identified two different categories of records, and proposes differing retention periods for each. The first category involves records associated with installation or modification of a system and would contain data required for evaluating the product's performance and compliance to the safety case conditions throughout the life of the product. FRA will consider the life of the product to begin when the product is first placed in use and end with the permanent withdrawal of the product from service. In the event of permanent transfer of the product to another railroad, the receiving railroad would become responsible for maintaining the records. This responsibility will continue until the product is completely withdrawn from rail service. The second category of records addresses periodic testing and will have a retention period of at least one year, or the periodicity of the subsequent test, whichever is greater. Results obtained by subsequent tests will supersede the earlier test. The earlier test results will be moot for evaluating the current condition.

Regrettably, in some cases, the use of electronic records may not meet the minimum standards required by FRA. Consequently, FRA establishes procedural requirements related to withdrawing authorization to use electronic records in paragraph (c). If FRA finds it necessary to withdraw an authorization, FRA will explain the reason in writing.

Section 229.315 Operation Maintenance Manual

This section requires that each railroad have a manual covering the requirements for the installation, periodic maintenance and testing, modification, and repair of its safety critical locomotive control systems. This manual can be kept in paper or electronic form. It is recommended that electronic copies of the manual be maintained in the same manner as other electronic records kept for this part and that it be included in the railroad's configuration management plan (with the master copy and dated amendments carefully maintained so that the status of instructions to the field as of any given date can be readily determined).

Paragraph (a) requires that the manual be available to both persons required to perform such tasks and to FRA. Paragraph (b) requires that plans necessary for proper maintenance and testing of products be correct, legible, and available where such systems are deployed or maintained. The paragraph also requires that the manual identify the current version of software installed, revisions, and revision dates. Paragraph (c) requires that the manual identify the hardware, software, and firmware revisions in accordance with the configuration management requirement. Paragraph (d) requires the identification, replacement, handling, and repair of safety critical components in accordance with the configuration management requirements. Finally, paragraph (e) requires the manual be ready for use prior to deployment of the product, and that it be available for FRA review.

Section 229.317 Training and Qualification Program

This section provides specific parameters for training railroad employees and contractor employees to ensure they have the necessary knowledge and skills to complete their duties related to safety-critical products. Paragraph (a) requires the training to be formally conducted and documented based on educational best practices. Paragraphs (b) and (c) require the employer to identify employees that will be performing inspection, testing, maintenance, repairing, dispatching, and operating tasks related to the safety critical locomotive systems, and develop a written task analysis for the performance of duties. The employer is required to identify additional knowledge and skills above those required for basic job performance necessary to perform each task. Work situations often present unexpected challenges, and employees who understand the context within which the job is to be done would be better able to respond with actions that preserve safety. Further, the specific requirements of the job would be better understood, and requirements that are better understood are more likely to be adhered to. Well-informed employees would be less likely to conduct ad hoc trouble shooting; and therefore, should be of greater value in assisting with trouble shooting.

AAR submitted comments stating that it seems unnecessary to publish training requirements that specifically address locomotive electronics, and claiming that requiring a formal task analysis is overly burdensome. Training for personnel that works with locomotive electronics is technical and specialized. As such, FRA continues to believe that the training requirements for locomotive electronics should be addressed specifically in §§ 229.17 and 229.19. FRA also believes that a formal task analysis as part of training is vital to preparing personnel to operate locomotive electronics safely. AAR failed to explain why requiring a formal task analysis will be overly burdensome and they failed to suggest any alternative training. Accordingly, in this final rule, FRA retains the proposed training requirements.

Paragraph (d) requires the employer to develop a training curriculum that includes either classroom, hands-on, or other formally-structured training designed to impart the knowledge and skills necessary to perform each task.

Paragraph (e) adds a requirement that all persons subject to training requirements and their direct supervisors must successfully complete the training curriculum and pass an examination for the tasks for which they are responsible. Generally, giving appropriate training to each of these employees prior to task assignment will be required. The exception would be when an employee, who has not received the appropriate training, is conducting the task under the direct, on-site supervision of a qualified person.

Paragraph (f) requires periodic refresher training. This periodic training must include classroom, hands-on, computer-based training, or other formally structured training. The intent is for personnel to maintain the knowledge and skills required to perform their assigned task safely.

Paragraph (g) adds a requirement to compare and evaluate the effectiveness of training. The evaluation would first determine whether the training program materials and curriculum are imparting the specific skills, knowledge, and abilities to accomplish the stated goals of the training program; and second, determine whether the stated goals of the training program reflect the correct, and current, products and operations.

Paragraph (h) requires the railroad to maintain records that designate qualified persons. Records retention is required until recording new qualifications, or for at least one year after such person(s) leave applicable service. The records are required to be available for FRA inspection and copying.

Section 229.319 Operating Personnel Training

This section contains minimum training requirements for locomotive engineers and other operating personnel who interact with safety critical locomotive control systems. ''Other operating personnel'' refers to onboard train and engine crew members (*i.e.,* conductors, brakemen, and assistant engineers).

Paragraph (a) requires training program to cover familiarization with the onboard equipment and the functioning of that equipment as part of, and its relationship to, other onboard systems under that person's control. The training program must cover all notifications by the system (*i.e.,* onboard displays) and actions or responses to such notifications required by onboard personnel. The training is also required to address how each action or response ensures proper operation of the system and safe operation of the train.

During system operations emergent conditions could arise which would affect the safe operation of the system. This section also requires operating personnel to be informed as soon as practical after discovery of the condition, and any special actions required for safe train operations.

For certified locomotive engineers and conductors, paragraph (b) requires that the training requirements of this section be integrated into the training requirements of parts 240 and 242. Although this requirement only addresses engineers, in the event of certification of other operating personnel, the expectation is that these requirements would be included in their training requirements.

Appendix F—Recommended Practices for Design and Safety Analysis

Appendix F provides an optional set of criteria for performing risk management design of locomotive control systems. FRA recognizes that not all safety risks associated with human error can be eliminated by design, no matter how well trained and skilled the designers, implementers, and operators. The intention of the appendix is to provide one set of safety guidelines distilled from proven design considerations. There are numerous other approaches to risk management-based design. The basic principles of this appendix capture the lessons learned from the research, design, and implementation of similar technology in other modes of transportation and other industries. The overriding goal of this appendix is to minimize the potential for design-induced error by ensuring that systems are suitable for operators, and their tasks and environment.

FRA believes that new locomotive systems will be in service for a long period. Over time, there will be modifications from the original design. FRA is concerned that subsequent modifications to a product might not conform to the product's original design philosophy. The original designers of products could likely be unavailable after several years of operation of the product. FRA believes mitigating this is most successful by fully explaining and documenting the original design decisions and their rationale. Further, FRA feels that assumption of long product life cycles during the design and analysis phase will force product designers and users to consider long-term effects of operation. Such a criterion would not be applicable if, for instance, the railroad limited the product's term of proposed use.

Translation of these guidelines into processes helps ensure the safe performance of the product and minimizes failures that would have the potential to affect the safety of railroad operations. The identification of fault paths are essential to establishing failure modes and appropriate mitigations. Failing to identify a fault path can have the effect of making a system seem safer on paper than it actually is. When an unidentified fault path is discovered in service which leads to a previously unidentified safety-relevant hazard, the threshold in the safety analysis is automatically exceeded, and both the designer and the railroad must take mitigating measures. The frequency of such discoveries relates to the quality of the safety analysis efforts. Safety analyses of poor quality are more likely to lead to in-service discovery of unidentified fault paths. Some of those paths might lead to potential serious consequences, while others might have less serious consequences.

Given technology, cost, and other constraints, there are limitations regarding the level of safety obtainable. FRA recognizes this. However, FRA also believes that there are well-established and proven design and analysis techniques that can successfully mitigate these design restrictions. The use of proven safety considerations and concepts is necessary for the development of products. Only by forcing conscious decisions by the designer on risk mitigation techniques adopted, and justifying those choices (and their decision that a mitigation technique is not applicable) does the designer fully consider the implications of those choices. FRA notes that in normal operation, the product design should preclude human errors that cause a safety hazard. In addition to documenting design decisions, describing system requirements within the context of the concept of operations further mitigates against the loss of individual designers. In summary, the recommended approach ensures retention of a body of corporate knowledge regarding the product, and influences on the safety of the design. It also promotes full disclosure of safety risks to minimize or eliminate elements of risk where practical.

C. Amendments to Part 238

Section 238.105 Train Electronic Hardware and Software Safety

This section incorporates existing waivers and addresses certain operational realities. Since the implementation of the Passenger Equipment Safety Standards, FRA has granted two waivers from the requirements of § 238.105(d) (FRA–2004–19396 and FRA–2008–0139). The first waiver is for 26 EMU bi-level passenger cars operated by Northeastern Illinois Regional Commuter Railroad Corporation (METRA). The second waiver is for 14 new EMU bi-level passenger cars to be operated by Northern Indiana Commuter Transportation District. There are over 1,000 EMU passenger cars (M–7) being operated by Long Island Railroad & Metro-North Commuter Railroad (MNCW) for the past five years that FRA has discovered will need a waiver to be in compliance with § 238.105(d). The MNCW has placed an order for additional 300 plus options, EMU passenger cars (M–8) that will also need a waiver from the requirements of existing § 238.105(d).

The portion of the requirements that these cars' brake systems cannot satisfy is the requirement for a full service brake in the event of hardware/software failure of the brake system or access to direct manual control of the primary braking system, both service and emergency braking. The braking system on these cars does not have the full service function but does default to emergency brake application in the event of hardware/software failure of the brake system, and the operator has the ability to apply the brake system at an emergency rate from the conductor's valve located in the cab. A slight change to the language in § 238.105, that will permit a service or emergency braking, rather than requiring the capability to execute both a service and emergency brake, will alleviate the need for these waivers and would not reduce the braking rate of the equipment or the

stop distances. Accordingly, the language in § 238.105(d)(1)(ii) in this final rule has been modified to permit either a ''service or emergency braking.''

Section 238.309 Periodic Brake Equipment Maintenance

For convenience and clarity, FRA is consolidating locomotive air brake maintenance for conventional locomotives into part 229. Currently, because conventional locomotives are used in passenger service, certain air brake maintenance requirements are included in the Passenger Equipment Safety Standards contained in this section. Placing all of the requirements for conventional locomotives in part 229 will make the standards easier to follow and avoid confusion.

The brake maintenance requirements that are included in this final rule in part 229 extend the intervals at which required brake maintenance is performed for several types of brake systems for non-conventional locomotives. The length of the intervals reflects the results of studies and performance evaluations related to a series of waivers starting in 1981 and continuing to present day. Overall, the type of brake maintenance required for passenger equipment will remain the same.

VII. Regulatory Impact and Notices

A. Executive Orders 12866 and 13563 and DOT Regulatory Policies and Procedures

This final rule has been evaluated in accordance with existing policies and procedures, and determined to be non-significant under both Executive Orders 12866 and 13563, and DOT policies and procedures (44 *FR* 11034; February 26, 1979). FRA has prepared and placed in the docket a regulatory impact analysis addressing the economic impact of this final rule. Document inspection and copying facilities are available at Room W12–140 on the Ground level of the West Building, 1200 New Jersey Avenue SE., Washington, DC 20590.

As part of the regulatory impact analysis, FRA has assessed quantitative measurements of cost and benefit streams expected from the adoption of this final rule. This analysis includes qualitative discussions and quantitative measurements of costs and benefits in this rulemaking. The primary costs or burdens in this final rule are from the alerter and revised minimum (*i.e.,* cold weather) cab temperature requirements. There is also a cost associated with certain daily inspections required when periodic inspections are conducted less frequently. Although the final rule includes requirements for new locomotives to have air conditioning units and cab securement there are no additional costs for these requirements since they are current industry practice. Safety benefits will accrue from fewer train accidents. Cost savings will result from fewer waivers and waiver renewals, a reduction in downtime for locomotives due to the changes to headlight and brake requirements, and an increased interval between periodic inspection of certain micro-processor based locomotives. This last benefit consists of cost savings from a reduction of employee time for the periodic inspections and saving from reduced locomotive down-time. For the twenty year period the estimated quantified costs have a Present Value (PV) 7% of $27.7 million. For this period the estimated quantified benefits have a PV, 7% of $385 million.

B. Regulatory Flexibility Act and Executive Order 13272

FRA developed this final rule in accordance with Executive Order 13272 (''Proper Consideration of Small Entities in Agency Rulemaking'') and DOT's procedures and policies to promote compliance with the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) to ensure potential impacts of rules on small entities are properly considered.

The Regulatory Flexibility Act requires an agency to review regulations to assess their impact on small entities. An agency must conduct a regulatory flexibility analysis unless it determines and certifies that a rule is not expected to have a significant impact on a substantial number of small entities.

As discussed earlier, FRA has initiated this rulemaking in its efforts to update and reevaluate current regulations. Therefore, FRA is revising the Locomotive Safety Standards to update, consolidate and clarify existing rules, incorporate existing industry and engineering best practices, and incorporate former waivers into the regulation. FRA believes this final rule will modernize and improve its safety regulatory program related to locomotives. Pursuant to the Regulatory Flexibility Act (5 U.S.C. 605(b)), FRA certifies that this final rule will not have a significant economic impact on a substantial number of small entities. Although a substantial number of small railroads will be affected by this final rule, none will be significantly impacted. FRA invited all interested parties to submit data and information regarding the potential economic impact that will result from the adoption of the final rule.

1. Description of Regulated Entities and Impacts

The ''universe'' of the entities to be considered generally includes only those small entities that are reasonably expected to be directly regulated by this action. For this rulemaking, the types of small entities that are potentially affected by this rulemaking are: (a) small railroads and (b) governmental jurisdictions of small communities.

''Small entity'' is defined in 5 U.S.C. 601 as having the same meaning as ''small business concern'' under Section 3 of the Small Business Act. This includes any small business concern that is independently owned and operated, and is not dominant in its field of operation. Section 601(4) includes nonprofit enterprises that are independently owned and operated, and are not dominant in their field of operations within the definition of ''small entities.'' Additionally, 5 U.S.C. 601(5) defines ''small entities'' as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations less than 50,000.

The U.S. Small Business Administration (SBA) stipulates ''size standards'' for small entities. It provides that the largest for-profit railroad business firm may be (and still classify as a ''small entity'') 1,500 employees for ''line-haul operating'' railroads, and 500 employees for ''shortline operating'' railroads.

