THIS DOCUMENT IS A DRAFT OF THE RULE FOR PARTICULAR APPLICABILITY FOR THE ORLANDO MAGLEV SYSTEM - IT IS STILL A WORKING DRAFT AND IS BEING DISTRIBUTED SO THAT EVERYONE THAT IS PART OF DRAFTING THIS RULE CAN HAVE ONE MORE OPPORTUNITY TO REVIEW BOTH THEIR PARTS AND THE PARTS OF OTHERS

ANY ADDITIONAL INPUT MUST BE RECEIVED BY COB MARCH 17 AND MUST BE A MARKUP OF THIS VERSION - WE CANNOT AFFORD TO HAVE MULTIPLE VERSIONS FLOATING AROUND.

March 8, 1993

2-23-93

Rule of Particular Applicability: Florida Maglev Demonstration Project

PART 1: GENERAL REQUIREMENTS

§ 1.1 Purpose and scope.

This rule prescribes minimum Federal safety standards for the magnetic levitation transportation system connecting the Orlando International Airport with International Drive in Orange County, Florida. That system, described in section 1.11 of this part, is known as the Florida Maglev Demonstration Project. The purpose of the rule is to prevent accidents, casualties, and property damage that could result from operation of that system.

§ 1.3 Applicability.

(a) This is a rule of particular applicability that applies only to the Florida Maglev Demonstration Project ("the railroad").

(b) Except as stated in paragraph (c), this rule -- rather than the generally applicable Federal railroad safety regulations -- applies to the railroad.

(c) Effective on the date the railroad begins revenue operations, the following generally applicable Federal railroad safety regulations, all of which are found in Title 49 of the Code of Federal Regulations, are hereby made applicable to the system, regardless of any statements of limited application that they may contain:

[note that Part 210, noise emission, is not listed here, pending joint determination with EPA as to whether it applies]

(1) Part 209, Railroad Safety Enforcement Procedures;
(2) Part 211, Rules of Practice;
(3) Part 212, State Safety Participation Regulations;
(4) Part 214, Railroad Workplace Safety

[need to consider whether we need to have special requirements for guideway work or simply make current Part 214 applicable]

(4) Part 216, Special Notice and Emergency Order Procedures (for purposes of application of Part 216 to the system, "locomotive" as used in that Part shall be construed to include the control unit of the passenger vehicles used on the system, and "track" shall be construed as including the system's guideway);

(5) Part 218, Subpart D, Prohibition Against Tampering With Safety Devices;

[will system have any "safety devices" as defined in 218.53? will control section of maglev vehicle fit definition of "locomotive" in 218.5(h), or should we add a parenthetical making that connection as we did in Part 216, above? does it make more sense to prohibit tampering more specifically within this rule? consensus at meeting seemed to indicate that specific references to tampering in this rule are needed, but, if so, those need to be supplied]

(6) Part 219, Control of Alcohol and Drug Use;

(7) Part 221, Rear End Marking Device;

(8) Part 225, Railroad Accidents/Incidents: Reports, Classification, and Investigations (see also Part 8 of this rule);

(9) Part 228, Hours of Service of Railroad Employees; and

(10) Part 240, Qualification and Certification of Locomotive Engineers.

[consensus at last meeting was to delete this reference and deal with subject exclusively under Part 7 of this rule, but we have left this here as reminder that this needs to be accomplished]

(d) The Federal railroad safety statutes apply to all railroads, as defined in section 202(e) of the Federal Railroad Safety Act of 1970, 45 U.S.C. 431(e). The system is a railroad under that definition. Therefore, the Federal railroad safety statutes (e.g., the substantive provisions of the Hours of Service Act, 45 U.S.C. §§ 61-64b) apply directly to the system. However, pursuant to authority granted under section 117 of the Rock Island Railroad Transition and Employee Assistance Act, 45 U.S.C. 1013, FRA has exempted the railroad from certain requirements of the Safety Appliance Acts, 45 U.S.C. 1-14, 16. See Part 4 (The Vehicle) of this Rule.

[the last two sentences may be a bit presumptuous; perhaps we should not include them unless and until the necessary findings have been made, after a hearing, to support any exemption]

§ 1.5 Definitions.

FRA means the Federal Railroad Administration.

Federal railroad safety statutes means those laws referred to in section 212(e) of the Federal Railroad Safety Act of 1970, 45 U.S.C. 441(e).

Person includes, but is not limited to, a railroad (including the system to which this rule applies); any manager, supervisor, official, or other employee or agent of a railroad; any owner, manufacturer, lessor, or lessee of railroad equipment, track, guideways, or facilities; any independent contractor providing goods or services to a railroad; and any employee of such owner, manufacturer, lessor, lessee, or independent contractor.

The railroad means the magnetic levitation transportation system connecting the Orlando International Airport with International Drive in Orange County, Florida, also known as the Florida Maglev Demonstration Project, the nature of which is described in section 1.11 of this rule.

[review of draft text of other Parts will no doubt reveal many words and phrases in need of definition; will have to choose whether to place definitions within each Part or here; likely candidates for inclusion here are: "RW-MSB", "DIN", and other terms used in more than one Part]

§ 1.7 Enforcement.

(a) Civil penalties. Any person who violates any requirement of this rule or causes the violation of any such requirement is subject to a civil penalty of at least $500 and not more than $10,000 per violation, except that, where a grossly negligent violation or a pattern of repeated violations has created an imminent hazard of death or injury or has caused death or injury, a penalty of up to $20,000 per violation may be assessed. Penalties may be assessed against individuals only for willful violations. Each day a violation continues shall constitute a separate offense. See Appendix A to this rule for a statement of agency civil penalty policy.

(b) Criminal penalties. Any person who knowingly and willfully falsifies a record or report required to be made under this rule or knowingly and willfully fails to make, prepare, or preserve such a record or report may be liable for

criminal penalties of a fine up to $5,000, imprisonment up to two years, or both, under the authority of 45 U.S.C. 438(e).

(c) Tampering. **[Consensus appears to be to deal with this as appropriate in each part.]**

(d) Other remedies. FRA has other enforcement remedies available to it, including the authority to seek injunctive relief and to issue compliance orders, special notices for repair, orders disqualifying individuals from safety-sensitive service, and emergency orders. FRA may use these other remedies, in addition to or instead of civil or criminal penalties, to ensure the system's compliance with the Federal railroad safety regulations and statutes and to otherwise address safety concerns with respect to the system.

§ 1.9 Preemption

Under section 205 of the Federal Railroad Safety Act of 1970 (45 U.S.C. 434), issuance of this rule preempts any state law, rule, regulation, order, or standard covering the same subject matter. However, by issuance of this rule FRA does not intend to preempt any provisions of state criminal law that impose sanctions for reckless conduct that leads to actual loss of life, injury, or damage to property, whether such provisions apply specifically to railroad employees or generally to the public at large.

§ 1.11 System Description

[will incorporate Bob Dorer's piece here]

§ 1.13 Insurance Requirements

[RCC has done research on what is required in other modes but RRS and RCC need to decide what, if any, similar requirements to include here]

§ 1.15 Certification

[have we resolved whether or not we want system developer to certify that certain components and/or system meet certain specs.?]

PART 2: SYSTEM SAFETY

Definitions to be inserted into Part 1

(a) *System* means a composite of equipment and facilities, people, and procedures which are integrated to perform a specific operational function in a specific environment.

(b) *System Safety* means the application of operating, technical and management techniques and principles to the safety aspects throughout the system life cycle to reduce safety-critical hazards and unsafe conditions to the lowest level possible through the most effective use of available resources.

(c) *System Safety Program (SSP)* means the combined tasks and activities of system safety management, engineering, and analysis that enhance the operational effectiveness by satisfying system safety requirements in a timely and cost-effective manner throughout all phases of the system life-cycle.

(d) *System Safety Program Plan* means the formal documentation of the SSP tasks and activities required to implement the SSP.

(e) *System Safety Program Management* means the component of the system safety program that defines the system safety program requirements in terms of ensuring the planning, implementation, and accomplishment of system safety tasks and activities.

(f) *Hazard Management* means the component of the system safety program that: (1) defines methodology used to identify and resolve potential safety-critical hazards and undesired conditions and (2) establishes a decision-making organization to consider acceptance, control, or elimination of such hazards and undesired conditions with respect to expenditure of resources.

(g) *Configuration Management* means the process that assures that all documentation which describes a system and its various components is current and reflects the actual functional and physical characteristics of the system throughout its life cycle.

§ 2.1 GENERAL

(a) This part prescribes minimum system safety assurance standards for ensuring that safety is integrated within all aspects of the Florida Maglev Demonstration Project system for all appropriate phases of the life cycle, including the transition from construction to pre-revenue and revenue operations.

(b) In addition, this part prescribes minimum requirements for the development, documentation, and implementation of a formal, system safety program. This system safety program shall incorporate the system safety management tasks and activities required to identify, evaluate, and eliminate hazards and unsafe conditions or reduce the associated risk to a level acceptable to the operating system management throughout the system life cycle.

§ 2.3 SYSTEM SAFETY ASSURANCE

(a) The Florida Maglev Demonstration Project system shall, for all aspects of the system, develop and document general safety engineering requirements and design criteria for construction and operational requirements including safety standards and system specifications which contain safety requirements that must be complied with. These requirements shall ensure that: maglev system safety-critical hazards and unsafe conditions are prevented whenever feasible; their effects if they do occur are minimized; and if necessary, timely and effective emergency response is provided.

(1) Provisions for failsafe, fault-tolerant (fail operational), reliability, and redundancy of design and operation, safety (protective) devices, warning devices, and special procedures and training, as appropriate, shall be described which eliminate or minimize hazards and unsafe conditions associated with all safety-critical functions.

(2) As a minimum, requirements shall described to prevent safety-critical hazards and unsafe conditions in the following categories: basic design hazards, inherent hazards, malfunctions, maintenance hazards, environmental hazards, human factor hazards, and fire hazards.

(b) The following general design factors shall be incorporated:
[These are <u>not how</u> but rather <u>what</u> the approach should be for the system]

(1) Eliminate identified hazards or reduce associated risk through design, including material selection or substitution. When potentially hazardous materials must be used, select those with least risk throughout the life cycle of the system.

(2) Isolate hazardous substances, components, and operations from other activities, areas, personnel, and incompatible materials.

(3) Locate equipment so that access during operations, servicing, maintenance, repair, or adjustment minimizes personnel exposure to hazards (e.g., hazardous chemicals, high voltage, electromagnetic radiation, cutting edges, or sharp points).

(4) Minimize risk resulting from excessive environmental conditions (e.g., temperature, pressure, noise, toxicity, acceleration and vibration).

(5) Design to minimize risk created by human error in the operation and support of the system.

(6) Consider alternate approaches to minimize risk from hazards that cannot be eliminated. Such approaches include interlocks, redundancy, failsafe design, system protection, fire suppression, and protective clothing, equipment, devices, and procedures.

(7) Protect the power sources, controls and critical components of redundant subsystems by physical separation or shielding.

(8) When alternate design approaches cannot eliminate the hazard, provide warning and caution notes in assembly, operations, maintenance, and repair instructions, and distinctive markings on hazardous components and materials, equipment, and facilities to ensure personnel and equipment protection. These shall be standardized in accordance with management requirements.

(9) Minimize the severity of personnel injury or damage to equipment in the event of a mishap.

(10) Design software controlled or monitored functions to minimize initiation of hazardous events or mishaps.

(11) Review design criteria for inadequate or overly restrictive requirements regarding safety. Recommend new design criteria supported by study, analyses, or test data.

(e) The system safety assurance requirements shall comply with and be consistent with the detailed provisions of Part 3-11 of this Rule.

§ 2.5 SYSTEM SAFETY PROGRAM

(a) The Florida Maglev Demonstration Project system shall use the system safety concept as the basis for developing and implementing a formal system safety program (SSP). The SSP will provide the means to ensure the highest level of safety possible consistent with accomplishing transportation mission requirements. The following elements shall be included to ensure an effective system safety program: a planned approach for task accomplishment, qualified people to accomplish tasks, authority to implement tasks through all levels of management, and appropriate resources both manning and funding to assure tasks are completed.

(b) The SSP shall encompass the entire Florida Maglev Demonstration Project system management process and define a systematic, ongoing approach for ensuring that: (1) maglev system safety-critical hazards and unsafe conditions are prevented whenever feasible, (2) their effects if they do occur are minimized, and (3) if necessary, timely and effective emergency response is provided.