Federal agencies may adopt their own size standards for small entities in consultation with SBA and in conjunction with public comment. Pursuant to the authority provided to it by SBA, FRA has published a final policy, which formally establishes small entities as railroads that meet the line haulage revenue requirements of a Class III railroad. Currently, the revenue requirements are $20 million or less in annual operating revenue, adjusted annually for inflation. The $20 million limit (adjusted annually for inflation) is based on the Surface Transportation Board's threshold of a Class III railroad carrier, which is adjusted by applying the railroad revenue deflator adjustment. The same dollar limit on revenues is established to determine whether a railroad shipper or contractor is a small entity. Governments of cities, counties, towns, townships, villages, school districts, or special districts with populations less than 50,000 are also considered small entities under FRA's policy. FRA is using this definition for this rulemaking.

2. Small Entities

a. Railroads

There are approximately 702 [1] small railroads meeting the definition of ''small entity'' as described above. FRA estimates that all of these small entities could potentially be impacted by one or more of the requirements in this final rule. Note, however, that approximately fifty of these railroads are subsidiaries of large short line holding companies with the technical multidisciplinary expertise and resources comparable to larger railroads. It is important to note that many of the changes or additions in this rulemaking will not impact all or many small railroads. The nature of some of the changes will dictate that the impacts primarily fall on large railroads that purchase new and/or electronically advanced locomotives. Small railroads generally do not purchase new locomotives, they tend to buy used locomotives from larger railroads. Also, some of the final rule's requirements, i.e., requirements for alerters, cab door securement and air conditioning units, will be a burden to very few, if any, small railroads. The most burdensome requirement for small railroads will be the revisions to cab cold weather temperature requirements since older locomotives are less likely to meet the revised standards and small railroads tend to own older locomotives. However, even this burden not significant. FRA has estimated the total burden for the cold weather requirements is less than $900,000 (PV, 7%) over the 20 year analysis.

It is also important to note that this final rule only applies to non-steam locomotives. There are some small railroads that own one or more steam locomotives which these changes will not impact. There are a few small railroads that own all or almost all steam locomotives. Most of these entities are either museum railroads or tourist railroads. For these entities, this final rule's regulations will have no impact. FRA estimates that there are about five small railroads that only own steam locomotives.

b. Governmental Jurisdictions of Small Communities

Small entities that are classified as governmental jurisdictions will also be affected by the requirements in this rulemaking. As stated above, and defined by SBA, this term refers to governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of less than 50,000. FRA does not expect this group of entities to be impacted. The final rule will apply to governmental jurisdictions or transit authorities that provide commuter rail service—none of which is small as defined above (*i.e.,* no entity serves a locality with a population less than 50,000). These entities also receive Federal transportation funds. Intercity rail service providers Amtrak and the Alaska Railroad Corporation will also be subject to this rule, but they are not small entities and likewise receive Federal transportation funds. While other railroads are subject to this final rule by the application of § 238.3, FRA is not aware of any railroad subject to this rule that is a small entity that will be impacted by this rule.

3. Economic Impacts on Small Entities (railroads)

This certification is not intended to be a stand-alone document. In order to get a better understanding of the total costs for the railroad industry, which forms the base for these estimates or more cost detail on any specific requirement, a review of FRA's RIA is recommended. FRA has placed a copy of the RIA in the docket for this rulemaking.

Based on information currently available, FRA estimates that the average small railroad will spend approximately $1,000 over 20 years to comply with this final rule. This is because most of the regulatory changes in the Locomotive Safety Standards final rule are oriented towards new and remanufactured locomotives. Most small railroads do not purchase new or remanufactured locomotives. Therefore, the impact for most, if not all small railroads will be minimal.

4. Significant Economic Impact Criteria

Previously, FRA sampled small railroads and found that revenue averaged approximately $4.7 million (not discounted) in 2006. One percent of average annual revenue per small railroad is $47,000. FRA estimates that the average small railroad will spend approximately $1,000 over twenty years to comply with the requirements in this final rule. Based on this, FRA concludes that the expected burden of this final rule will not have a significant impact on the competitive position of small entities, or on the small entity segment of the railroad industry as a whole.

5. Substantial Number Criteria

This final rule will likely burden all small railroads that are not exempt from its scope or application. Therefore, as noted above this rule will impact a substantial number of small railroads.

6. Certification

Pursuant to the Regulatory Flexibility Act (5 U.S.C. 605(b)), FRA certifies that this final rule is not expected to have a significant economic impact on a substantial number of small entities. Although a substantial number of small railroads will be affected by this final rule, none of these entities will be significantly impacted.

C. Paperwork Reduction Act

The information collection requirements in this final rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995, 44 U.S.C. 3501 *et seq.* The sections that contain the new and current information collection requirements and the estimated time to fulfill each requirement are as follows:

CFR Section	Respondent universe	Total annual responses	Average time per response	Total annual burden hours
229.9—Movement of Non-Complying Locomotives.	44 Railroads	21,000 tags	1 minute	350 hours.
229.15—Remote Control Locomotives (RCL)—(New Requirements)				
—Tagging at Control Stand Throttle.	44 Railroads	3,000 tags	2 minutes	100 hours.
—Testing and Repair of Operational Control Unit (OCU) on RCL—Records.	44 Railroads	200 testing/repair records.	5 minutes	17 hours.

[1] For 2010 there were 754 total railroads reporting to the FRA. Total small railroads potentially impacted by this rulemaking would equal 754–26 (commuter railroads)—2 (intercity railroads)—7 (Class I railroads)—12 (Class II railroads)—5 (Steam railroads) = 702.

CFR Section	Respondent universe	Total annual responses	Average time per response	Total annual burden hours
229.17—Accident Reports	44 Railroads	1 report	15 minutes	.25 hour.
229.20—Electronic Recordkeeping				
—Electronic Record of Inspections and Maintenance and Automatic Notification to Railroad that Locomotive is Due for Inspection (New Requirement).	44 Railroads	21,000 notifications	1 second	6 hours.
229.21—Daily Inspection	754 Railroads	6,890,000 records	16 or 18 min.	1,911,780 hours.
—MU Locomotives: Written Reports.	754 Railroads	250 reports	13 minutes	54 hours.
Form FRA F 6180.49A Locomotive Inspection/Repair Record.	754 Railroads	4,000 forms	2 minutes	133 hours.
229.23/229.27/229.31—Periodic Inspection Annual. Biennial/Main Reservoir Tests—FRA F 6180.49A.	754 Railroads	9,500 insp./tests/forms	8 hours	76,000 hours.
229.23/229.27/229.29/229.31—Periodic Inspection/Annual Biennial Tests/Main Res. Tests—*Secondary Records* on Form FRA F 6180.49A.	754 Railroads	9,500 records	2 minutes	317 hours.
—List of Defects and Repairs on Each Locomotive and Copy to Employees Performing Insp. (New Requirement).	754 Railroads	4,000 lists + 4,000 copies.	2 minutes	266 hours.
—Document to Employees Performing Inspections of All Tests Since Last Periodic Inspection (New Requirement).	754 Railroads	9,500 documents	2 minutes	317 hours.
229.33—Out-of Use Credit	754 Railroads	500 notations	5 minutes	42 hours.
229.25(1)—Test: Every Periodic Insp.—Written Copies of Instruction.	754 Railroads	200 amendments	15 minutes	50 hours.
229.25(2)—Duty Verification Readout Rec.	754 Railroads	4,025 records	90 minutes	6,038 hours.
229.25(3)—Pre-Maintenance Test—Failures.	754 Railroads	700 notations	30 minutes	350 hours.
229.135(A.)—Removal From Service	754 Railroads	1,000 tags	1 minute	17 hours.
229.135(B.)—Preserving Accident Data.	754 Railroads	10,000 reports	15 minutes	2,500 hours.
229.27—Annual Tests	754 Railroads	700 test records	90 minutes	1,050 hours.
229.29—Air Brake System Maintenance and Testing (New Requirement).				
—Air Flow Meter Testing—Record.	754 Railroads	88,000 tests/records	15 seconds	367 hours.
229.46—Brakes General				
—Tagging Isolation Switch of Locomotive That May Only Be Used in Trailing Position (New Requirement).	754 Railroads	2,100 tags	2 minutes	70 hours.
229.85—Danger Markings on All Doors, Cover Plates, or Barriers.	754 Railroads	1,000 decals	1 minute	17 hours.
229.123—Pilots, Snowplows, End Plates—Markings—Stencilling (New Requirement).	754 Railroads	20 stencilling	2 minutes	1 hour.
—Notation on Form FRA F 6180.49A for Pilot, Snowplows, or End Plate Clearance Above Six Inches (New Requirement).	754 Railroads	20 notations	2 minutes	1 hour.
229.135—Event Recorders				
229.135(b)(5)—Equipment Requirements—Remanufactured Locomotives with *Certified* Crashworthy Memory Module.	754 Railroads	1,000 Certified Memory Modules.	2 hours	2,000 hours.
229.140—Alerters—Visual Indication to Locomotive Operator before Alarm Sounds on New Locomotives (New Requirement).	600 Locomotives	74,880,000 visual indications.	4 seconds	83,200 hours.
NEW REQUIREMENTS—SUBPART E—LOCOMOTIVE ELECTRONICS				

CFR Section	Respondent universe	Total annual responses	Average time per response	Total annual burden hours
229.303—Requests to FRA for Approval of On-Track Testing of Products Outside a Test Facility.	754 Railroads	20 requests	8 hours	160 hours.
—Identification to FRA of Products Under Development.	754 Railroads/3 Manufacturers.	20 products	2 hours	40 hours.
229.307—Safety Analysis by RR of Each Product Developed.	754 Railroads	300 analyses	240 hours	72,000 hours.
229.309—Notification to FRA of Safety-Critical Change in Product.	754 Railroads	10 notification	16 hours	160 hours.
Report to Railroad by Product Suppliers/Private Equipment Owners of Previously Unidentified Hazards of a Product.	3 Manufacturers	10 reports	8 hours	80 hours.
229.311—Review of Safety Analyses (SA)				
—Notification to FRA of Railroad Intent to Place Product In Service.	754 Railroads	300 notifications	2 hours	600 hours.
—RR Documents That Demonstrate Product Meets Safety Requirements of the SA for the Life-Cycle of Product.	754 Railroads	300 documents	2 hours	600 hours.
—RR Database of All Safety Relevant Hazards Encountered with Product Placed in Service.	754 Railroads	300 databases	4 hours	1,200 hours.
—Written Reports to FRA If Frequency of Safety-Relevant Hazards Exceeds Threshold.	754 Railroads	10 reports	2 hours	20 hours.
—Final Reports to FRA on Countermeasures to Reduce Frequency of Safety-Relevant Hazard(s).	754 Railroads	10 reports	4 hours	40 hours.
229.313—Product Testing Results—Records.	754 Railroads	120,000 records	5 minutes	10,000 hours.
229.315—Operations and Maintenance Manual—All Product Documents.	754 Railroads	300 manuals	40 hours	12,000 hours.
—Configuration Management Control Plans.	754 Railroads	300 plans	8 hours	2,400 hours.
—Identification of Safety-Critical Components.	754 Railroads	60,000 components	5 minutes	5,000 hours.
229.317—Product Training and Qualifications Program.	754 Railroads	300 programs	40 hours	12,000 hours.
—Product Training of Individuals	754 Railroads	10,000 trained employees.	30 minutes	5,000 hours.
—Refresher Training	754 Railroads	1,000 trained employees	20 minutes	333 hours.
—RR Regular and Periodic Evaluation of Effectiveness of Training Program.	754 Railroads	300 evaluations	4 hours	1,200 hours.
—Records of Qualified Individuals.	754 Railroads	10,000 records	10 minutes	1,667 hours.
Appendix F—Guidance for Verification and Validation of Product—Third Party Assessment.	754 Railroads/3 Manufacturers.	1 assessment	4,000 hours	4,000 hours.
—Reviewer Final Report	754 Railroads/3 Manufacturers.	1 report	80 hours	80 hours.

All estimates include the time for reviewing instructions; searching existing data sources; gathering or maintaining the needed data; and reviewing the information. Pursuant to 44 U.S.C. 3506(c)(2)(B), FRA solicits comments concerning: whether these information collection requirements are necessary for the proper performance of the functions of FRA, including whether the information has practical utility; the accuracy of FRA's estimates of the burden of the information collection requirements; the quality, utility, and clarity of the information to be collected; and whether the burden of collection of information on those who are to respond, including through the use of automated collection techniques or other forms of information technology, may be minimized. For information or a copy of the paperwork package submitted to OMB, contact Mr. Robert Brogan, Office of Safety, Information Clearance Officer, at 202–493–6292, or Ms. Kimberly Toone, Office of Information Technology, at 202–493–6139.

Organizations and individuals desiring to submit comments on the collection of information requirements should direct them to Mr. Robert Brogan or Ms. Kimberly Toone, Federal

Railroad Administration, 1200 New Jersey Avenue SE., 3rd Floor, Washington, DC 20590. Comments may also be submitted via email to Mr. Brogan or Ms. Toone at the following address: *Robert.Brogan@dot.gov; Kimberly.Toone@dot.gov*.

OMB is required to make a decision concerning the collection of information requirements contained in this proposed rule between 30 and 60 days after publication of this document in the **Federal Register**. Therefore, a comment to OMB is best assured of having its full effect if OMB receives it within 30 days of publication. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

FRA cannot impose a penalty on persons for violating information collection requirements which do not display a current OMB control number, if required. FRA intends to obtain current OMB control numbers for any new information collection requirements resulting from this rulemaking action prior to the effective date of the final rule. The OMB control number, when assigned, will be announced by separate notice in the **Federal Register**.

D. Federalism Implications

FRA has analyzed this rule in accordance with the principles and criteria contained in Executive Order 13132, issued on August 4, 1999, which directs Federal agencies to exercise great care in establishing policies that have federalism implications. *See* 64 FR 43255. This final rule will not have a substantial effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among various levels of government. This final rule will not have federalism implications that impose any direct compliance costs on State and local governments.

FRA notes that the RSAC, which endorsed and recommended the majority of this final rule to FRA, has as permanent members, two organizations representing State and local interests: AASHTO and the Association of State Rail Safety Managers (ASRSM). Both of these State organizations concurred with the RSAC recommendation endorsing this final rule. The RSAC regularly provides recommendations to the FRA Administrator for solutions to regulatory issues that reflect significant input from its State members. To date, FRA has received no indication of concerns about the Federalism implications of this rulemaking from these representatives or of any other representatives of State government. Consequently, FRA concludes that this proposed rule has no federalism implications, other than the preemption of state laws covering the subject matter of this final rule, which occurs by operation of law as discussed below.

This final rule could have preemptive effect by operation of law under certain provisions of the Federal railroad safety statutes, specifically, the former Federal Railroad Safety Act of 1970 (former FRSA), repealed and recodified at 49 U.S.C. 20106, and the former Locomotive Boiler Inspection Act at 45 U.S.C. 22–34, repealed and recodified at 49 U.S.C. 20701–20703. The former FRSA provides that States may not adopt or continue in effect any law, regulation, or order related to railroad safety or security that covers the subject matter of a regulation prescribed or order issued by the Secretary of Transportation (with respect to railroad safety matters) or the Secretary of Homeland Security (with respect to railroad security matters), except when the State law, regulation, or order qualifies under the ''local safety or security hazard'' exception to section 20106. Moreover, the former LIA has been interpreted by the Supreme Court as preempting the field concerning locomotive safety. *See Kurns* v. *Railroad Friction Products Corp.,* 565 U.S. _____ (2012); *Kurns* v. *Railroad Friction Products Corp.,* 132 S.CT. 1262; and *Napier v. Atlantic Coast Line R.R.,* 272 U.S. 605 (1926).

E. Environmental Impact

FRA has evaluated this final rule in accordance with its ''Procedures for Considering Environmental Impacts'' (FRA's Procedures) (64 FR 28545, May 26, 1999) as required by the National Environmental Policy Act (42 U.S.C. 4321 *et seq.*), other environmental statutes, Executive Orders, and related regulatory requirements. FRA has determined that this final rule is not a major FRA action (requiring the preparation of an environmental impact statement or environmental assessment) because it is categorically excluded from detailed environmental review pursuant to section 4(c)(20) of FRA's Procedures. 64 FR 28547, May 26, 1999. Section 4(c)(20) reads as follows: (c) Actions categorically excluded. Certain classes of FRA actions have been determined to be categorically excluded from the requirements of these Procedures as they do not individually or cumulatively have a significant effect on the human environment. Promulgation of railroad safety rules and policy statements that do not result in significantly increased emissions or air or water pollutants or noise or increased traffic congestion in any mode of transportation are excluded.

In accordance with section 4(c) and (e) of FRA's Procedures, the agency has further concluded that no extraordinary circumstances exist with respect to this final rule that might trigger the need for a more detailed environmental review. As a result, FRA finds that this final rule is not a major Federal action significantly affecting the quality of the human environment.

F. Unfunded Mandates Reform Act of 1995

Pursuant to Section 201 of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4, 2 U.S.C. 1531), each Federal agency ''shall, unless otherwise prohibited by law, assess the effects of Federal regulatory actions on State, local, and tribal governments, and the private sector (other than to the extent that such regulations incorporate requirements specifically set forth in law).'' Section 202 of the Act (2 U.S.C. 1532) further requires that ''before promulgating any general notice of proposed rulemaking that is likely to result in the promulgation of any rule that includes any Federal mandate that may result in expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100,000,000 or more (adjusted annually for inflation) in any 1 year, and before promulgating any final rule for which a general notice of proposed rulemaking was published, the agency shall prepare a written statement'' detailing the effect on State, local, and tribal governments and the private sector. For the year 2010, this monetary amount of $100,000,000 has been adjusted to $140,800,000 to account for inflation. This final rule would not result in the expenditure of more than $140,800,000 by the public sector in any one year, and thus preparation of such a statement is not required.

G. Privacy Act

Anyone is able to search the electronic form of any comment or petition received into any of FRA's dockets by the name of the individual submitting the comment or petition (or signing the comment or petition, if submitted on behalf of an association, business, labor union, etc.). Please visit *http://www.regulations.gov/#!privacyNotice.* You may also review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–19478), or you may visit *http://www.dot.gov/privacy.html.*

List of Subjects

49 CFR Part 229

Locomotive headlights, Locomotives, Railroad safety, Remote control locomotives.

49 CFR Part 238

Passenger equipment, Penalties, Railroad safety, Reporting and recordkeeping requirements.

The Final Rule

For the reasons discussed in the preamble, FRA amends parts 229 and 238 of chapter II, subtitle B of Title 49, Code of Federal Regulations, as follows:

PART 229—[AMENDED]

■ 1. The authority citation for part 229 continues to read as follows:

Authority: 49 U.S.C. 20102–03, 20107, 20133, 20137–38, 20143, 20701–03, 21301–02, 21304; 28 U.S.C. 2401, note; and 49 CFR 1.49.

■ 2. Section 229.5 is amended by adding in alphabetical order the following definitions to read as follows:

§ 229.5 Definitions.

* * * * *

Alerter means a device or system installed in the locomotive cab to promote continuous, active locomotive engineer attentiveness by monitoring select locomotive engineer-induced control activities. If fluctuation of a monitored locomotive engineer-induced control activity is not detected within a predetermined time, a sequence of audible and visual alarms is activated so as to progressively prompt a response by the locomotive engineer. Failure by the locomotive engineer to institute a change of state in a monitored control, or acknowledge the alerter alarm activity through a manual reset provision, results in a penalty brake application that brings the locomotive or train to a stop.

* * * * *

Assignment Address means a unique identifier of the RCL that insures that only the OCU's linked to a specific RCL can command that RCL.

* * * * *

Controlling locomotive means a locomotive from where the operator controls the traction and braking functions of the locomotive or locomotive consist, normally the lead locomotive.

* * * * *

Locomotive Control Unit (LCU) means a system onboard an RCL that communicates via a radio link which receives, processes, and confirms commands from the OCU, which directs the locomotive to execute them.

* * * * *

Operator Control Unit (OCU) means a mobile unit that communicates via a radio link the commands for movement (direction, speed, braking) or for operations (bell, horn, sand) to an RCL.

* * * * *

Qualified mechanical inspector means a person who has received instruction and training that includes ''hands-on'' experience (under appropriate supervision or apprenticeship) in one or more of the following functions: troubleshooting, inspection, testing, maintenance or repair of the specific locomotive equipment for which the person is assigned responsibility. This person shall also possess a current understanding of what is required to properly repair and maintain the locomotive equipment for which the person is assigned responsibility. Further, the qualified mechanical inspector shall be a person whose primary responsibility includes work generally consistent with the functions listed in this definition.

* * * * *

Remote Control Locomotive (RCL) means a remote control locomotive that, through use of a radio link can be operated by a person not physically within the confines of the locomotive cab. For purposes of this part, the term RCL does not refer to a locomotive or group of locomotives remotely controlled from the lead locomotive of a train, as in a distributed power arrangement.

Remote Control Operator (RCO) means a person who utilizes an OCU in connection with operations involving a RCL with or without cars.

Remote Control Pullback Protection means a function of a RCL that enforces speeds and stops in the direction of pulling movement.

* * * * *

■ 3. Section 229.7 is revised to read as follows:

§ 229.7 Prohibited acts and penalties.

(a) Federal Rail Safety Laws (49 U.S.C. 20701–20703) make it unlawful for any carrier to use or permit to be used on its line any locomotive unless the entire locomotive and its appurtenances—

(1) Are in proper condition and safe to operate in the service to which they are put, without unnecessary peril to life or limb; and

(2) Have been inspected and tested as required by this part.

(b) Any person (including but not limited to a railroad; any manager, supervisor, official, or other employee or agent of a railroad; any owner, manufacturer, lessor, or lessee of railroad equipment, track, or facilities; any employee of such owner, manufacturer, lessor, lessee, or independent contractor) who violates any requirement of this part or of the Federal Rail Safety Laws or causes the violation of any such requirement is subject to a civil penalty of at least $650, but not more than $25,000 per violation, except that: Penalties may be assessed against individuals only for willful violations, and, where a grossly negligent violation or a pattern of repeated violations has created an imminent hazard of death or injury to persons, or has caused death or injury, a penalty not to exceed $100,000 per violation may be assessed. Each day a violation continues shall constitute a separate offense. Appendix B of this part contains a statement of agency civil penalty policy.

(c) Any person who knowingly and willfully falsifies a record or report required by this part is subject to criminal penalties under 49 U.S.C. 21311.

■ 4. Section 229.15 is added to read as follows:

§ 229.15 Remote Control Locomotives.

(a) *Design and operation.* (1) Each locomotive equipped with a locomotive control unit (LCU) shall respond only to the operator control units (OCUs) assigned to that receiver.

(2) If one or more OCUs are assigned to a LCU, the LCU shall respond only to the OCU that is in primary command. If a subsequent OCU is assigned to a LCU, the previous assignment will be automatically cancelled.

(3) If more than one OCU is assigned to a LCU, the secondary OCUs' man down feature, bell, horn, and emergency brake application functions shall remain active. The remote control system shall be designed so that if the signal from the OCU to the RCL is interrupted for a set period not to exceed five seconds, the remote control system shall cause:

(i) A full service application of the locomotive and train brakes; and

(ii) The elimination of locomotive tractive effort.

(4) Each OCU shall be designed to control only one RCL at a time. OCU's having the capability to control more than one RCL shall have a means to lock in one RCL ''assignment address'' to prevent simultaneous control over more than one locomotive.

(5) If an OCU is equipped with an ''on'' and ''off'' switch, when the switch is moved from the ''on'' to the ''off''

position, the remote control system shall cause:

(i) A full service application of the locomotive train brakes; and

(ii) The elimination of locomotive tractive effort.

(6) Each RCL shall have a distinct and unambiguous audible or visual warning device that indicates to nearby personnel that the locomotive is under active remote control operation.

(7) When the main reservoir pressure drops below 90 psi while the RCL is moving, the RCL shall initiate a full service application of the locomotive and train brakes, and eliminate locomotive tractive effort.

(8) When the air valves and the electrical selector switch on the RCL are moved from manual to remote control mode or from remote control to manual mode, an emergency application of the locomotive and train brakes shall be initiated.

(9) Operating control handles located in the RCL cab shall be removed, pinned in place, protected electronically, or otherwise rendered inoperable as necessary to prevent movement caused by the RCL's cab controls while the RCL is being operated by remote control.

(10) The RCL system (both the OCU and LCU), shall be designed to perform a self diagnostic test of the electronic components of the system. The system shall be designed to immediately effect a full service application of the locomotive and train brakes and the elimination of locomotive tractive effort in the event a failure is detected.

(11) Each RCL shall be tagged at the locomotive control stand throttle indicating the locomotive is being used in a remote control mode. The tag shall be removed when the locomotive is placed back in manual mode.

(12) Each OCU shall have the following controls and switches and shall be capable of performing the following functions:

(i) Directional control;

(ii) Throttle or speed control;

(iii) Locomotive independent air brake application and release;

(iv) Automatic train air brake application and release control;

(v) Audible warning device control (horn);

(vi) Audible bell control, if equipped;

(vii) Sand control (unless automatic);

(viii) Bi-directional headlight control;

(ix) Emergency air brake application switch;

(x) Generator field switch or equivalent to eliminate tractive effort to the locomotive;

(xi) Audio/visual indication of wheel slip, only if an audio/visual indication is not provided by the RCL;

(xii) Audio indication of movement of the RCL; and

(xiv) Require at least two separate actions by the RCO to begin movement of the RCL.

(13) Each OCU shall be equipped with the following features:

(i) A harness with a breakaway safety feature;

(ii) An operator alertness device that requires manual resetting or its equivalent. The alertness device shall incorporate a timing sequence not to exceed 60 seconds. Failure to reset the switch within the timing sequence shall cause a service application of the locomotive and train brakes, and the elimination of locomotive tractive effort; and,

(iii) A tilt feature that, when tilted to a predetermined angle, shall cause:

(A) An emergency application of the locomotive and train brakes, and the elimination of locomotive tractive effort; and

(B) If the OCU is equipped with a tilt bypass system that permits the tilt protection feature to be temporarily disabled, this bypass feature shall deactivate within 60 seconds on the primary OCU and within 60 seconds for all secondary OCUs, unless reactivated by the RCO.

(14) Each OCU shall be equipped with one of the following control systems:

(i) An automatic speed control system with a maximum 15 mph speed limiter; or

(ii) A graduated throttle and brake. A graduated throttle and brake control system built after September 6, 2012, shall be equipped with a speed limiter to a maximum of 15 mph.

(15) RCL systems built after September 6, 2012, shall be equipped to automatically notify the railroad in the event the RCO becomes incapacitated or OCU tilt feature is activated.

(16) RCL systems built prior to September 6, 2012, not equipped with automatic notification of operator incapacitated feature may not be utilized in one-person operation. (b) *Inspection, testing, and repair.*

(1) Each time an OCU is linked to a RCL, and at the start of each shift, a railroad shall test:

(i) The air brakes and the OCU's safety features, including the tilt switch and alerter device; and

(ii) The man down/tilt feature automatic notification.

(2) An OCU shall not continue in use with any defective safety feature identified in paragraph (b)(1) of this section.

(3) A defective OCU shall be tracked under its own identification number assigned by the railroad. Records of repairs shall be maintained by the railroad and made available to FRA upon request.

(4) Each time an RCL is placed in service and at the start of each shift locomotives that utilize a positive train stop system shall perform a conditioning run over tracks that the positive train stop system is being utilized on to ensure that the system functions as intended.

■ 5. Section 229.19 is revised to read as follows:

§ 229.19 Prior waivers.

Waivers from any requirement of this part, issued prior to June 8, 2012, shall terminate on the date specified in the letter granting the waiver. If no date is specified, then the waiver shall automatically terminate on June 8, 2017.

■ 6. Section 229.20 is added to read as follows:

§ 229.20 Electronic recordkeeping.

(a) For purposes of compliance with the recordkeeping requirements of this part, except for the daily inspection record maintained on the locomotive required by § 229.21, the cab copy of Form FRA F 6180–49–A required by § 229.23, the fragmented air brake maintenance record required by § 229.27, and records required under § 229.9, a railroad may create, maintain, and transfer any of the records required by this part through electronic transmission, storage, and retrieval provided that all of the requirements contained in this section are met.

(b) *Design requirements.* Any electronic record system used to create, maintain, or transfer a record required to be maintained by this part shall meet the following design requirements:

(1) The electronic record system shall be designed such that the integrity of each record is maintained through appropriate levels of security such as recognition of an electronic signature, or other means, which uniquely identify the initiating person as the author of that record. No two persons shall have the same electronic identity;

(2) The electronic system shall ensure that each record cannot be modified, or replaced, once the record is transmitted;

(3) Any amendment to a record shall be electronically stored apart from the record which it amends. Each amendment to a record shall uniquely identify the person making the amendment;

(4) The electronic system shall provide for the maintenance of inspection records as originally submitted without corruption or loss of data; and

(5) Policies and procedures shall be in place to prevent persons from altering electronic records, or otherwise interfering with the electronic system.

(c) *Operational requirements.* Any electronic record system used to create, maintain, or transfer a record required to be maintained by this part shall meet the following operating requirements:

(1) The electronic storage of any record required by this part shall be initiated by the person performing the activity to which the record pertains within 24 hours following the completion of the activity; and

(2) For each locomotive for which records of inspection or maintenance required by this part are maintained electronically, the electronic record system shall automatically notify the railroad each time the locomotive is due for an inspection, or maintenance that the electronic system is tracking. The automatic notification tracking requirement does not apply to daily inspections.