(c) A System Safety Unit shall be established with the responsibility to ensure that the SSP is implemented successfully and to ensure that appropriate measures to correct safety-critical hazards and unsafe conditions are implemented as necessary throughout the lifecycle of the Florida Maglev Demonstration Project.

(d) As part of the management structure, the System Safety Unit Head shall possess authority delegated directly from the Chief Executive Officer of the Florida Maglev Demonstration Project.

[(d) is recognized as the preferred approach to make sure that the safety unit has adequate "clout" to get things done. If (b) overreaches FRA authority, then (a) could be included in § 2.9.3 However, the SSP plan documents what is but does not establish the unit. So I believe that (d) should remain a separate item located here.) Arne: ? still needs answering]

(e) The Florida Maglev Demonstration Project shall submit a SSP Plan and other system safety supporting documentation to the FRA six (6) months prior to commencing revenue operations. The contents of the SSP Plan and other documentation shall comply with the requirements of § 2.7 and 2.9 of this Rule.

§ 2.7 SYSTEM SAFETY PROGRAM PLAN (SSPP)

(a) The Florida Maglev Demonstration Project shall submit a System Safety Program Plan (SSP Plan) which formally documents the following minimum elements of the SSP: the planned approach for task accomplishment; designation of qualified people to accomplish tasks; authority to implement tasks through all levels of management, and appropriate resources. The SSP Plan shall describe functional interfaces between system organizations; safety unit and other organizational responsibilities; tasks, activities and depth of effort; technical methods of accomplishment; appropriate labor and funding resources; data requirements and necessary outputs; and schedule of efforts, (milestones) to assure tasks are completed.

(b) The submission of this SSP Plan will be reviewed by the FRA for comprehensiveness, accuracy, and clarity. Based on these reviews, and as necessary **[due to changes in the threat-Arne, awkward wording SM]** to address subsequently identified hazards and unsafe conditions with a potential effect on the overall safety of the system, the FRA will issue advisory notices to the Florida Maglev Demonstration Project management to require changes or additions to this document.

> **[This approach could be looked at as allowing approval by exception. Otherwise, what do we do with the submittals?]**

(c) The SSP Plan for the Florida Maglev Demonstration Project must be up-dated semi-annually. **[Phil's suggestion. This may be too strict! Suggest periodic revisions when the Chief Executive Officer appointed, new guideway segments and/or stations are opened, other major change to system operations, etc. When should it be re-submitted to FRA?]**

(d) Any changes to Florida Maglev Demonstration Project system operations (including emergency) and maintenance procedures that affect system safety and which require revision to the SSP Plan must also be submitted to the FRA.

§ 2.7.1 Minimum Contents of SSP Plan

As a minimum, the SSP Plan for the Florida Maglev Demonstration Project submitted to the FRA shall include the items described in the following paragraphs.

(a) *Chief Executive Officer's Safety Policy Statement* (Includes assertion of management commitment/approval, signature and date)

(b) *Introduction* (Includes authority, purpose, scope, goals/objectives, schedule for update. Contains, as a minimum, a summary description of the planned approach to accomplish tasks, qualified people to accomplish tasks, authority to implement tasks through all levels of management, and appropriate resources to assure tasks are completed throughout the system)

(c) *System Description* (Includes history, scope of service, organizational structure, physical plant, operations, maintenance, and modifications to the system. As a minimum, contains brief description of guideway, number and type of vehicles, command and control system, location of maintenance and storage facilities, map of total system)

(d) *Specific System Safety Assurance Requirements* (Includes provisions indicating compliance with the requirements of § 2.3 of this Rule, and other parts of this Rule as referenced below, for the following systems and their associated subsystems:

(1) Revenue, maintenance and inspection vehicles (See Part 4 of this Rule).

(2) Guideway structures and equipment (See Part 5 of this Rule).

(3) Operational control and communications system (See Part 6 of this Rule).

(4) Stations, as related to revenue train operations. **[Where? Arne]**

(5) Maintenance facilities as related to revenue train operations. **[Where? Arne]**

(6) Operational, **maintenance (why delete?)**, and emergency procedures (See Parts 9 and 11 of this Rule). **Why do you indicate Part 4?**

(7) Personnel training and certification (See § 2.9.3 and Part 9 of this Rule).

(8) Operating Environment (Internal. See Part 10 of this Rule)

(e) *System Safety Program Management* (Includes responsibilities and tasks/activities of System Safety unit personnel, e.g., inspections, rules/procedures review, and training; and safety-related responsibilities and activities of other system organizational unit personnel [See § 2.3 above and § 2.7.3 below])

(f) *System Modification/New Systems/Configuration Management* (Includes procedures to ensure that safety-related changes are approved prior to implementation and that documentation reflects actual system [See § 2.9.7 and § 2.9.9])

(g) *System Safety Program Methodology and Tasks (Hazard Management)* (Includes the type and level of analysis used to identify and resolve safety-critical hazards and unsafe conditions [See § 2.9.5 below])

(h) *System Safety Program Implementation, Schedule, and Maintenance* (Includes procedures and schedule for implementation and update, internal safety program audit process [See § 2.7.7 below])

(i) *System Safety Program Verification* (compliance through inspections, surveys, audits of reporting systems, emergency drills, etc.) [See § 2.7.9 below])

§ 2.7.3 SSP Management/Organization/Tasks

(a) The SSP Plan shall include an organization diagram for the Florida Maglev Demonstration Project which shows the organizational and functional relationships and lines of communication between the System Safety Unit and other organizational units of the system. An organizational diagram that details the structure and titles of each position within the Safety Unit shall be included.

(b) The SSP Plan for the Florida Maglev Demonstration Project shall describe the responsibilities and authority of System Safety Unit personnel and safety-related responsibilities of other system organizational unit personnel. Position descriptions for each System Safety Unit staff member shall be included. In addition, the organizational unit responsible for executing each of the tasks required described in (c) and (d) below shall be designated.

(c) Specific tasks of the System Safety Unit for the Florida Maglev Demonstration Project shall be described.

(d) Safety-related tasks of other organizational units shall be described.

§ 2.7.5 Hazard Management Methodology

The System Safety Unit for the Florida Maglev Demonstration Project shall document the on-going process to be used with the cooperation of other internal organizational units to ensure that all safety-critical hazards and unsafe conditions are resolved during pre-revenue operations and on a continuing basis throughout the system life cycle:

[I HAVE REVISED THIS SLIGHTLY. AGREE THAT THIS SHOULD BE DONE 1ST BEFORE REVENUE OPERATIONS! BUT IT SHOULDN'T STOP WHEN THE SYSTEM IS OPERATIONAL, REVENUE WISE. IT IS A CONTINUING PROCESS THROUGHOUT THE LIFE OF THE SYSTEM OPERATION.]

(a) Describe the analysis techniques and formats to be used in qualitative or quantitative analysis to identify hazards and unsafe conditions, their causes and effects, elimination, or risk reduction requirements and how those requirements are met.

(b) Describe the depth within the system to which each technique is used including hazard and unsafe condition identification associated with the system, subsystem, components, personnel, support equipment, facilities, and their interrelationship in the logistic support, training, maintenance, and operational environments.

(c) Describe the hazard severity categories, hazard probability levels, and the system safety precedence that shall be followed to satisfy the safety requirements of the SS Program. State any qualitative or quantitative measures of safety to be used for risk assessment including a description of the acceptable risk level. Include system safety definitions which deviate from or are in addition to those in this Rule.

(d) Describe process to provide review and analysis during pre-revenue operations and throughout the system life cycle of any proposed changes to the system elements listed in § 2.5 (c) and requirements as contained other parts of this Rule to ensure that the safety implications of such changes to the system are considered and appropriate action taken if necessary.

(e) Describe the analytical process to be performed for overall hazard management:

(1) Identify and describe hazards.

(2) Utilize the results of safety data acquisition and analysis, inspections and tests, audits, drills, and accident reports and investigations.

(3) Determine the criticality (severity and probability) of hazards and conditions to establish priority for action.

(4) Develop alternative countermeasures which can eliminate or control the identified hazard or condition.

(5) Present alternative countermeasures to management.

(6) Prepare documentation which contains results of (1)-(5).

(f) Provide follow-up during pre-revenue operations and throughout the life cycle to ensure that appropriate actions are taken, monitor effectiveness of these actions, and ensure that new safety-critical hazards and unsafe conditions are not introduced as a result.

(g) Describe closed-loop procedures for taking action to resolve identified hazards.

§ 2.7.7 Safety Data

(a) The SSP Plan shall describe the approach for researching, distributing, and analyzing pertinent historical hazard or unsafe condition data.

(b) The SSP Plan shall identify deliverable data by title and number.

(c) The SSP Plan shall identify non-deliverable system safety data and describe the procedures for accessibility by safety management and retention of data of historical value.

§ 2.7.7 SSP Plan Implementation, Schedule, and Maintenance

The SSP Plan for the Florida Maglev Demonstration Project shall describe the necessary directives, guidelines, and instructions required to implement the provisions of the SSP.

(a) The Plan shall include specific provisions for the continuous integration of SSP requirements into the overall operational and maintenance plans, including planning, design, specifications, procurement, construction, testing, operation, maintenance, and disposal activities.

(b) A time schedule for accomplishing the various tasks and procedures to update the SSP Plan shall be included.

(c) All changes to system equipment or facilities, procedures, etc. or the SSP Plan, which affect the safety of system operations and maintenance shall be incorporated in any operating and maintenance manuals and distributed to appropriate employees.

§ 2.7.9 SSP Verification

(a) The SSP Plan for the Florida Maglev Demonstration Project shall describe the verification requirements for making sure that safety is adequately demonstrated and shall identify any certification requirements for safety devices or other special safety features. Methods to demonstrate compliance with these SSP requirements include program reviews, audits, inspections, tests, investigations, and drills.

(b) The verification program shall include activities and procedures for:

(1) Ensuring adequate on-the-job safety surveillance, determining compliance with the SSP Plan, and recommending specific corrective action plans to eliminate or minimize the effects of any deviations from compliance.

(2) Ensuring test information is transmitted to management for review and analysis.

(3) Ensuring the safe conduct of all tests.

§ 2.7.11 Safety Training and Certification

A safety training plan shall be developed for the Florida Maglev Demonstration Project which documents the procedures and criteria used to ensure that all necessary safety training associated with operations, maintenance **(? how deal with]**, and emergency response is conducted and documented. A safety certification plan shall be developed which provides for complete and accurate records of the results of safety training to ensure that personnel possess the knowledge and skills necessary to perform their jobs safely.

§ 2.9 SSP PLAN SUPPORTING DOCUMENTATION

[THEY WERE PRESENTED BRIEFLY IN JULY VERSION, BUT PHIL REQUESTED AN EXPANSION.]

The SSP Plan for the Florida Maglev Demonstration Project shall include references to separate, detailed procedures/plans for other system programs and activities which relate to system safety. Those procedures/plans shall comply with the provisions stated in other appropriate parts of this Rule. As a minimum, these procedures/plans shall include those listed in the following paragraphs.

[The following items are included here but referenced as supporting documentation to the SSP Plan. I believe that while they are safety-related, they are likely to be thick individual documents which would be too cumbersome to include in the SSP Plan itself, unless as separate stand-alone "Attachments" or Appendices. Moreover, I don't necessarily believe that they all should all be submitted to the FRA! However, I do believe that these documents all have a direct relation to safety.]

§ 2.9.1 Operational Safety Audits and Inspections

An operational safety audit and inspection plan shall be developed for the Florida Maglev Demonstration Project which documents the procedures and implementation of the schedule which are contained in Parts 4F, 5F and 6 of this Rule. **?? REFERENCES ??**

[See 49 CFR, Part 240 and Parts 9 and 11 of this Rule].

§ 2.9.5 Maintenance Audits and Inspections

A maintenance audit and inspection plan for the Florida Maglev Demonstration Project shall be developed which documents the procedures for performing necessary safety-related maintenance.

[See Parts 4F and 5F of this Rule]. **???? REFERENCES ????**

§ 2.9.7 System Modification Review and Approval

The process and procedure for the Florida Maglev Demonstration Project system modification and review shall be documented in a formal Plan. Such modifications or changes include those to operational rules and procedures, maintenance procedures and manuals, equipment and/or facilities, etc. This plan shall provide documentation which verifies the need, effectiveness, scope, and priority of modification, and approves or rejects the modification. Exceptions, and notification and coordination procedures shall also be described. **CHANGE IN WORDING reflects your comment ?????**

§ 2.9.9 New Equipment, Facilities, and Systems

The process and procedure for verifying compliance with safety requirements contained in various system specifications shall be documented in a formal Plan. Coordinated reviews of contractual documentation, system design reviews, hazards analyses, and conduct of appropriate inspections and tests shall be used to demonstrate compliance.