(d) *Accessibility and availability requirements.* Any electronic record system used to create, maintain, or transfer a record required to be maintained by this part shall meet the following access and availability requirements:

(1) Except as provided in § 229.313(c)(2), the carrier shall provide FRA with all electronic records maintained for compliance with this part for any specific locomotives at any mechanical department terminal upon request;

(2) Paper copies of electronic records and amendments to those records that may be necessary to document compliance with this part, shall be provided to FRA for inspection and copying upon request *http://web2.westlaw.com/find/default.wl?DB=1000547&DocName=49CFRS213%2E305&FindType=L&AP=&mt=Westlaw&fn=_top&sv=Split&vr=2.0&rs=.* Paper copies shall be provided to FRA no later than 15 days from the date the request is made; and,

(3) Inspection records required by this part shall be available to persons who performed the inspection and to persons performing subsequent inspections on the same locomotive.

■ 7. Section 229.23 is revised to read as follows:

§ 229.23 Periodic inspection: general.

(a) Each locomotive shall be inspected at each periodic inspection to determine whether it complies with this part. Except as provided in § 229.9, all non-complying conditions shall be repaired before the locomotive is used. Except as provided in § 229.33 and paragraph (b) of this section, the interval between any two periodic inspections may not exceed 92 days. Periodic inspections shall only be made where adequate facilities are available. At each periodic inspection, a locomotive shall be positioned so that a person may safely inspect the entire underneath portion of the locomotive.

(b) For each locomotive equipped with advanced microprocessor-based on-board electronic condition monitoring controls:

(1) The interval between periodic inspections shall not exceed 184 days; and

(2) At least once each 31 days, the daily inspection required by § 229.21, shall be performed by a qualified mechanical inspector as defined in § 229.5. A record of the inspection that contains the name of the person performing the inspection and the date that it was performed shall be maintained in the locomotive cab until the next periodic inspection is performed.

(c) Each new locomotive shall receive an initial periodic inspection before it is used.

(d) At the initial periodic inspection, the date and place of the last tests performed that are the equivalent of the tests required by §§ 229.27, 229.29, and 229.31 shall be entered on Form FRA F 6180–49A. These dates shall determine when the tests first become due under §§ 229.27, 229.29, and 229.31. Out of use credit may be carried over from Form FRA F 6180–49 and entered on Form FRA F 6180–49A.

(e) Each periodic inspection shall be recorded on Form FRA F 6180–49A. The form shall be signed by the person conducting the inspection and certified by that person's supervisor that the work was done. The form shall be displayed under a transparent cover in a conspicuous place in the cab of each locomotive. A railroad maintaining and transferring records as provided for in § 229.20 shall print the name of the person who performed the inspections, repairs, or certified work on the Form FRA F 6180–49A that is displayed in the cab of each locomotive.

(f) At the first periodic inspection in each calendar year, the carrier shall remove from each locomotive Form FRA F 6180–49A covering the previous calendar year. If a locomotive does not receive its first periodic inspection in a calendar year before April 2, or July 3 if it's a locomotive equipped with advanced microprocessor-based on-board electronic condition monitoring controls, because it is out of use, the form shall be promptly replaced. The Form FRA F 6180–49A covering the preceding year for each locomotive, in or out of use, shall be signed by the railroad official responsible for the locomotive and filed as required in § 229.23(f). The date and place of the last periodic inspection and the date and place of the last tests performed under §§ 229.27, 229.29, and 229.31 shall be transferred to the replacement Form FRA F 6180–49A.

(g) The railroad mechanical officer who is in charge of a locomotive shall maintain in his office a secondary record of the information reported on Form FRA F 6180–49A. The secondary record shall be retained until Form FRA F 6180–49A has been removed from the locomotive and filed in the railroad office of the mechanical officer in charge of the locomotive. If the Form FRA F 6180–49A removed from the locomotive is not clearly legible, the secondary record shall be retained until the Form FRA F 6180–49A for the succeeding year is filed. The Form F 6180–49A removed from a locomotive shall be retained until the Form FRA F 6180–49A for the succeeding year is filed.

(h) The railroad shall maintain, and provide employees performing inspections under this section with, a list of the defects and repairs made on each locomotive over the last ninety-two days;

(i) The railroad shall provide employees performing inspections under this section with a document containing all tests conducted since the last periodic inspection, and procedures needed to perform the inspection.

■ 8. Section 229.25 is amended by revising paragraphs (d) and (e) and adding paragraph (f) to read as follows:

§ 229.25 Tests: Every periodic inspection.

* * * * *

(d) *Event recorder.* A microprocessor-based self-monitoring event recorder, if installed, is exempt from periodic inspection under paragraphs (d)(1) through (5) of this section and shall be inspected annually as required by § 229.27(c). Other types of event recorders, if installed, shall be inspected, maintained, and tested in accordance with instructions of the manufacturer, supplier, or owner thereof and in accordance with the following criteria:

(1) A written or electronic copy of the instructions in use shall be kept at the point where the work is performed and a hard-copy version, written in the English language, shall be made available upon request to FRA.

(2) The event recorder shall be tested before any maintenance work is performed on it. At a minimum, the

event recorder test shall include cycling, as practicable, all required recording elements and determining the full range of each element by reading out recorded data.

(3) If the pre-maintenance test reveals that the device is not recording all the specified data and that all recordings are within the designed recording elements, this fact shall be noted, and maintenance and testing shall be performed as necessary until a subsequent test is successful.

(4) When a successful test is accomplished, a copy of the data-verification results shall be maintained in any medium with the maintenance records for the locomotive until the next one is filed.

(5) A railroad's event recorder periodic maintenance shall be considered effective if 90 percent of the recorders on locomotives inbound for periodic inspection in any given calendar month are still fully functional; maintenance practices and test intervals shall be adjusted as necessary to yield effective periodic maintenance.

(e) *Remote control locomotive.* Remote control locomotive system components that interface with the mechanical devices of the locomotive shall be tested including, but not limited to, air pressure monitoring devices, pressure switches, and speed sensors.

(f) *Alerters.* The alerter shall be tested, and all automatic timing resets shall function as intended.

■ 9. Section 229.27 is revised to read as follows:

§ 229.27 Annual tests.

(a) All testing under this section shall be performed at intervals that do not exceed 368 calendar days.

(b) Load meters that indicate current (amperage) being applied to traction motors shall be tested. Each device used by the engineer to aid in the control or braking of the train or locomotive that provides an indication of air pressure electronically shall be tested by comparison with a test gauge or self-test designed for this purpose. An error greater than five percent or greater than three pounds per square inch shall be corrected. The date and place of the test shall be recorded on Form FRA F 6180–49A, and the person conducting the test and that person's supervisor shall sign the form.

(c) A microprocessor-based event recorder with a self-monitoring feature equipped to verify that all data elements required by this part are recorded, requires further maintenance and testing only if either of the following conditions exist:

(1) The self-monitoring feature displays an indication of a failure. If a failure is displayed, further maintenance and testing must be performed until a subsequent test is successful. When a successful test is accomplished, a record, in any medium, shall be made of that fact and of any maintenance work necessary to achieve the successful result. This record shall be available at the location where the locomotive is maintained until a record of a subsequent successful test is filed; or,

(2) A download of the event recorder, taken within the preceding 30 days and reviewed for the previous 48 hours of locomotive operation, reveals a failure to record a regularly recurring data element or reveals that any required data element is not representative of the actual operations of the locomotive during this time period. If the review is not successful, further maintenance and testing shall be performed until a subsequent test is successful. When a successful test is accomplished, a record, in any medium, shall be made of that fact and of any maintenance work necessary to achieve the successful result. This record shall be kept at the location where the locomotive is maintained until a record of a subsequent successful test is filed. The download shall be taken from information stored in the certified crashworthy crash hardened event recorder memory module if the locomotive is so equipped.

■ 10. Section 229.29 is revised to read as follows:

§ 229.29 Air brake system calibration, maintenance, and testing.

(a) A locomotive's air brake system shall receive the calibration, maintenance, and testing as prescribed in this section. The level of maintenance and testing and the intervals for receiving such maintenance and testing of locomotives with various types of air brake systems shall be conducted in accordance with paragraphs (d) through (f) of this section. Records of the maintenance and testing required in this section shall be maintained in accordance with paragraph (g) of this section.

(b) Except for DMU or MU locomotives covered under § 238.309 of this chapter, the air flow method (AFM) indicator shall be calibrated in accordance with § 232.205(c)(1)(iii) at intervals not to exceed 92 days, and records shall be maintained as prescribed paragraph (g)(1) of this section.

(c) Except for DMU or MU locomotives covered under § 238.309 of this chapter, the extent of air brake system maintenance and testing that is required on a locomotive shall be in accordance with the following levels:

(1) *Level one:* Locomotives shall have the filtering devices or dirt collectors located in the main reservoir supply line to the air brake system cleaned, repaired, or replaced.

(2) *Level two:* Locomotives shall have the following components cleaned, repaired, and tested: brake cylinder relay valve portions; main reservoir safety valves; brake pipe vent valve portions; and, feed and reducing valve portions in the air brake system (including related dirt collectors and filters).

(3) *Level three:* Locomotives shall have the components identified in this paragraph removed from the locomotive and disassembled, cleaned and lubricated (if necessary), and tested. In addition, all parts of such components that can deteriorate within the inspection interval as defined in paragraphs (d) through (f) of this section shall be replaced and tested. The components include: all pneumatic components of the locomotive equipment's brake system that contain moving parts, and are sealed against air leaks; all valves and valve portions; electric-pneumatic master controllers in the air brake system; and all air brake related filters and dirt collectors.

(d) Except for MU locomotives covered under § 238.309 of this chapter, all locomotives shall receive level one air brake maintenance and testing as described in this section at intervals that do not exceed 368 days.

(e) Locomotives equipped with an air brake system not specifically identified in paragraphs (f)(1) through (3) of this section shall receive level two air brake maintenance and testing as described in this section at intervals that do not exceed 368 days and level three air brake maintenance and testing at intervals that do not exceed 736 days.

(f) Level two and level three air brake maintenance and testing shall be performed on each locomotive identified in this paragraph at the following intervals:

(1) At intervals that do not exceed 1,104 days for a locomotive equipped with a 26–L or equivalent brake system;

(2) At intervals that do not exceed 1,472 days for locomotives equipped with an air dryer and a 26–L or equivalent brake system and for locomotives not equipped with an air compressor and that are semi-permanently coupled and dedicated to locomotives with an air dryer; or

(3) At intervals that do not exceed 1,840 days for locomotives equipped

with CCB–1, CCB–2, CCB–26, EPIC 1 (formerly EPIC 3102), EPIC 3102D2, EPIC 2, KB–HS1, or Fastbrake brake systems.

(g) Records of the air brake system maintenance and testing required by this section shall be generated and maintained in accordance with the following:

(1) The date of AFM indicator calibration shall be recorded and certified in the remarks section of Form F6180–49A.

(2) The date and place of the cleaning, repairing and testing required by this section shall be recorded on Form FRA F 6180–49A, and the work shall be certified. A record of the parts of the air brake system that are cleaned, repaired, and tested shall be kept in the railroad's files or in the cab of the locomotive.

(3) At its option, a railroad may fragment the work required by this section. In that event, a separate record shall be maintained under a transparent cover in the cab. The air record shall include: the locomotive number; a list of the air brake components; and the date and place of the inspection and testing of each component. The signature of the person performing the work and the signature of that person's supervisor shall be included for each component. A duplicate record shall be maintained in the railroad's files.

■ 11. Section 229.46 is revised to read as follows:

§ 229.46 Brakes: general.

(a) Before each trip, the railroad shall know the following:

(1) The locomotive brakes and devices for regulating pressures, including but not limited to the automatic and independent brake control systems, operate as intended; and

(2) The water and oil have been drained from the air brake system of all locomotives in the consist.

(b) A locomotive with an inoperative or ineffective automatic or independent brake control system will be considered to be operating as intended for purposes of paragraph (a) of this section, if all of the following conditions are met:

(1) The locomotive is in a trailing position and is not the controlling locomotive in a distributed power train consist;

(2) The railroad has previously determined, in conjunction with the locomotive and/or airbrake manufacturer, that placing such a locomotive in trailing position adequately isolates the non-functional valves so as to allow safe operation of the brake systems from the controlling locomotive;

(3) If deactivation of the circuit breaker for the air brake system is required, it shall be specified in the railroad's operating rules;

(4) A tag shall immediately be placed on the isolation switch of the locomotive giving the date and location and stating that the unit may only be used in a trailing position and may not be used as a lead or controlling locomotive;

(5) The tag required in paragraph (b)(4) of this section remains attached to the isolation switch of the locomotive until repairs are made; and

(6) The inoperative or ineffective brake control system is repaired prior to or at the next periodic inspection.

■ 12. Section 229.61 is revised to read as follows:

§ 229.61 Draft system.

(a) A coupler may not have any of the following conditions:

(1) A distance between the guard arm and the knuckle nose of more than 5 5/16 inches on D&E couplers.

(2) A crack or break in the side wall or pin bearing bosses outside of the shaded areas shown in Figure 1 or in the pulling face of the knuckle.

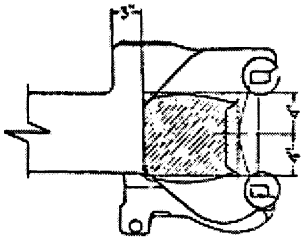

Figure 1

(3) A coupler assembly without anti-creep protection.

(4) Free slack in the coupler or drawbar not absorbed by friction devices or draft gears that exceeds one-half inches.

(5) A broken or cracked coupler carrier.

(6) A broken or cracked yoke.

(7) A broken draft gear.

(b) A device shall be provided under the lower end of all drawbar pins and articulated connection pins to prevent the pin from falling out of place in case of breakage.

■ 13. Section 229.85 is revised to read as follows:

§ 229.85 High voltage markings: doors, cover plates, or barriers.

All doors, cover plates, or barriers providing direct access to high voltage equipment shall be marked ''Danger-High Voltage'' or with the word ''Danger'' and the normal voltage carried by the parts so protected.

■ 14. Section 229.114 is added to read as follows:

§ 229.114 Steam generator inspections and tests.

(a) *Periodic steam generator inspection.* Except as provided in § 229.33, each steam generator shall be inspected and tested in accordance with paragraph (d) of this section at intervals not to exceed 92 days, unless the steam generator is isolated in accordance with paragraph (b) of this section. All non-complying conditions shall be repaired or the steam generator shall be isolated as prescribed in paragraph (b) of this section before the locomotive is used.

(b) *Isolation of a steam generator.* A steam generator will be considered isolated if the water suction pipe to the water pump and the leads to the main switch (steam generator switch) are disconnected, and the train line shut-off-valve is wired closed or a blind gasket is applied. Before an isolated steam generator is returned to use, it shall be inspected and tested pursuant to paragraph (d) of this section.