§ 2.9.11 Configuration Management

(a) The configuration management program for the Florida Maglev Demonstration Project shall be documented in a formal plan
to maintain all specifications and as-built drawings, rule books, manuals and other system documentation accurately and completely so that they reflect the actual configuration of equipment, facilities, procedures, etc. of the system on a real-time basis.

(b) This Plan shall include a description of the authority needed to make changes, the process for incorporating these changes into all appropriate documentation, and the process for ensuring that all system organizational units, including System Safety are formally made aware of these changes.

(c) This Plan shall describe configuration management coordination requirements for system modifications and the procurement of new equipment, facilities, and systems.

§ 2.9.13 Reliability Assurance

(a) The reliability assurance program for the Florida Maglev Demonstration Project shall be documented in a formal plan which identifies systems, subsystems, and components that

rely on high levels of reliability to ensure that safety-critical **(WHAT IS COMMENT?)** functions are not degraded or interrupted in an unsafe manner by failures.

(b) This Plan shall describe approaches used to achieve adequate reliability of these safety-critical **(WHAT IS ISSUE of "HOW?")** functions and shall include requirements for follow-up to ensure that reliability provisions to prevent safety-critical failures are appropriately incorporated.

§ 2.9.15 Quality Assurance

The quality assurance program for the Florida Maglev Demonstration Project shall be documented in a formal plan which describe the procedures, tests, and inspections to be used to verify that all required safety and safety-related features and equipment for all systems, subsystems, and components are properly installed and function in accordance with specifications. **[why delete design criteria and drawings?]**

§ 2.9.17 Interdepartmental/Outside Organization Coordination

(a) The process and procedure for the Florida Maglev Demonstration Project organization interdepartmental coordination program shall be documented in a formal plan. This plan shall document the functional roles and relationship between all organizational unit heads including System Safety, operations, maintenance, construction, etc. and shall describe the procedures to be followed by each unit to report safety problem issues and changes to operations, as well as procedures to followed in emergencies to ensure coordinated actions.

(b) The process and procedure for an outside organization coordination program shall be documented in a formal plan. This plan shall document the functional roles and relationship between all system organizational unit personnel heads and local, state, and federal authorities as well as other companies and contractors. This plan shall describe the notification and reporting procedures used to alert these entities of construction program schedules, operational changes, emergencies, and others as appropriate which affect system or outside operations.

§ 2.9.19 Accident/Incident Reporting and Investigation

(a) The requirements of 49 CFR 219 shall be complied with.
[WHO IS ADAPTING 219!?]

[Or the specific requirements as adapted from 219 and contained elsewhere in this Rule]

(b) The internal accident/incident investigation process and procedure for the Florida Maglev Demonstration Project shall be documented in a formal Plan. This Plan shall include: notification procedure and criteria for which accidents/incidents are investigated, who participates and who is in charge of the investigation, the appropriate procedure for the investigation, reports and documentation, follow-up to ensure corrective action, and the procedure for complying with the legal requirements of notifying other agencies.

§ 2.9.21 Emergency Preparedness

The Florida Maglev Demonstration Project shall develop, document, and implement an emergency preparedness program which complies with the requirements of Part 11 of this rule.

§ 2.9.23 Employee Safety

The process and procedures for the Florida Maglev Demonstration Project employee safety program shall be documented in a formal Plan. This Plan shall describe required occupational safety procedures, special protective equipment, and requirements for enforcing their use. Local, state, and federal notification procedures for injuries and accidents shall be included.

§ 2.9.25 Hazardous Materials

The process and procedures for the Florida Maglev Demonstration Project hazardous materials program shall be documented in a formal Plan. This Plan shall describe the characteristics and safety implications of hazardous materials used, safe procedures and personal protective equipment to be worn when handling them. Local, state, and federal notification procedures for spills shall be included.

§ 2.9.27 Contractor Safety Coordination

The process and procedures for the Florida Maglev Demonstration Project Contractor Safety Coordination program shall be documented in a formal Plan. The Plan shall describe safety requirements which contractors must comply with, including applicable sections of the Florida Maglev Demonstration Project System Safety Program Plan and other applicable system safety-related plans described in this Rule, as determined appropriate by Project management personnel.

Moved text from 2.7 (previously 2.9)

As a minimum, these tasks shall include: **[I HAD INSERTED THE FOLLOWING IN RESPONSE TO PHIL'S REQUEST TO "REWRITE/ADAPT/TAYLOR APTA REQUIREMENTS. I AGREE THAT THIS IS A LONG LIST BUT DON'T UNDERSTAND THE COMMENT THAT THEY ARE HOW INSTEAD OF WHAT TO DO]**

(1) Conduct system safety coordination to ensure that safety information is passed to all sections of the organization.

(2) Represent the organization at safety meetings, seminars, and briefings with federal and other agencies, and ensure that the information gained at these meetings is made available to other affected divisions or sections of the system's organization.

(3) Conduct or participate in all accident and incident investigations to ensure that the safety implications of accidents or incidents are investigated.

(4) Review maintenance records and failure reports and analyses to identify safety problems related to maintenance actions. Formal safety analysis techniques are often used in such reviews.

(5) Perform appropriate analyses to assist in identifying and resolving hazards.

(6) Develop corrective actions and assist in the evaluation of solutions to the safety problems uncovered through analyses and failure report data. Such corrective actions should be tracked to completion.

(7) Participate in training activities to assure that safety elements are part of the curriculum, and that safety information is disseminated to all affected employees.

(8) Conduct safety inspections and perform system safety audits on a regular basis to monitor system-wide compliance with the SSP Plan.

(9) Develop/update safety rules/procedures.

(10) Evaluate proposed system modifications from the safety perspective.

(11) Assure awareness of and compliance with pertinent legislation, regulations, and standards.

(12) Prepare emergency preparedness plans.

(13) Provide liaison with outside emergency response organizations and assist in such activities as familiarization training and emergency preparedness drills.

(14) Update the System Safety Program Plan on a periodic basis.

(d) Safety-related tasks of other organizational units shall be described. As a minimum, these tasks shall include:

(1) Prepare failure and unsatisfactory condition reports on problems, failures and unsatisfactory conditions encountered during normal operations to ensure that appropriate elements are notified of the problem and corrective actions are undertaken.

(2) Conduct analyses of failures to determine the cause or causes for the failures and to identify where corrective actions are warranted.

(3) Develop corrective action requirements by determining trends or failure patterns.

(4) Conduct operator training and refresher training to ensure that all operator personnel are continuously aware of the hazards in the system and of the correct actions to take in an emergency.

(5) Conduct maintenance training and refresher training to ensure that all maintenance personnel are aware of the safety hazards in performing maintenance tasks.

(6) Participate in investigations of accidents and incidents by assigning a qualified representative to the accident/incident investigations.

(9) Implement and maintain compliance with pertinent legislation, regulations, and standards.

(10) Evaluate proposed system modifications from the safety perspective.

(11) Maintain change control/configuration management system for all safety-critical systems and subsystems.

(12) Develop/update operating and maintenance rules and procedures.

(13) Assist in developing/updating and emergency plan rules and procedures.

(14) Conduct emergency and disaster plan evaluation and training to identify problems in implementing the plans, to ensure knowledge of these plans by the system staff, and to maintain the proficiency of appropriate emergency personnel.

[REFERENCES]

1. Department of Defense, Military Standard 882B, System Safety Program Requirements. Washington, D.C. 1984. Notice 1, July 1987.

2. American Public Transit Association (APTA), Rail Safety Audit Program Manual, Washington, D.C. 8-14-89.

3. Roland, Harold E. and Brian Moriarty, System Safety Engineering and Management, Second Edition, John Wiley and Sons, New York. 1990.

4. Chapter 2, Quality Assurance Program Requirements; Manual of Standards and Recommended Practices; Section J, Specification for Quality Assurance. M-1003. Issue of 1985

5. FAA, Advisory Circular 25.1309.1A, System Design and Analysis, 6/21/88.

5. System Safety Program Plans for Las Vegas Maglev Systems (2), Booz-Allen and Parsons Brinkerhoff

6. Selected System Safety Program Plans for Operational Rail Transit Systems

PART 3: PRE-REVENUE VERIFICATION AND TESTING OF MAGLEV SYSTEM

§ 3.1 SCOPE

This part establishes the requirements for a series of "pre-revenue verifications" and "pre-revenue tests" intended to demonstrate overall system safety prior to initiation of revenue service operation. By definition herein, "pre-revenue verifications" consist of, but are not limited to, existing test and analysis data, software programs, design drawings, reports, manuals, codes, specifications, hardware, and other material as applicable to system safety demonstration. "Pre-revenue tests" consist of the actual conduct of field and laboratory investigations and analyses that demonstrate the required "proofs of safety".

§ 3.3 RESPONSIBILITY FOR VERIFICATION DEMONSTRATIONS AND TESTS

It shall be the Florida Maglev owner's responsibility to comply with the verification requirements and to conduct the tests to demonstrate proof(s) of safety in accordance with the requirements delineated below.

§ 3.5 VERIFICATION AND TEST REQUIREMENTS DEFINITION

The specific verification requirements and test requirements are delineated in terms of detailed objectives in § 3.9 (a)-(j) covering the following specific topics:

(a) System Safety
(b) Vehicle Accident Survivability
(c) Vehicle Levitation and Lateral Guidance
(d) Vehicle Power, Propulsion and Braking
(e) Vehicle Safety Features
(f) Vehicle Internal Noise
(g) Vehicle Maintenance and Inspection
(h) Guideway
(i) Command, Control and Communications
(j) Operating Environment

Based on the results of the verification demonstrations and tests, additional requirements may be submitted to the owner/operator by FRA to fully establish the required proof(s) of safety.

§ 3.7 VERIFICATION COMPLIANCE AND TEST IMPLEMENTATION PLAN

The owner/operator shall respond to the requirements of § 3.9 (a)-(j) addressing the "Pre-Revenue Verifications" and the "Pre-Revenue Tests" in the following manner:

(a) by submitting a "Verification Compliance Plan" clearly detailing the specific data, analysis results, codes, specifications, software, and other documentation which are planned to be submitted to FRA as "proofs of verification". The plan shall be specific in **discussing and establishing the applicability of the proposed material to the respective safety issues.**

(b) by submitting a detailed "Test Implementation Plan" addressing the following:

- o specific test approach
- o detailed plans for: measurement and instrumentation, hardware and equipment, data acquisition and reduction, and other test or site specific requirements
- o test matrix and procedure
- o test conduct, operations and logistics
- o test program schedule and responsibilities
- o data analysis
- o "proof of safety" demonstration

Both the Verification Compliance Plan and the Test Implementation Plan shall be submitted for FRA review and approval within 90 working days after RPA official issue date. FRA concurrence and approval is required for both plans prior to submittal of verification compliance material, and/or to test conduct initiation.

§ 3.9 PRE-REVENUE VERIFICATION AND TESTING REQUIREMENTS FOR THE ORLANDO MAGLEV SYSTEM

This section prescribes the specific requirements for verifications and tests to be conducted prior to revenue service commissioning.

(a) SYSTEM SAFETY

(1) Pre-Revenue Verification: Safety-Critical Systems, Subsystems, and Components

OBJECTIVE: To verify that each safety-critical system, subsystem, and component of the maglev system described in Parts 4-11 of this Rule complies with the requirements contained in § 2.5. This is to be accomplished by:

(i) submitting "sign-off" documentation by responsible Chief Design Engineer which "certifies" that all safety-critical systems, subsystems, and components comply with final specifications and engineering drawings, and submitting these specifications and engineering drawings for FRA review.

(ii) providing material and documentation which verify that the actual (as-built) construction, manufacture, and installation of the safety-critical systems, subsystems, and components complies with all plans, specifications, and engineering drawings.

(2) Pre-Revenue Tests: Safety-Critical Systems, Subsystems, and Components

OBJECTIVE: To conduct tests to demonstrate that the actual (as-built) construction, manufacture, and installation of each safety-critical system, subsystem, and component of the maglev system does in fact function within the safety envelope as designed.

(3) Pre-Revenue Verification: Design, Operations, and Maintenance

OBJECTIVE: To demonstrate that the maglev system complies with the design, operational, and maintenance safety requirements described in Parts 4-11 of this Rule. This shall be accomplished by:

(i) submitting "sign-off" documentation by responsible Chief Design Engineer which "certifies" that all design, operational, and maintenance safety requirements comply with final specifications and engineering drawings, and submitting such specifications and engineering drawings for FRA review.

(ii) submitting material and documentation which compares and certifies that the actual design, operational, and maintenance safety requirements are in compliance with all plans, specifications, and engineering drawings.

(4) Pre-Revenue Verification: System Safety Program

OBJECTIVES: (a) To demonstrate that an adequate System Safety Program (SSP) to identify and resolve safety-critical hazards and unsafe conditions has been developed and documented and the SSP is comprehensive in including all the necessary elements as described § 2.9. Certification shall be provided attesting to the adequacy of the SSP, and said document shall be submitted for FRA review.

(b) To demonstrate that System Safety personnel possess sufficient knowledge, authority and resources to provide the required safety oversight.

(c) To demonstrate that adequate other safety-related plans and procedures are submitted as described/required in the SSP plan and as required by the FRA. At a minimum, these plans and procedures shall include those listed § 2.11.

(5) Pre-Revenue Verification: Emergency Preparedness Plan (EPP)

OBJECTIVE: To demonstrate that adequate provisions for emergency preparedness plans and procedures, related training, and emergency features and equipment have been developed and documented by providing certification attesting to the adequacy of such EPP, and submitting the EPP for FRA review.

(6) Pre-Revenue Verification: Coordination of Emergency Response

OBJECTIVE: To verify that the most effective and timely response is planned for various types of emergencies by both maglev system and outside emergency response organization personnel and that at a minimum response planning include the following:

- Notification, communication, fire-fighting, and other necessary procedures in terms of adequacy and correct actions

- Provision for necessary equipment and training in proper use

Emergency procedures and agreements with local emergency response organizations shall be submitted for FRA review.

(7) Pre-Revenue Verification: Training of Maglev System and Outside Response Organization Personnel for Emergency Response

OBJECTIVE: To demonstrate that an adequate training program has been developed and documented, including:

- Notification, communication, fire-fighting, passenger evacuation, and other necessary procedures

- Proper use of emergency equipment

The training program description including emergency response procedures and use of relevant equipment shall be submitted for FRA review.

(8) Pre-Revenue Test: Emergency Response Exercises/Drills

OBJECTIVE: To conduct tests to demonstrate the adequacy of response to specific types of emergencies by both maglev system and outside emergency response organization personnel. Test exercises/drills shall include:

- Notification, communication, fire-fighting, and other necessary procedures

- Availability of necessary equipment and proper use.

(9) Pre-Revenue Test: Evacuation of Passengers

OBJECTIVE: To conduct tests to demonstrate timely and effective passenger emergency evacuation from the vehicle to a point of safety when the vehicle is stopped on the guideway at (1) a station or emergency access/egress point and (2) a location other than a station or emergency access/egress point.

(b) VEHICLE ACCIDENT SURVIVABILITY

(1) Pre-Revenue Verification: Structural Crashworthiness Verification of Individual Vehicles

OBJECTIVE: To demonstrate compliance with § 4.1, "Structural Crashworthiness of the Individual Vehicles", by conducting the required analyses and tests.

(2) Pre-Revenue Verification: Consist Structural Crashworthiness Verification

OBJECTIVE: To demonstrate compliance with § 4.3, "Structural Crashworthiness of the Consist", by analyses using accepted analysis techniques

(3) Pre-Revenue Service Verification: Verification of Interior Compartment Arrangement

OBJECTIVE: To demonstrate compliance with § 4.5, "Interior Compartment Arrangement", by furnishing final interior design drawings to the FRA for review

(c) VEHICLE LEVITATION AND LATERAL GUIDANCE

(1) Pre-Revenue Test Verification: Minimum Clearance, Fault Detection/Tolerance and Control Circuit Adequacy Demonstration

OBJECTIVE: To verify the adequacy and safe operation of the vehicle levitation and guidance system (VLGS) by:

(a) demonstrating the ability of the VLGS to maintain a minimum clearance of 3mm or greater at all surfaces between the guideway and the vehicle over the range of guideway irregularities, operating speeds, and environmental conditions which are expected during system operation.

(b) demonstrating the ability of the VLGS to detect failure of a safety critical component of the levitation and guidance control systems, and automatically implement corrective actions.

(c) demonstrate the ability to maintain levitation and guidance with multiple failures in the control circuits

(2) Pre-Revenue Test: VLGS Safety Assessment

OBJECTIVE: To determine the maximum speed that the vehicle can be operated while maintaining a minimum gap of 3mm over a guideway span where the levitation surface has an irregularity which corresponds to a "A" mm offset form the midpoint of a 25m chord when the guideway is deflected by the vehicle load. (The value "A" is to be selected to be at least equal to twice the difference between the nominal gap at that operating speed and 3mm, and shall be large enough to demonstrate the fault detection and fault tolerance capabilities of the levitation system controls). Additionally, to

demonstrate system operation under simulated failure and reactivation of a single levitation circuit, and with simulated failure of both levitation control circuits in both levitation frames.

(d) VEHICLE POWER, PROPULSION, AND BRAKING

(1) Pre-Revenue Test: Vehicle Power Safety Demonstration

OBJECTIVE: To demonstrate the safety and effectiveness of guideway-to-vehicle power transfer to adequately support and meet the vehicle power requirements by conducting tests to:

(a) verify that power transfer from current collectors meet the design levels dictated by the vehicle design power profiles, and demonstrate current collector system's overall safety operation, including circuit protection, collector deployment and retraction, and safety interlocks

(b) evaluate power transfer as a function of vehicle speed, and establish that power transfer levels and battery capacities meet vehicle system requirements for the Florida operational environment

(2) Pre-Revenue Test: Vehicle Propulsion System Safety Demonstration

OBJECTIVE: To demonstrate the safe operation of the vehicle propulsion system, including the power supply/distribution and the propulsion control system, by conducting the required tests to:

(a) verify that power supply capability and safety protection circuitry performs according to design codes and electrical safety codes/standards, and that the power distribution system (including power conditioning, switching, and longstators) meet propulsion capacity requirements, and electrical safety codes/standards

(b) verify that propulsion control system provides acceleration/deceleration/cruise control in accordance with the command and control algorithms, to establish overall propulsion control system safety by demonstrating control interlock to prevent activation of additional vehicles exceeding maximum control capacity (as required in RW-MSB, Chapter 2, Paragraphs 4.2 and 4.7), and to evaluate power control strategy, substation interlocks or other applicable procedures to prevent vehicle entry onto deactivated guideway segments or to prevent premature/unwanted reactivization of unpowered guideways.

(3) Pre-Revenue Testing: Vehicle Braking System Safety Evaluation

OBJECTIVE: To establish safe operation, coordinated braking control, and autonomy of the vehicle braking system addressing the respective capabilities of the power system, the eddy current brake, the contact brake and the parking brake. Specifically, tests shall be conducted to:

(a) demonstrate capability of the vehicle propulsion and power supply system to dynamically brake at a maximum brake rate and load, from maximum speed to zero, independently of any other brake system

(b) demonstrate vehicle safety control system operation in controlling brake rates and velocity to ensure safe terminal stopping and to maintain safe vehicle separation

(c) demonstrate eddy current brake system safety and capability to brake the vehicle at maximum brake rate/vehicle load from maximum speed to minimum eddy current brake speed operation, independently of any other brake system

(d) demonstrate brake rate control to maintain deceleration jerk rates within ride comfort limits when the vehicle transitions from eddy current brakes to skid brakes or when invoking other deceleration mechanisms (e.g.skid brakes or resumption of primary dynamic brake control)

(e) demonstrate the safe operation of the contact brake system under conditions where vehicle to guideway contact is possible (as specified in RW-MSB, Chapter 2, Paragraph 4.1)

(f) demonstrate contact brake system capability to maintain deceleration and jerk rates within ride comfort limits during contact brake applications, and demonstrate contact brake system capability to ensure safe stopping distances

(g) demonstrate that the parking brake system application has the required power to hold the vehicle in stationary position under worst case scenarios of guideway embankment/grade, environmental loads, surface friction, etc.,

(e) VEHICLE SAFETY FEATURES

(1) Pre-Revenue Verification: Operator Cab Safety

OBJECTIVE: (a) To verify that the operator cab complies with § 4.23 Operator Cab by furnishing final specifications and engineering drawings. Certification demonstrating compliance with final specifications and design drawings shall be provided, and specifications and design drawings shall be submitted for FRA revirw.

(b) To demonstrate that the actual (as-built) construction, manufacture, and installation of the cab interior and components complies with all plans, specifications, and engineering drawings, as required to conform to § 4.23 of this Rule by certifying of such.

(3) Pre-Revenue Verification: Passenger Sections

OBJECTIVE: (a) To verify that passenger sections comply with § 4.25 Passenger Sections by furnishing final specifications and engineering drawings to the FRA for review, including certification attesting to such compliance.

(b) To demonstrate that the actual (as-built) construction, manufacture, and installation of the passenger section interior and components complies with all plans, specifications, and engineering drawings, as required to conform to § 4.25 of this Rule by providing evidence of direct comparison with the actual (as-built) construction, manufacture, and installation of the passenger section interior and components showing compliance with all plans, specifications, and engineering drawings.

(f) VEHICLE INTERNAL NOISE

(1) Pre-Revenue Test: Internal Noise Standards Compliance

OBJECTIVE: To conduct measurement tests to demonstrate compliance with part 229.121, Locomotive Cab Noise, in the control station area. Because the operator may not be required to be at a specific location, general internal noise measurements should be made in the passenger compartment to determine the noisiest location in the vehicle where an operator may be stationed. These tests are described in part 229.121 and require that a sound level meter conforming to the requirements of ANSI S1.4-1971, Type 2, and set to an A-weighted slow response. An audiodosimeter of equivalent accuracy may also be used. Tests shallinclude measurements in the control station area under full speed and full acceleration conditions.

(g) VEHICLE MAINTENANCE AND INSPECTION

(1) Pre-Revenue Verification: Vehicle Maintenance and Inspection Adequacy Evaluation

OBJECTIVE: To verify that the maintenance, inspection, and training requirements stipulated under Part 4 are adequate and within acceptable safety guidelines. This shall be accomplished by providing certification by an FRA approved agent as to the adequacy of the vehicle maintenance, inspection, and training requirements, programs and documents.

(h) GUIDEWAY

(1) Pre-Revenue Verification: Guideway Structural Integrity Assessment

OBJECTIVE: To demonstrate overall structural integrity for the guideway by providing adequacy of:

(a) Design loadings, including vehicle imposed static and dynamic loads, structure ("dead") loads, and environmental loads such as thermal, wind, seismic, etc., applicable to the Florida operating conditions

(b) Proposed design procedures for steel structures and major components (including switches) to accommodate the loads. Factors of safety, allowable stresses and deflections, fatigue life estimates, corrosion protection, thermal effects mitigation, and critical structure and component failure avoidance procedures shall also be provided.

(c) Specifications and requirements for construction processes, quality control, and final structure acceptance criteria (including requirements for special testing, pilot test runs, and pre-revenue qualifications).

(2) Pre-Revenue Test: Magnetic Gap Tolerance Evaluation and Monitoring Capability Assessment

OBJECTIVE: To proof test the continuous real time gap monitoring diagnostic capability to ensure compliance with the stipulated gap levels of Part 5, and to demonstrate diagnostic capability to measure gap variations within a $\pm$ 0.2mm limit.

(3) Pre-Revenue Test: Guideway Switch Safety Evaluation

OBJECTIVE: To proof test the operation and setting of the switches to ensure that the electro-mechanical actuating drives function within safe limits and with adequate fail safe redundancies, and function in line with the requirements stipulated under Part 5.4 (a)

(4) Pre-Revenue Verification: Guideway Maintenance and Inspection Plan

OBJECTIVE: To establish the adequacy of the "Guideway Maintenance and Inspection Plan" called for under § 5.5 by providing certification attesting to the adequacy of all levels of maintenance and inspection of the guideway structure and components for assurance of operational safety.

(i) COMMAND, CONTROL AND COMMUNICATIONS (CCC)

Numerals in square brackets ([ ]) represent references which are cited at the end of this document.

(1) Pre-Revenue Test: Interlocking System Safety

OBJECTIVE: To demonstrate the fail-safety of the interlocking control system. This demonstration must involve and provide evidence of the correct functioning of the following elements of the operational control system:

(a) the switch positioning and locking sensors and the communication of their status to and from the decentralized train and guideway controller (DTGC) which is responsible for the switchable section of guideway

(b) initiation of emergency braking when the switch position and locked status is removed from the information loop, i.e., becomes unknown

(c) restrictive behavior of the interlocking system when conflicting vehicle moves across a guideway element is simulated.