(c) *Forms.* Each periodic steam generator inspection and test shall be recorded on Form FRA F 6180–49A required by paragraph § 229.23. When Form FRA F 6180–49A for the locomotive is replaced, data for the steam generator inspections shall be transferred to the new Form FRA F6180–49A.

(d) *Tests and requirements.* Each periodic steam generator inspection and test shall include the following tests and requirements:

(1) All electrical devices and visible insulation shall be inspected.

(2) All automatic controls, alarms, and protective devices shall be inspected and tested.

(3) Steam pressure gauges shall be tested by comparison with a dead-weight tester or a test gauge designed for this purpose. The siphons to the steam gauges shall be removed and their connections examined to determine that they are open.

(4) Safety valves shall be set and tested under steam after the steam pressure gauge is tested.

(e) *Annual steam generator tests.* Each steam generator that is not isolated in accordance with paragraph (b) of this section, shall be subjected to a hydrostatic pressure at least 25 percent above the working pressure and the visual return water-flow indicator shall be removed and inspected. The testing under this paragraph shall be performed at intervals that do not exceed 368 calendar days.

■ 15. Section 229.119 is amended by revising paragraphs (d) and (e) and

adding paragraphs (g) through (i) to read as follows:

§ 229.119 Cabs, floors, and passageways.

* * * * *

(d) Any occupied locomotive cab shall be provided with proper ventilation and with a heating arrangement that maintains a temperature of at least 60 degrees Fahrenheit 6 inches above the center of each seat in the cab compartment.

(e) Similar locomotives with open-end platforms coupled in multiple control and used in road service shall have a means of safe passage between them; no passageway is required through the nose of car body locomotives. There shall be a continuous barrier across the full width of the end of a locomotive or a continuous barrier between locomotives.

* * * * *

(g) Each locomotive or remanufactured locomotive placed in service for the first time on or after June 8, 2012, shall be equipped with an air conditioning unit in the locomotive cab compartment.

(h) Each air conditioning unit in the locomotive cab on a locomotive identified in paragraph (g) of this section shall be inspected and maintained to ensure that it operates properly and meets or exceeds the manufacturer's minimum operating specifications during the periodic inspection required for the locomotive pursuant to § 229.23 of this part.

(i) Each locomotive or remanufactured locomotive ordered on or after June 8, 2012, or placed in service for the first time on or after December 10, 2012, shall be equipped with a securement device on each exterior locomotive cab door that is capable of securing the door from inside of the cab.

■ 16. Section 229.123 is revised to read as follows:

§ 229.123 Pilots, snowplows, end plates.

(a) Each lead locomotive shall be equipped with a pilot, snowplow, or end plate that extends across both rails. The minimum clearance above the rail of the pilot, snowplow or end plate shall be 3 inches. Except as provided in paragraph (b) of this section, the maximum clearance shall be 6 inches. When the locomotive is equipped with a combination of the equipment listed in this paragraph, each extending across both rails, only the lowest piece of that equipment must satisfy clearance requirements of this section.

(b) To provide clearance for passing over retarders, locomotives utilized in hump yard or switching service at hump yard locations may have pilot, snowplow, or end plate maximum height of 9 inches.

(1) Each locomotive equipped with a pilot, snowplow, or end plate with clearance above 6 inches shall be prominently stenciled at each end of the locomotive with the words ''9-inch Maximum End Plate Height, Yard or Trail Service Only.''

(2) When operated in switching service in a leading position, locomotives with a pilot, snowplow, or end plate clearance above 6 inches shall be limited to 10 miles per hour over grade crossings.

(3) Train crews shall be notified in writing of the restrictions on the locomotive, by label or stencil in the cab, or by written operating instruction given to the crew and maintained in the cab of the locomotive.

(4) Pilot, snowplow, or end plate clearance above 6 inches shall be noted in the remarks section of Form FRA 6180–49a.

(5) Locomotives with a pilot, snowplow, or end plate clearance above 6 inches shall not be placed in the lead position when being moved under section § 229.9.

17. Section 229.125 is amended by revising paragraphs (a) and (d)(2) and (3) to read as follows:

§ 229.125 Headlights and auxiliary lights.

(a) Each lead locomotive used in road service shall illuminate its headlight while the locomotive is in use. When illuminated, the headlight shall produce a peak intensity of at least 200,000 candela and produce at least 3,000 candela at an angle of 7.5 degrees and at least 400 candela at an angle of 20 degrees from the centerline of the locomotive when the light is aimed parallel to the tracks. If a locomotive or locomotive consist in road service is regularly required to run backward for any portion of its trip other than to pick up a detached portion of its train or to make terminal movements, it shall also have on its rear a headlight that meets the intensity requirements above. Each headlight shall be aimed to illuminate a person at least 800 feet ahead and in front of the headlight. For purposes of this section, a headlight shall be comprised of either one or two lamps.

(1) If a locomotive is equipped with a single-lamp headlight, the single lamp shall produce a peak intensity of at least 200,000 candela and shall produce at least 3,000 candela at an angle of 7.5 degrees and at least 400 candela at an angle of 20 degrees from the centerline of the locomotive when the light is aimed parallel to the tracks. The following operative lamps meet the standard set forth in this paragraph: a single incandescent PAR–56, 200-watt, 30-volt lamp; a single halogen PAR–56, 200-watt, 30-volt lamp; a single halogen PAR–56, 350-watt, 75-volt lamp, or a single lamp meeting the intensity requirements given above.

(2) If a locomotive is equipped with a dual-lamp headlight, a peak intensity of at least 200,000 candela and at least 3,000 candela at an angle of 7.5 degrees and at least 400 candela at an angle of 20 degrees from the centerline of the locomotive when the light is aimed parallel to the tracks shall be produced by the headlight based either on a single lamp capable of individually producing the required peak intensity or on the candela produced by the headlight with both lamps illuminated. If both lamps are needed to produce the required peak intensity, then both lamps in the headlight shall be operational. The following operative lamps meet the standard set forth in this paragraph (a)(2): A single incandescent PAR–56, 200-watt, 30-volt lamp; a single halogen PAR–56, 200-watt, 30-volt lamp; a single halogen PAR–56, 350-watt, 75-volt lamp; two incandescent PAR–56, 350-watt, 75-volt lamps; or lamp(s) meeting the intensity requirements given above.

(i) A locomotive equipped with the two incandescent PAR–56, 350-watt, 75 volt lamps which has an en route failure of one lamp in the headlight fixture, may continue in service as a lead locomotive until its next daily inspection required by § 229.21 only if:

(A) Auxiliary lights burn steadily;

(B) Auxiliary lights are aimed horizontally parallel to the longitudinal centerline of the locomotive or aimed to cross no less than 400 feet in front of the locomotive.

(C) Second headlight lamp and both auxiliary lights continue to operate.

(ii) [Reserved].

* * * * *

(d) * * *

(2) Each auxiliary light shall produce a peak intensity of at least 200,000 candela or shall produce at least 3,000 candela at an angle of 7.5 degrees and at least 400 candela at an angle of 20 degrees from the centerline of the locomotive when the light is aimed parallel to the tracks. Any of the following operative lamps meet the standard set forth in this paragraph: an incandescent PAR–56, 200-watt, 30-volt lamp; a halogen PAR–56, 200-watt, 30-volt lamp; a halogen PAR–56, 350-watt, 75-volt lamp; an incandescent PAR–56, 350-watt, 75-volt lamp; or a single lamp having equivalent intensities at the specified angles.

(3) The auxiliary lights shall be aimed horizontally within 15 degrees of the

longitudinal centerline of the locomotive.

* * * * *

■ 18. Section 229.133 is amended by revising paragraphs (b)(1) and (2) and (c)(1) and (2) to read as follows:

§ 229.133 Interim locomotive conspicuity measures—auxiliary external lights.

* * * * *

(b) * * *

(1) *Strobe lights.* (i) Strobe lights shall consist of two white stroboscopic lights, each with ''effective intensity,'' as defined by the Illuminating Engineering Society's Guide for Calculating the Effective Intensity of Flashing Signal Lights (November 1964), of at least 500 candela.

(ii) The flash rate of strobe lights shall be at least 40 flashes per minute and at most 180 flashes per minute.

(iii) Strobe lights shall be placed at the front of the locomotive, at least 48 inches apart, and at least 36 inches above the top of the rail.

(2) *Oscillating light.* (i) An oscillating light shall consist of:

(A) One steadily burning white light producing at least 200,000 candela in a moving beam that depicts a circle or a horizontal figure ''8'' to the front, about the longitudinal centerline of the locomotive; or

(B) Two or more white lights producing at least 200,000 candela each, at one location on the front of the locomotive, that flash alternately with beams within five degrees horizontally to either side of the longitudinal centerline of the locomotive.

(ii) An oscillating light may incorporate a device that automatically extinguishes the white light if display of a light of another color is required to protect the safety of railroad operations.

* * * * *

(c)(1) Any lead locomotive equipped with oscillating lights as described in paragraph (b)(2) of this section that were ordered for installation on that locomotive prior to January 1, 1996, is considered in compliance with § 229.125(d)(1) through (3).

(2) Any lead locomotive equipped with strobe lights as described in paragraph (b)(1) and operated at speeds no greater than 40 miles per hour, is considered in compliance with § 229.125(d)(1) through (3) until the locomotive is retired or rebuilt, whichever comes first.

* * * * *

■ 19. Section 229.140 is added to read as follows:

§ 229.140 Alerters.

(a) Except for locomotives covered by part 238 of this chapter, each of the following locomotives shall be equipped with a functioning alerter as described in paragraphs (b) through (d) of this section:

(1) A locomotive that is placed in service for the first time on or after June 10, 2013, when used as a controlling locomotive and operated at speeds in excess of 25 mph.

(2) All controlling locomotives operated at speeds in excess of 25 mph on or after January 1, 2017.

(b) The alerter on locomotives subject to paragraph (a) of this section shall be equipped with a manual reset and the alerter warning timing cycle shall automatically reset as the result of any of the following operations, and at least three of the following automatic resets shall be functional at any given time:

(1) Movement of the throttle handle;

(2) Movement of the dynamic brake control handle;

(3) Movement of the operator's horn activation handle;

(4) Movement of the operator's bell activation switch;

(5) Movement of the automatic brake valve handle; or

(6) Bailing the independent brake by depressing the independent brake valve handle.

(c) All alerters shall provide an audio alarm upon expiration of the timing cycle interval. An alerter on a locomotive that is placed in service for the first time on or after June 10, 2013, shall display a visual indication to the operator at least five seconds prior to an audio alarm. The visual indication on an alerter so equipped shall be visible to the operator from their normal position in the cab.

(d) Alerter warning timing cycle interval shall be within 10 seconds of the calculated setting utilizing the formula (timing cycle specified in seconds = 2400 ÷ track speed specified in miles per hour).

(e) Any locomotive that is equipped with an alerter shall have the alerter functioning and operating as intended when the locomotive is used as a controlling locomotive.

(f) A controlling locomotive equipped with an alerter shall be tested prior to departure from each initial terminal, or prior to being coupled as the lead locomotive in a locomotive consist by allowing the warning timing cycle to expire that results in an application of the locomotive brakes at a penalty rate.

■ 20. Part 229 is amended by adding subpart E to read as follows:

Subpart E—Locomotive Electronics

Sec.

229.301 Purpose and scope.
229.303 Applicability.
229.305 Definitions.
229.307 Safety analysis.
229.309 Safety-critical changes and failures.
229.311 Review of SAs.
229.313 Product testing results and records.
229.315 Operations and maintenance manual.
229.317 Training and qualification program.
229.319 Operating Personnel Training.

Subpart E—Locomotive Electronics

§ 229.301 Purpose and scope.

(a) The purpose of this subpart is to promote the safe design, operation, and maintenance of safety-critical, as defined in § 229.305, electronic locomotive control systems, subsystems, and components.

(b) Locomotive control systems or their functions that comingle with safety critical processor based signal and train control systems are regulated under part 236 subparts H and I of this chapter.

§ 229.303 Applicability.

(a) The requirements of this subpart apply to all safety-critical electronic locomotive control systems, subsystems, and components (i.e., ''products'' as defined in § 229.305), except for the following:

(1) Products that are in service prior to June 8, 2012.

(2) Products that are under development as of October 9, 2012, and are placed in service prior to October 9, 2017.

(3) Products that comingle locomotive control systems with safety critical processor based signal and train control systems;

(4) Products that are used during on-track testing within a test facility; and

(5) Products that are used during on-track testing outside a test facility, if approved by FRA. To obtain FRA approval of on-track testing outside of a test facility, a railroad shall submit a request to FRA that provides:

(i) Adequate information regarding the function and history of the product that it intends to use;

(ii) The proposed tests;

(iii) The date, time and location of the tests; and

(iv) The potential safety consequences that will result from operating the product for purposes of testing.

(b) Railroads and vendors shall identify all products that are under development to FRA by October 9, 2012.

(c) The exceptions provided in paragraph (a) of this section do not apply to products or product changes that result in degradation of safety, or a material increase in safety-critical functionality.

§ 229.305 Definitions.

As used in this subpart—

Cohesion is a measure of how strongly-related or focused the responsibilities of a system, subsystem, or component are.

Comingle refers to the act of creating systems, subsystems, or components where the systems, subsystems, or components are tightly coupled and with low cohesion.

Component means an electronic element, device, or appliance (including hardware or software) that is part of a system or subsystem.

Configuration management control plan means a plan designed to ensure that the proper and intended product configuration, including the electronic hardware components and software version, is documented and maintained through the life-cycle of the products in use.

Executive software means software common to all installations of a given electronic product. It generally is used to schedule the execution of the site-specific application programs, run timers, read inputs, drive outputs, perform self-diagnostics, access and check memory, and monitor the execution of the application software to detect unsolicited changes in outputs.

Initialization refers to the startup process when it is determined that a product has all required data input and the product is prepared to function as intended.

Loosely coupled means an attribute of systems, referring to an approach to designing interfaces across systems, subsystems, or components to reduce the interdependencies between them—in particular, reducing the risk that changes within one system, subsystem, or component will create unanticipated changes within other system, subsystem, or component.

Materials handling refers to explicit instructions for handling safety-critical components established to comply with procedures specified by the railroad.

New or next-generation locomotive control system means a locomotive control system using technologies or combinations of technologies that are not in use in revenue service, products that are under development as of October 9, 2012, are placed into service prior to October 9, 2015, or products without established histories of safe practice.

Product means any safety critical electronic locomotive control system, subsystem, or component, not including safety critical processor based signal and train control systems, whose functions are directly related to safe movement and stopping of the train as well as the associated man-machine interfaces irrespective of the location of the control system, subsystem, or component.

Revision control means a chain of custody regimen designed to positively identify safety-critical components and spare equipment availability, including repair/replacement tracking.

Safety Analysis refers to a formal set of documentation which describes in detail all of the safety aspects of the product, including but not limited to procedures for its development, installation, implementation, operation, maintenance, repair, inspection, testing, and modification, as well as analyses supporting its safety claims.

Safety-critical, as applied to a function, a system, or any portion thereof, means the correct performance of which is essential to safety of personnel or equipment, or both; or the incorrect performance of which could cause a hazardous condition, or allow a hazardous condition which was intended to be prevented by the function or system to exist.

Subsystem means a defined portion of a system.

System refers to any electronic locomotive control system and includes all subsystems and components thereof, as the context requires.

Test facility means a track that is not part of the general railroad system of transportation and is being used exclusively for the purpose of testing equipment and has all of its public grade crossings protected.

Tightly Coupled means an attribute of systems, referring to an approach to designing interfaces across systems, subsystems, or components to maximize the interdependencies between them. In particular, increasing the risk that changes within one system, subsystem, or component will create unanticipated changes within other system, subsystem, or component.

§ 229.307 Safety analysis.

(a) A railroad shall develop a Safety Analysis (SA) for each product subject to this subpart prior to the initial use of such product on their railroad.

(b) The SA shall:

(1) establish and document the minimum requirements that will govern the development and implementation of all products subject to this subpart, and be based on good engineering practice and should be consistent with the guidance contained in Appendix F of this part in order to establish that a product's safety-critical functions will operate with a high degree of confidence in a fail-safe manner;

(2) Include procedures for immediate repair of safety-critical functions; and

(3) Be made available to FRA upon request.

(c) Each railroad shall comply with the SA requirements and procedures related to the development, implementation, and repair of a product subject to this subpart.

§ 229.309 Safety-critical changes and failures.

(a) Whenever a planned safety-critical design change is made to a product that is in use by a railroad and subject to this subpart, the railroad shall:

(1) Notify FRA's Associate Administrator for Safety of the design changes made by the product supplier;

(2) Ensure that the SA is updated as required;

(3) Conduct all safety-critical changes in a manner that allows the change to be audited;

(4) Specify all contractual arrangements with suppliers and private equipment owners for notification of any and all electronic safety-critical changes as well as safety-critical failures in the suppliers and private equipment owners' system, subsystem, or components, and the reasons for that change or failure from the suppliers or equipment owners, whether or not the railroad has experienced a failure of that safety critical system, sub-system, or component;

(5) Specify the railroad's procedures for action upon receipt of notification of a safety-critical change or failure of an electronic system, sub-system, or component, and until the upgrade or revision has been installed; and

(6) Identify all configuration/revision control measures designed to ensure that safety-functional requirements and safety-critical hazard mitigation processes are not compromised as a result of any such change, and that any such change can be audited.

(b) Product suppliers and private equipment owners shall report any safety-critical changes and previously unidentified hazards to each railroad using the product or equipment.

(c) Private equipment owners shall establish configuration/revision control measures for control of safety-critical changes and identification of previously unidentified hazards.

§ 229.311 Review of SAs.

(a) Prior to the initial planned use of a product subject to this subpart, a railroad shall inform the Associate Administrator for Safety/Chief Safety Officer, FRA, 1200 New Jersey Avenue SE., Mail Stop 25, Washington, DC 20590 of the intent to place this product

in service. The notification shall provide a description of the product, and identify the location where the complete SA documentation described in § 229.307, the testing records contained in § 229.313, and the training and qualification program described in § 229.319 is maintained.

(b) FRA may review or audit the SA within 60 days of receipt of the notification or anytime after the product is placed in use. If FRA has not notified the railroad of its intent to review or audit the SA within the 60-day period, the railroad may assume that FRA does not intend to review or audit, and place the product in use. FRA reserves the right, however, to conduct a review or audit at a later date.

(c) A railroad shall maintain and make available to FRA upon request all railroad or vendor documentation used to demonstrate that the product meets the safety requirements of the SA for the life-cycle of the product.

(d) After a product is placed in service, the railroad shall maintain a database of all safety-relevant hazards encountered with the product. The database shall include all hazards identified in the SA and those that had not been previously identified in the SA. If the frequency of the safety-relevant hazards exceeds the threshold set forth in the SA, then the railroad shall:

(1) Report the inconsistency by mail, facsimile, email, or hand delivery to the Director, Office of Safety Assurance and Compliance, FRA, 1200 New Jersey Ave. SE., Mail Stop 25, Washington, DC 20590, within 15 days of discovery;

(2) Take immediate countermeasures to reduce the frequency of the safety-relevant hazard(s) below the threshold set forth in the SA; and

(3) Provide a final report to FRA's Director, Office of Safety Assurance and Compliance, on the results of the analysis and countermeasures taken to reduce the frequency of the safety-relevant hazard(s) below the calculated probability of failure threshold set forth in the SA when the problem is resolved. For hazards not identified in the SA the threshold shall be exceeded at one occurrence.

§ 229.313 Product testing results and records.

(a) Results of product testing conducted by a railroad as required by this subpart shall be recorded on preprinted forms provided by the railroad, or stored electronically. Electronic recordkeeping or automated tracking systems, subject to the provisions contained in paragraph (e) of this section, may be utilized to store and maintain any testing or training record required by this subpart. Results of product testing conducted by a vendor or private equipment owner in support of a SA shall be provided to the railroad as part of the SA.

(b) The testing records shall contain all of the following:

(1) The name of the railroad;

(2) The location and date that the test was conducted;

(3) The equipment tested;

(4) The results of tests;

(5) The repairs or replacement of equipment;

(6) Any preventative adjustments made; and

(7) The condition in which the equipment is left.

(c) Each record shall be:

(1) Signed by the employee conducting the test, or electronically coded, or identified by the automated test equipment number;

(2) Filed in the office of a supervisory official having jurisdiction, unless otherwise noted; and

(3) Available for inspection and copying by FRA.

(d) The results of the testing conducted in accordance with this subpart shall be retained as follows:

(1) The results of tests that pertain to installation or modification of a product shall be retained for the life-cycle of the product tested and may be kept in any office designated by the railroad;

(2) The results of periodic tests required for the maintenance or repair of the product tested shall be retained until the next record is filed and in no case less than one year; and

(3) The results of all other tests and training shall be retained until the next record is filed and in no case less than one year.

(e) Electronic or automated tracking systems used to meet the requirements contained in paragraph (a) of this section shall be capable of being reviewed and monitored by FRA at any time to ensure the integrity of the system. FRA's Associate Administrator for Safety may prohibit or revoke a railroad's authority to utilize an electronic or automated tracking system in lieu of preprinted forms if FRA finds that the electronic or automated tracking system is not properly secured, is inaccessible to FRA, or railroad employees requiring access to discharge their assigned duties, or fails to adequately track and monitor the equipment. The Associate Administrator for Safety will provide the affected railroad with a written statement of the basis for the decision prohibiting or revoking the railroad from utilizing an electronic or automated tracking system.

§ 229.315 Operations and maintenance manual.

(a) The railroad shall maintain all documents pertaining to the installation, maintenance, repair, modification, inspection, and testing of a product subject to this part in one Operations and Maintenance Manual (OMM).

(1) The OMM shall be legible and shall be readily available to persons who conduct the installation, maintenance, repair, modification, inspection, and testing, and for inspection by FRA.

(2) At a minimum, the OMM shall contain all product vendor operation and maintenance guidance.

(b) The OMM shall contain the plans and detailed information necessary for the proper maintenance, repair, inspection, and testing of products subject to this subpart. The plans shall identify all software versions, revisions, and revision dates.

(c) Hardware, software, and firmware revisions shall be documented in the OMM according to the railroad's configuration management control plan.

(d) Safety-critical components, including spare products, shall be positively identified, handled, replaced, and repaired in accordance with the procedures specified in the railroad's configuration management control plan.

(e) A railroad shall determine that the requirements of this section have been met prior to placing a product subject to this subpart in use on their property.

§ 229.317 Training and qualification program.

(a) A railroad shall establish and implement training and qualification program for products subject to this subpart prior to the product being placed in use. These programs shall meet the requirements set forth in this section and in § 229.319.

(b) The program shall provide training for the individuals identified in this paragraph to ensure that they possess the necessary knowledge and skills to effectively complete their duties related to the product. These include:

(1) Individuals whose duties include installing, maintaining, repairing, modifying, inspecting, and testing safety-critical elements of the product;

(2) Individuals who operate trains or serve as a train or engine crew member subject to instruction and testing under part 217 of this chapter;

(3) Roadway and maintenance-of-way workers whose duties require them to know and understand how the product affects their safety and how to avoid interfering with its proper functioning; and

(4) Direct supervisors of the individuals identified in paragraphs (b)(1) through (3) of this section.

(c) When developing the training and qualification program required in this section, a railroad shall conduct a formal task analysis. The task analysis shall:

(1) Identify the specific goals of the program for each target population (craft, experience level, scope of work, etc.), task(s), and desired success rate;

(2) Identify the installation, maintenance, repair, modification, inspection, testing, and operating tasks that will be performed on the railroad's products, including but not limited to the development of failure scenarios and the actions expected under such scenarios;

(3) Develop written procedures for the performance of the tasks identified; and

(4) Identify any additional knowledge, skills, and abilities above those required for basic job performance necessary to perform each task.

(d) Based on the task analysis, a railroad shall develop a training curriculum that includes formally structured training designed to impart the knowledge, skills, and abilities identified as necessary to perform each task.

(e) All individuals identified in paragraph (b) of this section shall successfully complete a training curriculum and pass an examination that covers the product and appropriate rules and tasks for which they are responsible (however, such persons may perform such tasks under the direct onsite supervision of a qualified person prior to completing such training and passing the examination).

(f) A railroad shall conduct periodic refresher training at intervals to be formally specified in the program, except with respect to basic skills for which proficiency is known to remain high as a result of frequent repetition of the task.

(g) A railroad shall conduct regular and periodic evaluations of the effectiveness of the training program, verifying the adequacy of the training material and its validity with respect to the railroad's products and operations.

(h) A railroad shall maintain records that designate individuals who are qualified under this section until new designations are recorded or for at least one year after such persons leave applicable service. These records shall be maintained in a designated location and be available for inspection and replication by FRA.

§ 229.319 Operating Personnel Training.

(a) The training required under § 229.317 for any locomotive engineer or other person who participates in the operation of a train using an onboard electronic locomotive control system shall address all of the following elements and shall be specified in the training program.

(1) Familiarization with the electronic control system equipment onboard the locomotive and the functioning of that equipment as part of the system and in relation to other onboard systems under that person's control;

(2) Any actions required of the operating personnel to enable or enter data into the system and the role of that function in the safe operation of the train;

(3) Sequencing of interventions by the system, including notification, enforcement, penalty initiation and post penalty application procedures as applicable;

(4) Railroad operating rules applicable to control systems, including provisions for movement and protection of any unequipped trains, or trains with failed or cut-out controls;

(5) Means to detect deviations from proper functioning of onboard electronic control system equipment and instructions explaining the proper response to be taken regarding control of the train and notification of designated railroad personnel; and

(6) Information needed to prevent unintentional interference with the proper functioning of onboard electronic control equipment.

(b) The training required under this subpart for a locomotive engineer and conductor, together with required records, shall be integrated into the program of training required by parts 240 and 242 of this chapter.

■ 21. Appendix B is amended by:

■ a. Adding an entry under subpart A for 229.15;

■ b. Revising the entries under subpart B for 229.23 and 229.25 and under subpart C for 229.105;

■ c. Adding an entry under subpart C for 229.114;

■ d. Adding in the entry under subpart C for 229.119 entries for paragraphs (g), (h), and (i);

■ e. Adding an entry under subpart C for 229.140;

■ f. Moving the entry for 229.141 into numerical order under subpart C; and

■ g. Adding an entry for subpart E.

The additions and revisions read as follows:

Appendix B to Part 229—Schedule of Civil Penalties [1]

Section	Violation	Willful violation
Subpart A—General		
* * * * *	*	*
229.15 Remote control locomotives	2,500	5,000
* * * * *	*	*
Subpart B—Inspection and tests		
* * * * *	*	*
229.23 Periodic inspection General:		
(a)(1) Inspection overdue	2,500	5,000
(a)(2) Inspection performed improperly or at a location where the underneath portion cannot be safely inspected	2,500	5,000
(b)(1) Inspection overdue	2,500	5,000
(b)(2) Inspection overdue	2,500	5,000
(c) Inspection overdue	2,500	5,000
(e):		
(1) Form missing	1,000	2,000
(2) Form not properly displayed	1,000	2,000
(3) Form improperly executed	1,000	2,000
(f) Replace Form FRA F 6180.49A by April 2 or July 3		
(g) Secondary record of the information reported Form FRA F 6180.49A	1,000	2,000

Section	Violation	Willful violation
* * * * * * *		
229.25 Tests: every periodic inspection:		
(a) through (d)(4) and (e) and (f) Tests	2,500	5,000
(d)(5) Ineffective maintenance	8,000	16,000
* * * * * * *		
229.105 Steam generator number	1,000	1,500
* * * * * * *		
229.114 Steam generator inspections and tests	2,500	5,000
* * * * * * *		
229.119 Cabs, floors, and passageways:		
* * * * * * *		
(g) Failure to equip	2,500	5,000
(h) Failure to maintain	2,500	5,000
(i) Failure to equip	2,500	5,000
* * * * * * *		
229.140 Alerters	2,500	5,000
* * * * * * *		
Subpart E—Locomotive Electronics		
229.307 Safety analysis:		
(a) Failure to establish and maintain a safety analysis	5,000	10,000
(b) Failure to provide safety analysis upon request	2,500	5,000
(c) Failure to comply with safety analysis	5,000–10,000	15,000
229.309 Safety-critical changes and failure:		
(a)(1) Failure to notify FRA	1,000	2,000
(a)(2) Failure to update safety analysis	3,500	7,000
(a)(4) Failure to notify manufacturer	10,000	15,000
(b) Failure to notify railroad	10,000	15,000
(c) Failure to establish and maintain program	3,500	7,000
229.311 Review of SAs:		
(a) Failure to notify FRA	1,000	2,000
(b) Failure to report	1,000	2,000
(c) Failure to correct safety hazards	5,000–10,000	15,000
(d) Failure to final report	1,000	2,000
229.313 Product testing results and records:		
(a) Failure to maintain records and database	5,000	10,000
(b) Incomplete testing records	3,500	7,000
(c) Improper signature	3,500	7,000
229.315 Operations and maintenance manual:		
(a) Failure to implement and maintain manual	5,000	10,000
(c) Failure to document revisions	5,000	10,000
(d) Failure to follow plan	5,000–10,000	15,000
229.317 Training and qualification program:		
(a) Failure to establish and implement program	5,000	10,000
(b) Failure to conduct training	2,500	5,000
(g) Failure to evaluate program	2,500	5,000
(h) Failure to maintain records	1,500	3,000
229.319 Operating personnel training	2,500	5,000

[1] A penalty may be assessed against an individual only for a willful violation. Generally, when two or more violations of these regulations are discovered with respect to a single locomotive that is used by a railroad, the appropriate penalties set forth above are aggregated up to a maximum of $16,000 per day. However, a failure to perform, with respect to a particular locomotive, any of the inspections and tests required under subpart B of this part will be treated as a violation separate and distinct from, and in addition to, any substantive violative conditions found on that locomotive. Moreover, the Administrator reserves the right to assess a penalty of up to $100,000 for any violation where circumstances warrant. See 49 CFR part 209, appendix A.