(2) Pre-Revenue Test: Safe Speed Enforcement

OBJECTIVE: To demonstrate the fail-safety of the safe speed enforcement system by proving that emergency braking of the vehicle will be initiated when:

(a) a speed command is transmitted to the vehicle which conflicts with the predetermined vehicle speed over a given section of guideway (greater or less than allowable),

(b) vehicle-to-wayside communication is lost,

(c) self-diagnostic systems indicate malfunctions in the emergency braking, leviation or guidance systems,

(d) the control system detects the occurrence of any event, which, according to the system design criteria is required to initiate emergency braking of the vehicle. Additionally, it must be demonstrated that under no circumstances **(when emergency braking is applied)** will the vehicle come to rest outside of a safe stopping place.

(3) Pre-Revenue Test: Central Control and Monitoring Function Evaluation

OBJECTIVE: To demonstrate that the central control and monitoring function is such that:

(a) commands issued from the central control and monitoring facility are error-free within the tolerances specified for the system,

(b) simulation (and transmission to the vehicle) of corrupted data from the DTGC will result in the correct restrictive response of the vehicle-borne control systems,

(c) security precautions (keyed controls, etc.) are effective in precluding the issuance of conflicting commands from the central control and monitoring facility [1].

(4) Pre-Revenue Test: Data Transmission and Communications Systems Evaluation

OBJECTIVE: To demonstrate that the data transmission system functions as designed in that information transmitted in the following manner is error-free within specified tolerances:

(a) the vehicle to the wayside DTGC (and vice-versa),

(b) the vehicle to the central control and monitoring facility (and vice-versa), and

(c) the central control and monitoring facility to the wayside DTGC (and vice-versa).

(d) Additionally, it must be demonstrated that the system will assume the correct restrictive behavior in the event of loss of the vehicle-to-wayside communication link described above.

(5) Pre-Revenue Test: Vehicle Location System Safety Evaluation

OBJECTIVE: To demonstrate that the INKREFA [this is not an acronym] position finding system functions as described in [2] and to establish that the system has the characteristics necessary to provide the following information (error-free within the tolerances specified for the system):

(a) vehicle location
(b) speed
(c) direction of travel
(d) acceleration *(not safety-critical information)*
(e) rotor displacement angle *(not safety-critical information)*

and that it complies with the safety requirements.

Additionally, the quadruple redundancy of the INKREFA position finding and reporting system must be demonstrated. This will include a demonstration of the independence of each of the four INKREFA channels. This demonstration will include, but not be limited to, a demonstration of the reaction of the position finding system as three successive INKREFA locator tags (mounted on the underside of the guideway) are disabled one at a time.

[NOTE: The quadruple-redundancy is present to ensure system reliability and availability (not for fail-safety). At least two of the four INKREFAs must be operational and produce identical results for the system to remain operational.[2]]

(6) Pre-Revenue Test: Environmental Compatibility Assessment of CCC Hardware

OBJECTIVE: To establish that the performance of safety-critical (CCC) hardware is not compromised when subjected to Florida environmental conditions, especially in regard to the extremes of temperature and humidity. (Due to climatic differences between the TVE facility in Emsland and the proposed application of the same hardware in the Orlando area, tests of safety-critical hardware must be conducted under environmental conditions simulating the extremes of temperature and humidity which can be expected in central Florida in order to verify that components continue to perform as designed under these weather conditions.)

(j) OPERATING ENVIRONMENT

(1) Pre-Revenue Verification: Safe Operability of Maglev System Under Full Design Range of Climatic and Environmental Parameters

OBJECTIVE: To verify the ability of the maglev system to operate safely, within either normal or restricted operating criteria, for a broad range of climatic conditions, including extreme- but possible- wind loading, storm, fog, ice/snow, heat, flooding, seismic tremors and other factors. (See Part 10.5.5 for climate specifics.)

(2) Pre-Revenue Test: Lightning Impulse Safety Evaluation of Maglev System

OBJECTIVE: To demonstrate that adequate lightning protection for the maglev system, facilities and operation has been provided, to assure equipment protection and passenger safety from both direct and indirect hazards during and following a lightning strike. Also, to verify compliance with various lightning protection codes and requirements listed in Part 10.

(3) Pre-Revenue Verification: Electro-Static Discharge (ESD) Effects On The System

OBJECTIVE: To verify by appropriate design review that adequate ESD protection is provided, and such protection is in compliance with various ESD protection codes and requirements listed in Part 10.

(4) Pre-Revenue Test: Measurement of Electromagnetic Fields (EMF) Emissions Associated With Maglev System, Facilities and Operations

OBJECTIVE: To verify compliance with current (see Part 10, Subpart B) EMF Guidelines and Standards, the operator shall measure EMF emission (intensity levels and frequencies), as well as personnel and public exposure characteristics. The operator shall then monitor and document Maglev related EMF variability with location and time, under the full range of operating conditions.

(5) Pre-Revenue Verification: Measurement of Operating Environment For Electromagnetic Interference and Compatibility (EMI/EMC)

OBJECTIVE: To verify that the maglev system meets- under a full range of operating conditions - all applicable EMI/EMC safety standards (see Part 10, Subpart C), and that all electrical safety-critical systems can function normally in the existing electromagnetic environment, including effects of energy emitted from: 1) other system components; 2) hand-held communication devices (e.g. cellular phones, radios, calculators, lap-top computers and walkie-talkies); and 3) external sources (radars, TV and radio carrier signals, power transmissions, airport navigation and communication sources, and aircraft (ILS/MLS) landing systems).

§ 3.11 VERIFICATION DEMONSTRATIONS, TEST CONDUCT AND PROOF OF SAFETY

The requirements for the pre-revenue verifications and tests delineated in § 3.9 above shall be complied with in accordance with the stipulations in the respective FRA approved VERIFICATION COMPLIANCE PLAN (VCP) and the TEST IMPLEMENTATION PLAN (TIP) as required by § 3.7. The verifications material shall be submitted within 60 days after receipt of FRA approval of the respective VCPs. The results of the pre-revenue tests demonstrating the proof(s) of safety shall be documented in a comprehensive technical report and submitted to the FRA within 90 working days after test completion. Final proof of safety acceptance resides with the FRA or with its designated technical representative(s).

End Notes for Part 3

1. Expert Opinion on INKREFA and the b/v Sensor System as Part of the Position Finding System of the TR 7 Within the Framework of the BLT II. TÜV Rheinland, Central Division for Railroad, Control and Software Technology. Doc. No. BG-900314-174. January 25, 1990.

2. BLT II, Partial Acceptance Operational Stage 1. Report of Findings. Thyssen-Henschel, Products Department, New Traffic Technology. NTA/2100/07/90. Doc. No. BP-910191-0239. July 4, 1990

PART 4: THE VEHICLE

SUBPART A: ACCIDENT SURVIVABILITY

[Definitions section of Part 1 mustbe reviewed to assure that all terms are adequately and consistently defined. The following definitions should be placed in the Definitions section of Part 1:

Articulated joint: the flexible connection between vehicle sections.

Crew: refers to one or more on-board operators/attendants which are required for normal operation of a vehicle.

End facing glazing locations: refers to all exterior locations where (in the general case of a curved surface) the glazing surface makes an angle 50 degrees or less with the longitudinal line of motion of the vehicle.

Safety glazing: refers to that material utilized in vehicle windshields, windows, interior doors and partitions which has been designed to promote safety and reduce or minimize the risk of personal injury if damaged or broken from impact. Materials included under this category include, but are not limited to, tempered (safety) glass, glass laminates, plastics, plastic laminates, laminated glass-plastic combinations and multiple sheet units (separated by an airspace).

Side facing glazing locations: refers to all exterior locations other than end facing glazing locations.]

§ 4.1 Purpose and Scope

The proposed accident survivability regulations are based on accidents that may occur for the TR07 system in Florida . These accidents are dependent upon the features of the proposed system, including the guideway routing, the signal and control system, and guideway security. Any differences between the system as described in Part 1 of this rule and the system as it is constructed in Florida may necessitate revision of these regulations. The accidents of concern for these draft regulations are a vehicle impact with a guideway obstruction and the impact of an object thrown at the vehicle.

§ 4.3 Structural Crashworthiness of the Individual Vehicles

[NOTE: These regulations are intended to assure that the occupant compartment will maintain its structural integrity during a collision with the largest reasonably expected obstacle. The worst likely collision scenario needs to be evaluated.]

(a) Guideway Obstruction

The vehicle must be able to withstand without penetration into the occupant compartment an impact at 400 km/h with a stationary 50 kg obstacle on the guideway which has dimensions 1m x 1m x 1m. The occupant volume of the lead section of the consist shall be reduced by not more than 5% for such an impact. The occupant volume of the trailing section must remain intact.

(b) Thrown Object

The vehicle must be able to withstand without penetration into the occupant compartment a side impact from a 10 kg object with dimensions .2m x .2m x.2m. travelling at 40 km/h.

§ 4.5 Structural Crashworthiness of the Consist

[NOTE: These regulations are intended to assure that the consist does not buckle during a collision with the largest reasonably expected obstacle.]

(a) Electromagnet Attachment

The mechanical attachment of each magnet hinge to its frame must be able to withstand a longitudinal force of 1.2 G, a lateral force of 1.2 G, and a vertical force of .3 G without permanent deformation. [Need to check terminology. Values in (a), (b), (c), and (d) are preliminary.]

(b) Secondary Suspension Attachment

The mechanical attachments of the secondary suspension to its frame and to the carbody must be able to withstand a longitudinal force of 1.2 G, a lateral force of 1.2 G, and a vertical force of .3 G without permanent deformation.

(c) Vehicle Interconnection

(1) The articulated joint between vehicles must be able to withstand a shear force, oriented in any vertical plane, of .3 G without permanent deformation

(2) The articulated joint between vehicles must be able to withstand a compressive force of 1.8 G without permanent deformation.

§ 4.7 Interior Compartment Arrangement

[NOTE: These regulations are intended to assure that during a collision with the largest reasonably expected obstacle no interior fixtures break their mountings, that luggage is adequately restrained, and that the secondary impacts are not sufficiently severe to cause fatalities.]

(a) Ocuupant Seats

(1) The occupant seats must be able to withstand a longitudinal load of 8 G applied at seat level without permanent deformation of the seat, its mounting to the floor, or the surrounding floor area.

(2) The occupant seats must be able to withstand a lateral load of 3 G applied at seat level without permanent deformation of the seat, its mounting to the floor, or the surrounding floor area.

(b) Interior Fixtures

(1) All interior fixtures must be able to withstand a shear load parallel to its mounting surface of 2 G without permanent deformation of itself, its mounting, or the surface to which it is mounted.

(2) All interior fixtures must be able to withstand tension and compression loads normal to its mounting surface of 2 G without permanent deformation of itself, its mounting, or the surface to which it is mounted.

(c) Interior Surfaces

(1) All interior surfaces of the occupant compartments must be rounded and without sharp edges

(2) Interior materials and arrangement shall comply with the fire safety requirements cited in §4.33 (d).

(d) Luggage Stowage

Luggage must be stowed in overhead racks, under seats, in designated storage areas, or baggage compartments. Overhead racks and underseat areas must have dividers to limit longitudinal and lateral movement of stowed luggage. Storage areas and baggage compartments must have partitions which limit the longitudinal movement of stowed luggage.

§ 4.9 Safety Glazing

[NOTE: This section on safety glazing was drafted after a review of existing safety glazing standards and codes, including FRA and UIC for railroads, FAA for transport aircraft, and ANSI for motor vehicles (see Reference 1), and is intended to provide a reasonable set of minimum functional glazing safety requirements for the currently proposed Transrapid system configuration and operation in Florida. The primary safety features and considerations which are addressed include damage and penetration resistance from bird strikes, guideway debris and projectiles thrown or fired by vandals; and resistance to aerodynamic forces and fluctuations resulting from high speed operations in cross winds and wind shear conditions. Optical fidelity, stability and location are additional safety glazing features addressed for "cab" glazing locations that apply if a functional on-board crew or operator is required. The ease of removal provision to allow emergency exits for possible egress or access is not addressed as part of this section. Emergency exits for egress and access are expected to be covered under Part 11, Subpart D § 11.27 (d).

(a) Scope

This part provides minimum functional safety requirements for glazing materials utilized in vehicle windshields, windows, doors and interior partitions or components to protect passengers, operating crews and maintenance personnel from potential injury resulting from objects, including occupants, striking the glazing. This part applies to all equipment normally operated as part of the Florida Maglev Demonstration Project and includes revenue and maintenance vehicles.