Failure to observe any condition for movement set forth in § 229.9 will deprive the railroad of the benefit of the movement-for-repair provision and make the railroad and any responsible individuals liable for penalty under the particular regulatory section(s) concerning the substantive defect(s) present on the locomotive at the time of movement. Failure to comply with § 229.19 will result in the lapse of any affected waiver.

■ 22. Part 229 is amended by adding Appendix F to read as follows:

Appendix F to Part 229—Recommended Practices for Design and Safety Analysis

The purpose of this appendix is to provide recommended criteria for design and safety analysis that will maximize the safety of electronic locomotive control systems and mitigate potential negative safety effects. It seeks to promote full disclosure of potential safety risks to facilitate minimizing or eliminating elements of risk where practicable. It discuses critical elements of good engineering practice that the designer should consider when developing safety critical electronic locomotive control systems

to accomplish this objective. The criteria and processes specified this appendix is intended to minimize the probability of failure to an acceptable level within the limitations of the available engineering science, cost, and other constraints. Railroads procuring safety critical electronic locomotive controls are encouraged to ensure that their vendor addresses each of the elements of this appendix in the design of the product being procured. FRA uses the criteria and processes set forth in this appendix (or other technically equivalent criteria and processes that may be recommended by industry) when evaluating analyses, assumptions, and conclusions provided in the SA documents.

Definitions

In addition to the definitions contained in § 229.305, the following definitions are applicable to this Appendix:

Hazard means an existing or potential condition that can result in an accident.

High degree of confidence, as applied to the highest level of aggregation, means there exists credible safety analysis supporting the conclusion that the risks associated with the product have been adequately mitigated.

Human factors refers to a body of knowledge about human limitations, human abilities, and other human characteristics, such as behavior and motivation, that shall be considered in product design.

Human-machine interface (HMI) means the interrelated set of controls and displays that allows humans to interact with the machine.

Risk means the expected probability of occurrence for an individual accident event (probability) multiplied by the severity of the expected consequences associated with the accident (severity).

Risk assessment means the process of determining, either quantitatively or qualitatively, the measure of risk associated with use of the product under all intended operating conditions.

System Safety Precedence means the order of precedence in which methods used to eliminate or control identified hazards within a system are implemented.

Validation means the process of determining whether a product's design requirements fulfill its intended design objectives during its development and life-cycle. The goal of the validation process is to determine ''whether the correct product was built.''

Verification means the process of determining whether the results of a given phase of the development cycle fulfill the validated requirements established at the start of that phase. The goal of the verification process is to determine ''whether the product was built correctly.''

Safety Assessments—Recommended Contents

The safety-critical assessment of each product should include all of its interconnected subsystems and components and, where applicable, the interaction between such subsystems. FRA recommends that such assessments contain the following:

(a) A complete description of the product, including a list of all product components and their physical relationship in the subsystem or system;

(b) A description of the railroad operation or categories of operations on which the product is designed to be used;

(c) An operational concepts document, including a complete description of the product functionality and information flows; as well as identifying which functions are intended to enhance or preserve safety and the manner in which the product architecture implements these functions;

(d) A safety requirements document, including a list with complete descriptions of all functions, which the product performs to enhance or preserve safety, and that describes the manner in which product architecture satisfies safety requirements;

(e) A hazard log consisting of a comprehensive description of all safety relevant hazards addressed during the life cycle of the product, including maximum threshold limits for each hazard (for unidentified hazards, the threshold shall be exceeded at one occurrence);

(f) A risk assessment and analysis.

(1) The risk metric for the proposed product should describe with a high degree of confidence the accumulated risk of a locomotive control system that operates over the intended product life. Each risk metric for the proposed product should be expressed with an upper bound, as estimated with a sensitivity analysis, and the risk value selected is demonstrated to have a high degree of confidence.

(2) Each risk calculation should consider the totality of the locomotive control system and its method of operation. The failure modes of each subsystem or component, or both, should be determined for the integrated hardware/software (where applicable) as a function of the Mean Time to Hazardous Events (MTTHE), failure restoration rates, and the integrated hardware/software coverage of all processor based subsystems or components, or both. Train operating and movement rules, along with components that are layered in order to enhance safety-critical behavior, should also be considered.

(3) An MTTHE value should be calculated for each subsystem or component, or both, indicating the safety-critical behavior of the integrated hardware/software subsystem or component, or both. The human factor impact should be included in the assessment, whenever applicable, to provide an integrated MTTHE value. The MTTHE calculation should consider the rates of failures caused by permanent, transient, and intermittent faults accounting for the fault coverage of the integrated hardware/software subsystem or component, phased-interval maintenance, and restoration of the detected failures.

(4) The analysis should clearly document:

(i) Any assumptions regarding the reliability or availability of mechanical, electric, or electronic components. Such assumptions include MTTF projections, as well as Mean Time To Repair (MTTR) projections, unless the risk assessment specifically explains why these assumptions are not relevant. The analysis should document these assumptions in such a form as to permit later comparisons with in-service experience (e.g., a spreadsheet). The analysis should also document any assumptions regarding human performance. The documentation should be in a form that facilitates later comparisons with in-service experience.

(ii) Any assumptions regarding software defects. These assumptions should be in a form which permits the railroad to project the likelihood of detecting an in-service software defect and later comparisons with in-service experience.

(iii) All of the identified safety-critical fault paths leading to a mishap as predicted by the SA. The documentation should be in a form that facilitates later comparisons with in-service faults.

(4) MTTHE compliance verification and validation should be based on the assessment of the design for verification and validation process, historical performance data, analytical methods and experimental safety critical performance testing performed on the subsystem or component. The compliance process shall be demonstrated to be compliant and consistent with the MTTHE metric and demonstrated to have a high degree of confidence.

(5) The safety-critical behavior of all non-processor based components, which are part of a processor-based system or subsystem, should be quantified with an MTTHE metric. The MTTHE assessment methodology should consider failures caused by permanent, transient, and intermittent faults, phase interval maintenance and restoration of failures and the effect of fault coverage of each non-processor-based subsystem or component. The MTTHE compliance verification and validation should be based on the assessment of the design for verification and validation process, historical performance data, analytical methods and experimental safety critical performance testing performed on the subsystem or component. The non-processor based quantification compliance should also be demonstrated to have a high degree of confidence.

(g) A hazard mitigation analysis, including a complete and comprehensive description of all hazards to be addressed in the system design and development, mitigation techniques used, and system safety precedence followed;

(h) A complete description of the safety assessment and verification and validation processes applied to the product and the results of these processes;

(i) A complete description of the safety assurance concepts used in the product design, including an explanation of the design principles and assumptions; the designer should address each of the following safety considerations when designing and demonstrating the safety of products covered by this part. In the event that any of these principles are not followed, the analysis should describe both the reason(s) for departure and the alternative(s) utilized to mitigate or eliminate the hazards associated with the design principle not followed.

(1) *Normal operation.* The system (including all hardware and software) should demonstrate safe operation with no hardware failures under normal anticipated operating conditions with proper inputs and within the

expected range of environmental conditions. All safety-critical functions should be performed properly under these normal conditions. Absence of specific operator actions or procedures will not prevent the system from operating safely. Hazards categorized as unacceptable should be eliminated by design. Best effort should also be made by the designer to eliminate hazards that are undesirable. Those undesirable hazards that cannot be eliminated must be mitigated to an acceptable level.

(2) *Systematic failure.* It should be shown how the product is designed to mitigate or eliminate unsafe systematic failures—those conditions which can be attributed to human error that could occur at various stages throughout product development. This includes unsafe errors in the software due to human error in the software specification, design or coding phase, or both; human errors that could impact hardware design; unsafe conditions that could occur because of an improperly designed human-machine interface; installation and maintenance errors; and errors associated with making modifications.

(3) *Random failure.* The product should be shown to operate safely under conditions of random hardware failure. This includes single as well as multiple hardware failures, particularly in instances where one or more failures could occur, remain undetected (latent) and react in combination with a subsequent failure at a later time to cause an unsafe operating situation. In instances involving a latent failure, a subsequent failure is similar to there being a single failure. In the event of a transient failure, and if so designed, the system should restart itself if it is safe to do so. Frequency of attempted restarts should be considered in the hazard analysis. There should be no single point failures in the product that can result in hazards categorized as unacceptable or undesirable. Occurrence of credible single point failures that can result in hazards shall be detected and the product shall be detected and the product should achieve a known state that eliminates the possibility of false activation of any physical appliance. If one non-self-revealing failure combined with a second failure can cause a hazard that is categorized as unacceptable or undesirable, then the second failure should be detected and the product must achieve a known safe state that eliminates the possibility of false activation.

(4) *Common Mode failure.* Another concern of multiple failures involves common mode failure in which two or more subsystems or components intended to compensate one another to perform the same function all fail by the same mode and result in unsafe conditions. This is of particular concern in instances in which two or more elements (hardware or software, or both) are used in combination to ensure safety. If a common mode failure exists, then any analysis cannot rely on the assumption that failures are independent. Examples include: the use of redundancy in which two or more elements perform a given function in parallel and when one (hardware or software) element checks/monitors another element (of hardware or software) to help ensure its safe operation. Common mode failure relates to independence, which shall be ensured in these instances. When dealing with the effects of hardware failure, the designer should address the effects of the failure not only on other hardware, but also on the execution of the software, since hardware failures can greatly affect how the software operates.

(5) *External influences.* The product should operate safely when subjected to different external influences, including:

(i) Electrical influences such as power supply anomalies/transients, abnormal/improper input conditions (e.g., outside of normal range inputs relative to amplitude and frequency, unusual combinations of inputs) including those related to a human operator, and others such as electromagnetic interference or electrostatic discharges, or both;

(ii) Mechanical influences such as vibration and shock; and climatic conditions such as temperature and humidity.

(6) *Modifications.* Safety must be ensured following modifications to the hardware or software, or both. All or some of the concerns previously identified may be applicable depending upon the nature and extent of the modifications.

(7) *Software.* Software faults should not cause hazards categorized as unacceptable or undesirable.

(8) *Closed Loop Principle.* The product design should require positive action to be taken in a prescribed manner to either begin product operation or continue product operation.

(j) A human factors analysis, including a complete description of all human-machine interfaces, a complete description of all functions performed by humans in connection with the product to enhance or preserve safety, and an analysis of the physical ergonomics of the product on the operators and the safe operation of the system;

(k) A complete description of the specific training of railroad and contractor employees and supervisors necessary to ensure the safe and proper installation, implementation, operation, maintenance, repair, inspection, testing, and modification of the product;

(l) A complete description of the specific procedures and test equipment necessary to ensure the safe and proper installation, implementation, operation, maintenance, repair, inspection, test, and modification of the product. These procedures, including calibration requirements, should be consistent with or explain deviations from the equipment manufacturer's recommendations;

(m) A complete description of the necessary security measures for the product over its life-cycle;

(n) A complete description of each warning to be placed in the Operations and Maintenance Manual and of all warning labels required to be placed on equipment as necessary to ensure safety;

(o) A complete description of all initial implementation testing procedures necessary to establish that safety-functional requirements are met and safety-critical hazards are appropriately mitigated;

(p) A complete description of all post-implementation testing (validation) and monitoring procedures, including the intervals necessary to establish that safety-functional requirements, safety-critical hazard mitigation processes, and safety-critical tolerances are not compromised over time, through use, or after maintenance (repair, replacement, adjustment) is performed; and

(q) A complete description of each record necessary to ensure the safety of the system that is associated with periodic maintenance, inspections, tests, repairs, replacements, adjustments, and the system's resulting conditions, including records of component failures resulting in safety relevant hazards;

(r) A complete description of any safety-critical assumptions regarding availability of the product, and a complete description of all backup methods of operation; and

(s) The configuration/revision control measures designed to ensure that safety-functional requirements and safety-critical hazard mitigation processes are not compromised as a result of any change. Changes classified as maintenance require validation.

Guidance Regarding the Application of Human Factors in the Design of Products

The product design should sufficiently incorporate human factors engineering that is appropriate to the complexity of the product; the gender, educational, mental, and physical capabilities of the intended operators and maintainers; the degree of required human interaction with the component; and the environment in which the product will be used. HMI design criteria minimize negative safety effects by causing designers to consider human factors in the development of HMIs. As used in this discussion, ''designer'' means anyone who specifies requirements for—or designs a system or subsystem, or both, for—a product subject to this part, and ''operator'' means any human who is intended to receive information from, provide information to, or perform repairs or maintenance on a safety critical locomotive control product subject to this part.

I. FRA recommends that system designers should:

(a) Design systems that anticipate possible user errors and include capabilities to catch errors before they propagate through the system;

(b) Conduct cognitive task analyses prior to designing the system to better understand the information processing requirements of operators when making critical decisions;

(c) Present information that accurately represents or predicts system states; and

(d) Ensure that electronics equipment radio frequency emissions are compliant with appropriate Federal Communications Commission (FCC) regulations. The FCC rules and regulations are codified in Title 47 of the Code of Federal Regulations (CFR). The following documentation is applicable to obtaining FCC Equipment Authorization:

(1) *OET Bulletin Number 61 (October, 1992 Supersedes May, 1987 issue) FCC Equipment Authorization Program for Radio Frequency Devices.* This document provides an overview of the equipment authorization

program to control radio interference from radio transmitters and certain other electronic products and how to obtain an equipment authorization.

(2) *OET Bulletin 63: (October 1993) Understanding The FCC Part 15 Regulations for Low Power, Non-Licensed Transmitters.* This document provides a basic understanding of the FCC regulations for low power, unlicensed transmitters, and includes answers to some commonly-asked questions. This edition of the bulletin does not contain information concerning personal communication services (PCS) transmitters operating under Part 15, Subpart D of the rules.

(3) *Title 47 Code of Federal Regulations Parts 0 to 19.* The FCC rules and regulations governing PCS transmitters may be found in 47 CFR, Parts 0 to 19.

(4) *OET Bulletin 62 (December 1993) Understanding The FCC Regulations for Computers and other Digital Devices.* This document has been prepared to provide a basic understanding of the FCC regulations for digital (computing) devices, and includes answers to some commonly-asked questions.