(b) Requirements

(1) General
All material utilized in vehicle windshields, windows, doors and partitions shall be anti-spalling safety glazing. For Glazing surfaces normally exposed to the interior of the vehicles, including interior surfaces of windshields and windows, shall be of the non-splintering type. All external glazing and associated framing must be capable of withstanding, without separation, the maximum combination of pressure forces and fluctuations due to vehicle speed, specified cross winds and wind shear limits. Each individual unit of glazing with an area exceeding 250 cm^2 shall be clearly marked to indicate the following:

- o Material Type
- o Brand Identification (Logo)
- o Manufacturer or Certification Source

(2) Glazing materials shall comply with the fire safety requirements cited in § 4.33 (d)

(3) End Facing Glazing Locations (Including Windshields and Windows)

(i) Large Object Impact
The glazing material mounted in an actual frame must sustain, without penetration or separation from the frame, the impact of a 3 kg (6.6 lbs) bird at the maximum vehicle speed. Impact tests for certification purposes shall be conducted with either the glazing material normal to the path of the object of impact or at the minimum angle of intended installation in the vehicle from the direction of motion.

[NOTE: This requirement provides realistic protection from the primary potential system operating environment hazards of bird strikes and collisions with airborne debris on or near the guideway for both revenue and maintenance vehicles at all operating speeds.

The specified bird weight is based on the largest water foul common to this area of Florida, the Great Blue Heron. However, it should be pointed out that carrion resulting from frequent bird strikes could potentially attract scavengers such as buzzards, which can weigh up to 5.4 kg (12 lbs). Reference: Discussions with the Florida Game & Fresh Water Fish Commission's Office of Environmental Services.

The elevated guideway and lack of overhead structures for the high speed portion of this particular system reduce the threats of potential acts of vandalism involving suspended large objects and hand thrown projectiles impacting the end facing glazing locations. The ballistic impact requirement currently required under CFR Part 223 will be preserved for both the end facing and side facing locations.

Procedures and specifications for conducting impact testing to simulate bird strikes (large yielding objects) are contained under Section 5.8 of ANSI Z26.1-1977 (see Reference 2) and could be either referenced or replicated, with modifications for appropriate weight and speed, for inclusion in the final RPA.]

(ii) Ballistic Impact
The glazing material mounted in an actual frame must sustain without separation from the frame, the impact from a 22 caliber (40 grains) bullet at a minimum normal velocity of 293 mps (960 fps) without penetration of the back surface of the glazing material or particle penetration of a 0.015 cm (0.006 in) thick "witness foil" located 15.25 cm (6 in) behind the material.

[NOTE: Procedures and specifications for conducting ballistic impact testing for glazing are contained under Appendix A to CFR Part 223 and could be either referenced or replicated, with modifications, for inclusion in the final RPA.]

(4) Side Facing Glazing Locations (Including Side Windows and Doors)

(i) Large Object Impact
The glazing material mounted in an actual frame must sustain, without penetration or separation from the frame, the impact of a 3 kg (6.6 lbs) bird at 40 kph (25 mph). Impact

tests for certification purposes shall be conducted with the glazing material normal to the path of the object of impact.

[NOTE: This requirement provides realistic protection from the primary potential system operating environment hazard of bird strikes while on the elevated portion of the guideway and potential acts of vandalism involving hand thrown objects while near ground elevation for both revenue and maintenance vehicles.]

(ii) Ballistic Impact
The glazing material mounted in an actual frame must sustain without separation from the frame, the impact from a 22 caliber (40 grains) bullet at a minimum normal velocity of 293 mps (960 fps) without penetration of the back surface of the glazing material or particle penetration of a 0.015 cm (0.006 in) thick "witness foil" located 15.25 cm (6 in) behind the material.

[NOTE: Procedures and specifications for conducting ballistic impact testing for glazing are contained under Appendix A to CFR Part 223 and could be either referenced or replicated, with modifications, for inclusion in the final RPA.]

(5) Cab Glazing Locations
In addition to the requirements under 4.7.9.3 and 4.7.9.5, glazing in either end locations or side locations (including windshields and windows) which are required for visual operation of the vehicle by an on-board crew member shall be suitability dimensioned and positioned such that the crew cannot be misled or inconvenienced by reflections from internal or external light sources, while in their normal working position. Such glazing shall, if damaged, must remain in position and permit sufficient crew visibility to enable the vehicle to reach a safe location.

REFERENCES FOR § 4.9

(1) Safety Glazing Requirements for HSGGT Systems Operating in the USA, white paper prepared by D. Gray, March 17, 1992.

(2) American National Standard's Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways (ANSI Z26.1-1977).]

SUBPART B: LEVITATION AND LATERAL GUIDANCE

§ 4.11 Guideway Clearance

(a) Minimum Gap

If the gap should be reduced from the minimum 4 mm operating limit with the occurrence of guideway geometry defects or with the failure of individual magnet controller modules, three (3) levels of action must be taken in accordance with the minimum allowable gap tolerance levels described in 5.1(c).

(b) Gap Level II

If gap level II is reached and it is determined that the vehicle is at fault as described in 5.1(c) the vehicle shall proceed to the next scheduled stop, discharge all passengers, and shall be taken out of service. That vehicle shall not be placed back into service until the fault has been repaired.

(c) Gap Level III

If gap level III is reached and it is determined that the vehicle is at fault as described in 5.1(c) the vehicle shall proceed to the nearest safe stopping point next and discharge all passengers. At a minimum, sufficient repairs shall be made at the stopping point to reasonably assure that gap level II will not be exceeded in moving the vehicle to the maintenance facility. That vehicle shall not be placed back into service until the fault has been repaired.

§ 4.13 MONITORING SYSTEMS AND INSPECTION REQUIREMENTS

(a) Gap Monitoring

Continuous real time gap monitoring diagnostic capability shall be employed on each train to ensure compliance with the above stipulated gap levels and exposure. Diagnostics must be capable of measuring gap variations within +/-0.2mm.

(b) Self-Diagnostic Circuitry

The Levitation and Guidance control units shall be equipped with automatic self-diagnostic circuitry that will detect component failure and deactivate the control unit in which a fault has been found. This deactivation shall be reported to the Central Control facility. In the event a unit has been deactivated, ___ attempts may be made to reactivate the unit.

(c) Inspection, Maintenance, and Calibration

The Levitation and Guidance control circuits and magnets are to be inspected, calibrated and maintained in accordance with the approved Safety Operations and Maintenance Manual prior

to introduction of a new or repaired vehicle into revenue operations and at intervals of _____ weeks.

(d) Control Unit deactivation

In the event of deactivation of any control unit, the vehicle shall be removed from revenue service after proceeding to it's next scheduled stop.

§ 4.15 Levitation Systems

(a) Fail-Safe Design

The magnetic levitation system shall be a fail safe design, in that the vehicle shall be capable of guideway to skid pad contact, on either or both sides of the vehicle, at any vehicle speed, in the event of total or partial levitation system failure.

(b) Testing

The magnetic levitation system shall be tested before a train is dispatched. Trains shall not be allowed to move if levitation magnets at two or more hinge points in a single train section are disabled.

(c) Levitation Magnet Section Failure

A vehicle shall be stopped at the next available safe stopping point if the condition exists that a single failure of a levitation magnet section could result in a loss of safe hover.

(d) Multiple Control Circuit Failure

In the event of failure of both levitation control circuits in two or more levitation frames, the vehicle is to be brought to a stop at the next available safe stopping place and removed from service.

§ 4.17 Guidance Systems

(a) Testing

The magnetic guidance system shall be tested before a train is dispatched. Vehicles shall not be allowed to move if two or more guidance magnets in a single vehicle section are disabled.

(b) Guidance Magnet Failure

A vehicle shall be stopped at the next available safe stopping point if the condition exists that a single failure of a guidance magnet could result in loss of safe guidance control.

SUBPART C: ELECTRICAL SYSTEMS, PROPULSION, AND BRAKING

§ 4.19 Definitions

High Voltage: Voltages greater than 50 volts AC or 120 volts DC when stipulations in DIN VDE 0100, Part 410 are observed. (RW MSB; Chapt. 3, Sect. 3.1)

§ 4.21 Electrical Systems

(a)

Safety requirements with respect to personal safety, equipment protection and electrical system installation included in the RW-MSB; Chapter 3, section 1, section 2 and sections 3.1 through 3.1.1.3 shall apply to all on-board electrical equipment.

(b)

Warnings, either audio or flashing video indicators, shall be provided to both vehicle and system operators to alert them to real or impending unsafe on-board electrical system conditions.

(c)

Equipment chassis and other metal parts shall be grounded to the vehicle frame. Neither the chassis nor the frame shall be used as a normal conducting path for ground return currents of system/subsystem components.

(d)

Equipment shall be constructed such that personnel will not be exposed to high voltages when the equipment enclosure is closed.

(e)

Equipment enclosures containing high voltages shall have appropriate warning signs attached. The signs shall include a notice that the enclosure is to be opened by authorized personnel only.

(f)

Energy storage capacitors shall incorporate discharge resistors across them to bleed off stored charge when de-energized. The charge on the storage capacitors shall be reduced to below 50 Vdc within one (1) second. Warning signs shall be posted in a conspicuous location on the inside of the enclosure to inform maintenance personnel of the time required for voltages to decay to less than 50 V dc.

(g)

The internal power distribution system shall incorporate circuit breaker protection to interrupt power to system/sub-system components. Protection circuitry shall be coordinated to safely interrupt worst case short circuit current levels. Each critical circuit shall have individual circuit protection. [Definition needed for critical circuit.]

(h)

Maintenance work shall not be performed on on-board electrical systems or subsystems unless they have been disconnected from the vehicle power distribution network. Reconnection to the vehicle power distribution network shall be prevented by implementation of the procedures specified in: DIN VDE 0105, Operation of Electrical Power Installations, General Requirements, July 1983, Part 1, Section 9.

§ 4.23 Batteries

(a)

On-board battery systems shall comply with safety requirements contained in RW-MSB, Chapter 3, Section 4.2.

(b)

Batteries shall be force-ventilated to prevent explosive gas build-up. The charging system shall be interlocked with the ventilation system to prevent battery charging in the event of ventilation failure. [Reference 49 CFR 229.43]

(c)

Battery temperature sensors shall be used to interrupt or regulate battery charge rate to prevent battery temperature from exceeding safe limits.

(d)

Battery charging system shall be regulator controlled to prevent overcharging or generation of excessive gases.

(e)

Interconnection of batteries to provide higher voltages shall be accomplished via connections external to the battery enclosure.

(f)

Individual battery enclosures shall incorporate overcurrent protection to prevent battery discharge in the event of short circuits across output terminals.

(g)

If battery power distribution is intended to provide independent power to the public address system and designated fixtures for the emergency lighting system, a one hour capacity shall be provided [Lighting should last at least 1/2 hour to allowlighted evacuacuation of the vehicle. Is some extra margin of lighting time really needed? New, added to "track" 4.37]

§ 4.25 Current Collectors

(a)

Current collectors used to transfer power from the wayside to the vehicle through direct guideway to vehicle contact shall be interlocked such that vehicle motion can not be initiated unless a fail safe verification that the collector has been retracted, and is safely stowed aboard the vehicle, is received.

(b)

Current collector deployment commands shall be interlocked to prevent collector deployment unless the vehicle is stopped.

(c)

Current collectors shall be disconnected from vehicle power unless deployed and in contact with the power rail(s) to prevent voltages from appearing at the collectors when they are not in contact with the power rail(s).

(d)

Current collectors shall be protected by circuit breakers or fuses.

(e)

Umbilical connectors, other than those used to connect a service/rescue vehicle to the train, shall be interlocked such that vehicle motion cannot be initiated without a fail safe verification the umbilical cord has been removed.

§ 4.27 Brakes

(a)

Each brake system (dynamic, eddy-current, skid or other contact mechanism) on trains with more than one brake system, shall be capable of independently stopping the vehicle/train within a safe stopping distance as required by the train control system for safe system operation.

(b)

The eddy current brake system shall be tested before a train is dispatched. Trains shall not be allowed to move if the condition exists that one additional eddy current brake segment failure would result in a condition where the train could not follow the safe braking profile required by the train control system for safe system operation. [Arne's comments have not been addressed for (b), (c), (d), and (e).]

(c)

The skid brake system shall be capable of supporting the vehicle and shall be capable of bringing the vehicle to a safe stop from any speed.

(d)

The mechanical skid brake system shall be inspected daily if skid brake wear is not monitored on a continuous basis by a vehicle sensing system. Skid pads shall be replaced when they have worn down to minimum acceptable limits as specified by the vehicle or brake manufacturer.

(e)

Skid brake pads shall be inspected for excess wear following each brake cycle in which the vehicle is braked from a speed greater than TBD% of the normal skid brake application speed.

SUBPART D: SAFETY FEATURES

§ 4.29 General

(a)

Fan openings and exposed moving parts of mechanisms, shall be in non-hazardous locations or equipped with guards to prevent personal injury (See Subpart C, 4.19 (a) for requirements relating to high-voltage equipment, switches, circuit breakers, contactors, relays, grid resistors, and fuses. [Also listed in 229.41]).

(b)

Unsafe conditions which may endanger the safety of the passengers, crew or train, shall be prevented. These conditions include, but are not limited to, insecure attachment of components, including stator packs, auxiliary power pick up equipment, leaks and accumulations of fluids on electrical equipment that create a personal injury hazard; malfunction of components with moving parts such as actuators and doors, and cracks, breaks, excessive wear and other structural failures of components.

(c)

Vehicle interior section (compartment?) arrangement shall comply with the requirements contained in Subpart A, 4.7 of this Rule.

(d)

Fire Protection [Moved from Passenger car section; applicable to whole train. This could also be upgraded to be § 4.35]

[NIST Contract to clarify the requirements below.]

(1) Except as noted below, the vehicle structural design and arrangement shall comply with the general requirements contained in Chapter 11 of the RW MSB and the specific requirements contained in DIN 5510 Preventive Fire Protection in Railway Vehicles: Part 1, Levels of Protection, Fire Preventive Measures and Certification and Part 4, Structural Design of the Vehicles.

(2) Materials

(i) Vehicle materials shall be certified as complying/equivalant with the flame spread and smoke emission performance requirements contained in the FRA Rail Passenger Equipment Guidelines for Selecting Materials to Improve their Fire Safety Characteristics. [Docket No RSPC-84-1, Notice 3], as published in the Federal Register, Vol. 54. No. 10, January 17, 1989, pp. 1937-1840.

[Especially important for the floor structural test- require the ASTM-E119 test cited in the FRA fire safety guidelines rather than the FAA test requirement contained in 14 CFR, Appendix F (Part I). E-119 measures fire penetration and heat release which is in contrast to the FAA vertical test which relates to burn length and flaming dripping and the test would provide a means to determine whether fire resistance of the maglev vehicle structural flooring is acceptable for the U.S. environment.

[Part 2 of DIN 5510 which is in draft form specifies individual component materials tests to evaluate their fire, smoke, and toxicity characteristics. UIC Code 564-2 referenced in RW MSB also specifies such tests. However, it is unclear as to whether those tests are comparable to the FRA, Amtrak, or FAA tests. In addition, specific tests for certain components are not included in either the RW MSB cited documents or FAA Part 25, although they are called out by FRA, i.e., equipment box covers, lighting diffusers, and elastomers.

(ii) All materials shall also be certified as complying with requirements relating to testing of an assembly to provide information about the actual behavior of materials in a "real world" vehicle fire as contained in the Amtrak Specification for Flammability, Smoke Emissions and Toxicity, Specification No. 352, (AMTRAK Spec. 352). **[NIST to clarify]**

(iii) As an alternative to (ii), the results of a fire risk assessment using the hazard load analysis described in Appendix D of NFPA 130, Fixed Guideway Transit Systems shall be provided. [NIST to clarify]

(iv) All materials tested under (i) above shall be tested to determnine acute toxic potentcy per the measurment method contained in NIST Special publication 827: "Toxic Potency Measurement for Fire Hazard Analysis. (December 1991)" The LC_{50} value, measurements of CO, CO_2 O_2 and HCN shall be included in the test data.

(3) Electrical Fire Safety **(What about guideway general electrical and fire safety?]**

(i) The design and arrangement of the vehicle electrical systems shall comply with the requirements contained in the RW MSB: Chapter 11, Sections 4.5 and 4.6, and in Chapter 3, Sections 3.3 and 4.4; and in DIN 5510: Part 5, Electrical Operating Means.

(ii) Overcurrent protection devices, switching units, and heat sensors **[does Orlando system have these?]** shall be provided which comply with requirements contained in the RW MSB: Chapter 11, Sections 4.5 and 4.6, and in Chapter 3, Sections 3.3 and 4.4; and the specific requirements contained in DIN 5510: Part 5, Electrical Operating Means.

(4) Each vehicle **[or car section?]** shall be equipped with a fire detection and alarm system which complies with DIN 5510: Part 6, Auxiliary Measures, Function of the Emergency Brake Equipment, Information Systems, Fire Alarm Systems, Fire fighting Equipment.

(5) Each vehicle **[or car section?]** shall be equipped with a smoke detection and alarm system which complies with Amtrak specification 307-Smoke Alarm.

(6) Fire Suppression

(i) Each vehicle [or car section?] shall be equipped with an automatic fire suppression system, the operation of which shall provide notification to the operator/attendent and Central Control facility. [DIN 5510, Part 6 mentions the fire suppression system idea but states that automatic triggering of the firefighting system in response to a vehicle fire does not require provision of an alarm. Does Orlando plan to provide an automatic suppression system?]

(ii) Each passenger section shall be equipped with two (2) portable fire extinguishers (20 lb ABC type). [Halon is being phased out as a result of world environmental action.]

(iii) Each operator cab shall be equipped with at least one (1) portable fire extinguisher (20 lb ABC type). [TR07 also has powder and metal fire extinguishers.]

(iv) Fire extinguishers shall be stored in secure but accessible locations which are clearly visible and labeled, yet protected from unauthorized use.

(e)

The operator cab and passenger car sections shall be equipped with emergency communication, lighting, and access/egress systems which comply with the requirements contained in Part 11, Emergency Preparedness, subpart D, § 11.27 of this Rule.

§ 4.31 Operator Cab

(a)

The operator cab shall comply with the human dimensioning and ergonomics requirements described in DINs 33 400, 401, 402, 403, 413, 414, as cited in the RW MSB: Chapter 4, Section 11.

(b)

All exposed convex edges and corners, such as defroster ducting, engine control panels, window latches, etc. are to be protected with smooth, large radius rounding. The window latches shall be designed to prevent catching of fingers between latches when closing windows.

(c)

Cab windows shall provide an undistorted view of the guideway from the operator/attendent normal position in the cab.

(d)

Windshields and side windows shall comply with the glazing requirements contained in Subpart A, section 4.9.

(e)

All windshield wiper valves, door controls, and light switches are to be recessed and lights are to be flush mounted.

[TR07 doesn't have windshield wipers at TVE. Believe they should be provided, unsure how to require them?]

(f)

Locations subject to accidental head contact including the sun-visor and area over the cab door area shall be padded.

(g)

All exposed handles shall be covered with a soft-resilient type material.

(h)

All operator cab materials shall meet the requirements of Subpart A, section 33 (d) of this Rule.

(i)

Cab doors shall be equipped with a secure and operable latching device.

[This item originally also stated that Cab seats shall be securely mounted and braced. [§ 229.119] [AAR F, S-504, section 4 contains more specifics about cab seating mounting, believe this item should be moved to 4.5 and will defer to Dave T. decision about what text to include.]

(j)

Floors of cabs, passageways, and compartments shall be kept free from oil, water, waste or any obstruction that creates a slipping, tripping, or fire hazard. Floors shall be properly treated to provide secure footing.

(j)

(1) The cab shall be provided with proper ventilation and with an environmental control system capable of maintaining the interior temperature between 15 and 25 [check]

degrees Centigrade (60 and 80 degrees Fahrenheit) above the center of each seat in the cab.

[Lifted from TGV Rule text. Appropriate? Current FRA says heating temperature of 10 degrees Centigrade (50 degrees Fahrenheit] AAR RP-542 contains the 50 degree requirement but also contains many more details. Have added the following items, am unsure which should be considered safety]

(2) Window defrosters must be designed so the windows in line of the Operator/Attendent when looking ahead from their usual and proper position in the cab will remain frost free under normal winter conditions - delete this underlined portion. [NOTE: even though Orlando is "warm" a defroster is still needed.]

(3) Thermostats if used should be resistant to mechanical vibration of the power cab and to electrical power surges.

(4) Thermostats if used shall be capable of withstanding an electrical test of "15 makes and 15 brakes consecutively" while carrying twice normal current at maximum voltage.

(5) Relays, switches, solenoids, and contacts should be of rugged (define?) design to withstand "railroad" service and be properly insulated to prevent grounding.

(6) Other items relating to water, drain and valves.

[Should passenger sections have an environmental control system as a safety feature?]

(k)

Each operator cab shall have cab lights which will provide sufficient illumination for the control instruments, meters, and gauges to enable the operator/attendent to obtain accurate readings from the normal operating positions in the cab. Lights shall be located, constructed, and maintained so that light illuminates only those parts requiring illumination and does not interfere with vision of the guideway and signals used for manual operation in the yard [signals to be also provided on revenue guideway, if only for manual control? Each operator cab shall also have a conveniently located fixture that can be readily turned on and off by the crew and provides sufficient illumination with which to read operating manuals and other documents.

(l)

Cab passageways and compartments shall have adequate illumination [How many candela? 229.127 does not define. ADA says 2 candela at the floor. This item is not redundent, cab passageways amd compartments are not the same as cab indicators.]

(m)

The operator cab shall be equipped with a means of voice communication with the Central Control facility.

(n)

Each operating cab shall be equipped with a speed indicator which is clearly readable under all light conditions (what about other indicators being readable under all light conditions? from the operator/attendent normal operating position. [Applicability of following:] Each speed indicator required shall be tested for accuracy as soon as possible after departure [How to do?]

(o)

The control cab of each operator cab shall be equipped with a vertical handrail on each side of the cab door to provide safe access and egress. [copied from TGV text (11.8.7) which has more specifics of dimensioning, fastening, etc. Is it appropriate?]

(p)

Each operator cab used in revenue service shall have bi-directional headlights that produce at least 200,000 candela and tailights [if tailights are added, how bright should they be?] [§ 229.125] Each headlight (what and what distance should taillight illuminate? shall be arranged to illuminate a person at least 800 feet ahead and in front of the headlight. Headlights (what about tailights?) shall be provided with a dimmer to reduce the light output to _?_ candela at stations.

[Are taillights considered to be rear end marking devices? Rear end markers are currently covered in § 221. Will § 221 apply as is?]

(q)

Each maintenance vehicle used on the guideway or in yard service shall have two headlights, one located on the front of the vehicle or consist and one on its rear. Each headlight shall produce at least 60,000 candela and shall be arranged to illuminate a person at least 300 feet ahead of and in front of the headlight [NOTE: A Maintenance vehicle is not a operator cab. Don't know where this text "belongs," but § 229.125 (b) requires this for maintenance locomotives; idea of maintenance vehicle headlight (what about tailight?) as well as other items of the the maintenance vehicle which are closely related to "operator cab" should be covered "somewhere" in Rule.

(r)

The operator cab shall comply with the noise requirements contained in Subpart E, 4.39.

[(s) Should we include reference to Part 11, Emergency Preparedness re: emergency lights, communication, etc. or put specific text here?]

§ 4.33 Passenger Car Sections

(a) Interior circulation, handrails and stanchions

(1) Where provided, handrails and stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance, and alighting.

(2) Where provided, the diameter or width of the gripping surface of handrails and stanchions within the passenger compartment shall be 1-1/4 inches to 1-1/2 inches or shall provide an equivalent gripping surface. Handrails shall be placed to provide a minimum 1-1/2 inches knuckle clearance from the nearest adjacent surface.

(b)

Each passenger car section shall be equipped with a public address system permitting system personnel or recorded or digitized messages to announce stations and provide other passenger information.

(c) Access/Egress

(1) Aisle floor surfaces shall be slip-resistant.

(2) All thresholds other than flush level shall have a band of color(s) running the full width of the threshold which contrasts from the adjacent floor, either light-on-dark or dark-on-light.

(3) The design of car sections shall be coordinated with the boarding platform design such that the horizontal gap between a section door at rest and the platform shall be no greater than 3 inches and the height of the car floor shall be within plus or minus 5/8 inch of the platform height under all normal passenger load conditions. Vertical alignment may be accomplished by secondary suspension or other suitable means of meeting the requirement.

(4) All doorways shall have, when the door is open, at least 2 footcandles of illumination measured on the door threshold.

(5) Doors shall meet the following requirements:

(i) If doors to the platform close automatically or from a remote location, auditory and visual warning signals shall be provided to alert passengers of closing doors.