II. Human factors issues designers should consider with regard to the general functioning of a system include:

(a) *Reduced situational awareness and over-reliance.* HMI design shall give an operator active functions to perform, feedback on the results of the operator's actions, and information on the automatic functions of the system as well as its performance. The operator shall be ''in-the loop.'' Designers should consider at minimum the following methods of maintaining an active role for human operators:

(1) The system should require an operator to initiate action to operate the train and require an operator to remain ''in-the-loop'' for at least 30 minutes at a time;

(2) The system should provide timely feedback to an operator regarding the system's automated actions, the reasons for such actions, and the effects of the operator's manual actions on the system;

(3) The system should warn operators in advance when they require an operator to take action;

(4) HMI design should equalize an operator's workload; and

(5) HMI design should not distract from the operator's safety related duties.

(b) *Expectation of predictability and consistency in product behavior and communications.* HMI design should accommodate an operator's expectation of logical and consistent relationships between actions and results. Similar objects should behave consistently when an operator performs the same action upon them. End users have a limited memory and ability to process information. Therefore, HMI design should also minimize an operator's information processing load.

(1) To minimize information processing load, the designer should:

(i) Present integrated information that directly supports the variety and types of decisions that an operator makes;

(ii) Provide information in a format or representation that minimizes the time required to understand and act; and

(iii) Conduct utility tests of decision aids to establish clear benefits such as processing time saved or improved quality of decisions.

(2) To minimize short-term memory load, the designer should integrate data or information from multiple sources into a single format or representation (''chunking'') and design so that three or fewer ''chunks'' of information need to be remembered at any one time. To minimize long-term memory load, the designer should design to support recognition memory, design memory aids to minimize the amount of information that should be recalled from unaided memory when making critical decisions, and promote active processing of the information.

(3) When creating displays and controls, the designer shall consider user ergonomics and should:

(i) Locate displays as close as possible to the controls that affect them;

(ii) Locate displays and controls based on an operator's position;

(iii) Arrange controls to minimize the need for the operator to change position;

(iv) Arrange controls according to their expected order of use;

(v) Group similar controls together;

(vi) Design for high stimulus-response compatibility (geometric and conceptual);

(vii) Design safety-critical controls to require more than one positive action to activate (e.g., auto stick shift requires two movements to go into reverse);

(viii) Design controls to allow easy recovery from error; and

(ix) Design display and controls to reflect specific gender and physical limitations of the intended operators.

(4) Detailed locomotive ergonomics human machine interface guidance may be found in ''Human Factors Guidelines for Locomotive Cabs'' (FRA/ORD–98/03 or DOT–VNTSC–FRA–98–8).

(5) The designer should also address information management. To that end, HMI design should:

(i) Display information in a manner which emphasizes its relative importance;

(ii) Comply with the ANSI/HFS 100–2007, or more recent standard;

(iii) Utilize a display luminance that has a difference of at least 35cd/m2 between the foreground and background (the displays should be capable of a minimum contrast 3:1 with 7:1 preferred, and controls should be provided to adjust the brightness level and contrast level);

(iv) Display only the information necessary to the user;

(v) Where text is needed, use short, simple sentences or phrases with wording that an operator will understand and appropriate to the educational and cognitive capabilities of the intended operator;

(vi) Use complete words where possible; where abbreviations are necessary, choose a commonly accepted abbreviation or consistent method and select commonly used terms and words that the operator will understand;

(vii) Adopt a consistent format for all display screens by placing each design element in a consistent and specified location;

(viii) Display critical information in the center of the operator's field of view by placing items that need to be found quickly in the upper left hand corner and items which are not time-critical in the lower right hand corner of the field of view;

(ix) Group items that belong together;

(x) Design all visual displays to meet human performance criteria under monochrome conditions and add color only if it will help the user in performing a task, and use color coding as a redundant coding technique;

(xi) Limit the number of colors over a group of displays to no more than seven;

(xii) Design warnings to match the level of risk or danger with the alerting nature of the signal; and

(xiii) With respect to information entry, avoid full QWERTY keyboards for data entry.

(6) With respect to problem management, the HMI designer should ensure that the HMI design:

(i) enhances an operator's situation awareness;

(ii) supports response selection and scheduling; and

(iii) supports contingency planning.

(7) Designers should comply with FCC requirements for Maximum Permissible Exposure limits for field strength and power density for the transmitters operating at frequencies of 300 kHz to 100 GHz and specific absorption rate (SAR) limits for devices operating within close proximity to the body. The Commission's requirements are detailed in Parts 1 and 2 of the FCC's Rules and Regulations (47 CFR 1.1307(b), 1.1310, 2.1091, 2.1093). The FCC has a number of bulletins and supplements that offer guidelines and suggestions for evaluating compliance. These documents are not intended to establish mandatory procedures; other methods and procedures may be acceptable if based on sound engineering practice.

(i) OET Bulletin No. 65 (Edition 97–01, August 1997), ''Evaluating Compliance With FCC Guidelines For Human Exposure To Radio frequency Electromagnetic Fields'';

(ii) OET Bulletin No 65 Supplement A, (Edition 97–01, August 1997), OET Bulletin No 65 Supplement B (Edition 97–01, August 1997); and

(iii) OET Bulletin No 65 Supplement C (Edition 01–01, June 2001). This bulletin provides assistance in determining whether proposed or existing transmitting facilities, operations, or devices comply with limits for human exposure to radio frequency RF fields adopted by the FCC.

Guidance for Verification and Validation of Products

The goal of this assessment is to provide an evaluation of the product manufacturer's utilization of safety design practices during the product's development and testing phases, as required by the applicable railroad's requirements, the requirements of this part, and any other previously agreed-upon controlling documents or standards. The standards employed for verification or validation, or both, of products shall be sufficient to support achievement of the applicable requirements of this part.

(a) The latest version of the following standards have been recognized by FRA as

providing appropriate risk analysis processes for incorporation into verification and validation standards.

(1) U.S. Department of Defense Military Standard (MIL–STD) 882C, ''System Safety Program Requirements'' (January 19, 1993);

(2) The most recent CENLE/IEC Standards as follows:

(i) EN50126:/IEC 62278, Railway Applications: Communications, Signaling, and Processing Systems Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS);

(ii) EN50128/IEC 62279, Railway Applications: Communications, Signaling, and Processing Systems Software for Railway Control and Protection Systems;

(iii) EN50129, Railway Applications: Communications, Signaling, and Processing Systems-Safety Related Electronic Systems for Signaling; and

(iv) EN50155, Railway Applications: Electronic Equipment Used in Rolling Stock.

(3) ATCS Specification 140, Recommended Practices for Safety and Systems Assurance.

(4) ATCS Specification 130, Software Quality Assurance.

(5) Safety of High Speed Ground Transportation Systems. Analytical Methodology for Safety Validation of Computer Controlled Subsystems. Volume II: Development of a Safety Validation Methodology. Final Report September 1995. Author: Jonathan F. Luedeke, Battelle. DOT/FRA/ORD–95/10.2.

(6) IEC 61508 (International Electro-technical Commission), Functional Safety of Electrical/Electronic/Programmable/Electronic Safety (E/E/P/ES) Related Systems, Parts 1–7 as follows:

(i) IEC 61508–1 (1998–12) Part 1: General requirements and IEC 61508–1 Corr. (1999–05) Corrigendum 1–Part 1: General Requirements;

(ii) IEC 61508–2 (2000–05) Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems;

(iii) IEC 61508–3 (1998–12) Part 3: Software requirements and IEC 61508–3 Corr.1(1999–04) Corrigendum 1–Part3: Software requirements;

(iv) IEC 61508–4 (1998–12) Part 4: Definitions and abbreviations and IEC 61508–4 Corr.1(1999–04) Corrigendum 1–Part 4: Definitions and abbreviations;

(v) IEC 61508–5 (1998–12) Part 5: Examples of methods for the determination of safety integrity levels and IEC 61508–5 Corr.1 (1999–04) Corrigendum 1 Part 5: Examples of methods for determination of safety integrity levels;

(vi) 1IEC 61508–6 (2000–04) Part 6: Guidelines on the applications of IEC 61508–2 and –3; and,

(vii) IEC 61508–7 (2000–03) Part 7: Overview of techniques and measures.

(7) ANSI/GEIA–STD–0010: Standard Best Practices for System Safety Program Development and Execution

(b) When using unpublished standards, including proprietary standards, the standards should be available for inspection and replication by the railroad and FRA and should be available for public examination.

(c) *Third party assessments.* The railroad, the supplier, or FRA may conclude it is necessary for a third party assessment of the system. A third party assessor should be ''independent''. An ''independent third party'' means a technically competent entity responsible to and compensated by the railroad (or an association on behalf of one or more railroads) that is independent of the supplier of the product. An entity that is owned or controlled by the supplier, that is under common ownership or control with the supplier, or that is otherwise involved in the development of the product would not be considered ''independent''.

(1) The reviewer should not engage in design efforts, in order to preserve the reviewer's independence and maintain the supplier's proprietary right to the product. The supplier should provide the reviewer access to any, and all, documentation that the reviewer requests and attendance at any design review or walk through that the reviewer determines as necessary to complete and accomplish the third party assessment. Representatives from FRA or the railroad might accompany the reviewer.

(2) Third party reviews can occur at a preliminary level, a functional level, or implementation level. At the preliminary level, the reviewer should evaluate with respect to safety and comment on the adequacy of the processes, which the supplier applies to the design, and development of the product. At a minimum, the reviewer should compare the supplier processes with industry best practices to determine if the vendor methodology is acceptable and employ any other such tests or comparisons if they have been agreed to previously with the railroad or FRA. Based on these analyses, the reviewer shall identify and document any significant safety vulnerabilities that are not adequately mitigated by the supplier's (or user's) processes. At the functional level, the reviewer evaluates the adequacy, and comprehensiveness, of the safety analysis, and any other documents pertinent to the product being assessed for completeness, correctness, and compliance with applicable standards. This includes, but is not limited to the Preliminary Hazard Analysis (PHA), the Hazard Log (HL), all Fault Tree Analyses (FTA), all Failure Mode and Effects Criticality Analysis (FMECA), and other hazard analyses. At the implementation level, the reviewer randomly selects various safety-critical software modules for audit to verify whether the system process and design requirements were followed. The number of modules audited shall be determined as a representative number sufficient to provide confidence that all un-audited modules were developed in similar manner as the audited module. During this phase the reviewer would also evaluate and comment on the adequacy of the plan for installation and test of the product for revenue service.

(d) *Reviewer Report.* Upon completion of an assessment, the reviewer prepares a final report of the assessment. The report should contain the following information:

(1) The reviewer's evaluation of the adequacy of the risk analysis, including the supplier's MTTHE and risk estimates for the product, and the supplier's confidence interval in these estimates;

(2) Product vulnerabilities which the reviewer felt were not adequately mitigated, including the method by which the railroad would assure product safety in the event of a hardware or software failure (i.e., how does the railroad or vendor assure that all potentially hazardous failure modes are identified?) and the method by which the railroad or vendor addresses comprehensiveness of the product design for the requirements of the operations it will govern (i.e., how does the railroad and/or vendor assure that all potentially hazardous operating circumstances are identified? Who records any deficiencies identified in the design process? Who tracks the correction of these deficiencies and confirms that they are corrected?);

(3) A clear statement of position for all parties involved for each product vulnerability cited by the reviewer;

(4) Identification of any documentation or information sought by the reviewer that was denied, incomplete, or inadequate;

(5) A listing of each design procedure or process which was not properly followed;

(6) Identification of the software verification and validation procedures for the product's safety-critical applications, and the reviewer's evaluation of the adequacy of these procedures;

(7) Methods employed by the product manufacturer to develop safety-critical software, such as use of structured language, code checks, modularity, or other similar generally acceptable techniques; and

(8) Methods by which the supplier or railroad addresses comprehensiveness of the product design which considers the safety elements.

PART 238 [AMENDED]

■ 23. The authority citation for part 238 continues to read as follows:

Authority: 49 U.S.C. 20103, 20107, 20133, 20141, 20302–20303, 20306, 20701–20702, 21301–21302, 21304; 28 U.S.C. 2461, note; and 49 CFR 1.49.

■ 24. Section 238.105 is amended by revising paragraph (d)(1) to read as follows:

§ 238.105 Train electronic hardware and software safety.

* * * * *

(d) * * *

(1) Hardware and software that controls or monitors a train's primary braking system shall either:

(i) Fail safely by initiating a full service or emergency brake application in the event of a hardware or software failure that could impair the ability of the engineer to apply or release the brakes; or

(ii) Provide the engineer access to direct manual control of the primary braking system (service or emergency braking).

* * * * *

■ 25. Section 238.309 is amended by revising paragraphs (b), (c), and (e) to read as follows:

§ 238.309 Periodic brake equipment maintenance.

* * * * *

(b) *DMU and MU locomotives.* The brake equipment and brake cylinders of each DMU or MU locomotive shall be cleaned, repaired, and tested, and the filtering devices or dirt collectors located in the main reservoir supply line to the air brake system cleaned, repaired, or replaced at intervals in accordance with the following schedule:

(1) Every 736 days if the DMU or MU locomotive is part of a fleet that is not 100 percent equipped with air dryers;

(2) Every 1,104 days if the DMU or MU locomotive is part of a fleet that is 100 percent equipped with air dryers and is equipped with PS–68, 26–C, 26–L, PS–90, CS–1, RT–2, RT–5A, GRB–1, CS–2, or 26–R brake systems. (This listing of brake system types is intended to subsume all brake systems using 26 type, ABD, or ABDW control valves and PS68, PS–90, 26B–1, 26C, 26CE, 26–B1, 30CDW, or 30ECDW engineer's brake valves.);

(3) Every 1,840 days if the DMU or MU locomotive is part of a fleet that is 100 percent equipped with air dryers and is equipped with KB–HL1, KB–HS1, or KBCT1; and,

(4) Every 736 days for all other DMU or MU locomotives.

(c) *Conventional locomotives.* The brake equipment of each conventional locomotive shall be cleaned, repaired, and tested in accordance with the schedule provided in § 229.29 of this chapter.

* * * * *

(e) *Cab cars.* The brake equipment of each cab car shall be cleaned, repaired, and tested at intervals in accordance with the following schedule:

(1) Every 1,840 days for locomotives equipped with CCB–1, CCB–2, CCB–26, EPIC 1 (formerly EPIC 3102), EPIC 3102D2, EPIC 2, KB–HS1, or Fastbrake brake systems.

(2) Every 1,476 days for that portion of the cab car brake system using brake valves that are identical to the passenger coach 26–C brake system;

(3) Every 1,104 days for that portion of the cab car brake system using brake valves that are identical to the locomotive 26–L brake system; and

(4) Every 736 days for all other types of cab car brake valves.

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Issued in Washington, DC, on March 28, 2012.

Joseph C. Szabo,

Administrator.

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