(ii) Pressure sensative or electrical obstruction detection (or push back) shall be provided for each door leaf, to automatically recycle the door to the full open position for a fixed time delay.

(iii) Each door leaf shall be equipped with an auxiliary door lock mechanism [? how explain meaning further?].

(iv) The levitation control shall be interlocked with side door operation through door interlocks, so that the vehicle cannot be levitated or allowed to move until all car doors are fully closed and locked.

(v) Door control circuitry and operation shall meet the requirements contained in Part 6, subpart ? of this Rule.

[Have moved all references to emergency equipment to new Part 11.]

(d)

Vehicle emergency features and systems shall be provided which meet the requirements contained in Part 11, subpart D, § 11.27.

SUBPART E: INTERNAL NOISE

to be added

SUBPART F: VEHICLE MAINTENANCE AND INSPECTION

§4.35 Maintenance Standards

The railroad shall provide for vehicle maintenance and inspection.

Vehicle maintenance standards shall include, but are not limited to the following:

A. Structural integrity.
B. Levitation and Guidance Systems.
C. Access, egress equipment.
D. Emergency features and equipment.
E. Fire Protection Systems.
F. Propulsion and braking.
G. Performance Recording Equipment.
H. Communication Systems that provide voice or technical data.
I. Sanitation Systems.
J. Noise and Magnetic Emissions.
K. Control instruments and equipment.
L. Early Warning Devices.
M. Electrical and Mechanical Controls.

The above standards selected shall be incorporated in the railroad system operator's System Safety Program Plan (SSPP). Reference ?? SSPP.

§ 4.37 Inspection Intervals

Based on the maintenance standards, the railroad shall establish inspection functions and intervals for the vehicle(s) and for each system or subsystem defined in Part 4.37. The railroad shall incorporate these inspection functions and intervals in an overall Maintenance and Inspection Plan. Inspection intervals are to be specified by service usage factor or with actual calendar dates by which the inspection must occur. Deviation, changes or extension from established criteria for inspection will be by petition only. Ref ??

§ 4.39 Record Keeping

Written maintenance and inspection records shall be maintained by the railroad which substantiate compliance with standards and execution of inspections and/or component replacement.

§ 4.41 Record Keeping Retention Requirements

(a) Retention Interval

Based on the maintenance requirements established, written records will be retained for inspection by FRA at a central location(s) for a minimum period of two (2) years.

(b) Record Certification

Maintenance and inspection records will require the signature of a designated authorized individual on the records for each maintenance and inspection task performed.

(c) Record Duplication

Maintenance and inspection records will be maintained by the railroad in duplicate format which protects against any loss of a single set of records, particularly machine records.

§ 4.43 Vehicle Maintenance, Inspection Training And Certification

(a) Specialized Training

Personnel directly involved with railroad vehicle maintenance and inspection function(s) will be trained and certified by an established training program that includes classwork training, on the job training and standards of performance evaluations.

(b) Minimum Qualifications

Personnel deemed responsible for maintaining or inspecting maglev vehicle(s) shall be at least eighteen (18) years of age and have completed a minimum equivalent of a high school education.

(c) Training Program

The training program shall require joint development by the designer(s), fabricator(s) and operator(s) of the maglev system as defined in Part 1 and Part 4.37 Maintenance Standards.

(d) Personnel Certification

The railroad shall identify in writing individuals authorized to certify personnel to accomplish maintenance and inspection of the maglev vehicle(s). The operator may elect to incorporate this training and certification as part of its System Safety Program Plan (SSPP).

(e) Initial Certification

Initial authorized certifiers and inspectors identified by the railroad for maglev maintenance and inspection of the vehicle(s) shall present documented evidence of knowledge, qualifications and experience directly related to the maglev vehicle(s) to be maintained. Designers, fabricators and experienced operators of the Transrapid maglev vehicle(s) are considered as initial certifier candidates.

(f) Training Location

Training may occur through Commissioning and Pre-acceptance periods to allow for more complete operational and maintenance training. Other locations, aside from the Orlando system to be operated, where equivalent Transrapid system are currently operating, may be considered in part as adequate for specific systems and subsystems maintenance, inspection, training and certification. Final system training shall be on the Orlando system.

§ 4.45 Submittal Of Plans For Vehicle Maintenance And Inspection Training And Certification.

A Maintenance, Inspection, Training and Certification plan shall be submitted to the Federal Railroad Administration specific to the requirements of § 4.37 herein and as part of the System Safety Program Plan (SSPP).

PART 5: GUIDEWAY

§ 5.1 SCOPE

This part prescribes safety requirements for the Orlando Transrapid Maglev guideway system. The guideway system is defined as all structural elements and components comprising the guideway superstructure (running beams, supports, stator segments, and switches), guideway substructure (supporting columns, foundations, and below ground to elevated transitions), and other civil engineering structures including bridges, at-grade embankments and end-of-track devices.

§ 5.2 GUIDEWAY GEOMETRY

(a.) General

A major performance indicator of guideway geometry failure is a reduction in gap and the presence of sliding [term used by Germans to refer to the upper guideway surfaces that the skids contact during emergency stopping] surface irregularities. Hence, guideway geometry requirements are specified in terms of minimum allowable vertical and lateral gap tolerances, and by limits on sliding surface mismatch. The vertical gap between the lower surface of the stator pack and the upper surface of the electromagnets must be controlled to prevent the magnets from striking the guideway.

(b.) Gap Control

There are eight hinge points between the magnet assemblies on each side of each car-section. The gap must be controlled at all these hinge points. The lateral gap between the guidance magnets and the guide rail must be similarly controlled. At each hinge point the vehicle is equipped with gap sensing devices which continuously measure the levitation and guidance gaps. This information is used to control the currents in the electromagnets and hence the gaps. The actual sensors and the electronics associated with gap control, called the magnet control modules, are described in the RW-MSB chapter 2, section 4.2 and chapter 4, section 2 and 3. These modules must be maintained according to a prescribed schedule as determined in the pre-revenue testing phase of the project and calibrated as required under part 4.11.(b), to insure that they function as designed. When the gap at any hinge point is less than the designed minimum of 4 mm, one of two things may be at fault; the vehicle may have a malfunction or the guideway may have become misaligned, neither of which can be allowed to persist.

(c) Geometry

If the gap should be reduced from the minimum 4 mm operating limit with the occurrence of guideway geometry defects or with the failure of individual magnet controller modules, three (3) levels of action must be taken in accordance with the following minimum allowable gap tolerance levels:

o Gap Level I: Greater than or equal to 4mm shall be required for absolute minimum safety for normal operation.

o Gap Level II: Less than 4mm but greater than 2 mm is the trigger for problem identification and correction. If five of a single train's gap sensing systems or five consecutive trains have one gap sensor registering between the 4mm and 2mm thresholds, the location must be inspected within 1 hour and corrective action must be implemented within 24 hours. If corrective action can not be taken within 24 hours all operations must be slowed until trains can pass the location without violating the 4mm minimum gap limit. If it is determined that a magnet control module has malfunctioned, the vehicle shall be taken out of service after discharging passengers at the end of the trip.

o Gap Level III: 2 mm or less requires an immediate stoppage of operations over the location which causes the less than 2 mm gap and corrective action taken. No other trains except inspection vehicles may pass over the location until approved for further use. If it is determined that a magnet control module has malfunctioned, the vehicle shall be taken out of service after discharging passengers in accordance with the disabled vehicle plans presented in the emergency response preparedness plan.

(d.) Tolerance

Continuous real time gap monitoring diagnostic capability shall be employed on each train to ensure compliance with the above stipulated gap levels and exposure. Diagnostics must be capable of measuring gap variations within +/-0.2mm.

(e.) Sliding Surface

In addition to the magnetic gap tolerances, the sliding surface on top of the guideway must be maintained such that the vertical height (or "mismatch") across any break in the horizontal continuity of the sliding surfaces does not vary more than 0.6 mm. [reference: Florida proposal, page II-63, 'Tolerances for steps and gaps between consecutive beams'] If the height mismatch is greater than 0.6mm, all operations over the location must cease until appropriate corrective actions are completed.

(f.) Sliding Surface Mismatch Measurement

A measurement diagnostic capability shall be employed on each train **[or sweeper train?]** to ensure compliance with the above stipulated surface mismatch requirements. Diagnostics must be capable of measuring surface height variations within +/-0.3 mm.

§ 5.3 GUIDEWAY STRUCTURAL INTEGRITY

This section assigns direct responsibility to the Railroad to develop and submit to FRA a guideway structural integrity "proof of safety" in line with the requirements of § **3.9-h.(1)**.

§ 5.4 COMPONENT INTEGRITY

This section establishes structural integrity requirements on the following specific major components:

- o Switches
- o Stator packs/guide rail/fastenings
- o Skid surface joints
- o "End of track" devices

which are delineated as follows;

(a) Guideway Switches

- o The operation/setting of switches by the electro-mechanical actuating drives must be such as to permit vehicle passage only in the fully-locked, verified safe position. Adequate fail-safe redundancy must be inherent in the design and operation of the system.
- o Proof of switch structural integrity in terms of allowable stresses, deflections, fatigue life estimates, and design tolerance allowable must be demonstrated in accordance with requirements of § 3.9-h.(1).
- o Visual inspection of the switch for mechanical wear, corrosion, defective components, etc., shall be performed monthly in accordance with the inspection requirements stipulated under § 5.5.
- o During the operation of the switch sensors must verify that the beam bending actuators are functioning within design tolerances. If for any reason an actuator fails to bend the beam of the guideway according to the design requirements defined during the pre-revenue testing described in § 3.9-h.(1), the switch must be taken out of service until the switch is inspected and approved for further use.

(b) Stator Packs/Fastenings

Stator packs must be secured so as to prevent the sudden reduction of the nominal gap between the train magnets and the stator pack surface. In addition, in the event of a primary fastening system failure the fasteners should be of a design which allows the packs to drop 2 mm from their nominal position. After a primary fastener has failed the remaining fasteners must be fully capable of supporting the stator pack under all expected loading conditions. If a stator pack primary fastener is determined to have failed, train operations must cease over that location until corrective action is taken.

The method of measurement must be determined and demonstrated in line with the requirements of § 3.9-h.(2), pre-revenue acceptance testing.

(c) Sliding Surface Coefficient of Friction

In addition to the sliding surface geometry requirements stipulated in paragraph 5.2.(e), the surfaces must be maintained to provide an adequate coefficient of friction, under all weather conditions for which normal operations are allowed, to guarantee fail safe braking. A method for verifying an adequate coefficient of friction must be proposed by Orlando transraipd and demonstrated during the pre-revenue acceptance testing

(d) End of Track Devices

Guideway "ends" must be equipped with appropriate structures/devices to prevent vehicle intrusion beyond the point designated as "end of guideway" with minimal injury to passengers and/or damage to train/vehicle. At a minimum the end of track device should stop a train with a forward velocity of 1 m/s without exceeding a 4.0 m/sec**2 deceleration.

§ 5.5 INSPECTION

This section prescribes requirements for the frequency and manner of inspecting the guideway structure and components. The following four tiers or levels of inspections are required:

(a) A "sweeper train" inspection of the entire guideway must be performed after any stoppage for more then 6 hours and before initial daily operations. A "sweeper train" is defined as a normal revenue consist without passengers and may operate in either direction on the guideway.

(b) The primary inspection procedure depends on each train being equipped with a continuous "real time," gap measuring diagnostic system.

(c) Special periodic inspections are required for specific subsystems of the guideway, such as the bending beam switches, turn tables, guideway drains, guideway support seats, columns, and foundations. These inspections must be performed as required by local building codes and as recommended by Transrapid. All such procedures must be demonstrated during the commissioning and pre-revenue acceptance testing as described in § 3.9-h(1).

(d) In addition, emergency or special inspections, performed on the occurrence of catastrophic events such as fire, flood, severe rain storms, hurricanes, windstorms, earthquakes, or other occurrences which might have damaged the guideway are required. Guidelines must be established for when these inspections are required and what specific subsystems must be evaluated during the commissioning and pre-revenue acceptance testing as described in § 3.9-h(1).

§ 5.6 RECORD KEEPING

Written record of all periodic maintenance and inspections must be maintained for two (2) years after each periodic maintenance or inspection is accomplished.

The gap measuring system must keep a running summary of all locations where the gap is detected at less than the 4mm required for minimally safe normal operations. This summary must be recorded on the vehicle or at the central control facility and the record must be maintained for a period of six (6) months after the measurements were made.

If the gap is detected at less than 1mm, while in normal operation, a record must be made of the gaps at all hinge points 25 m prior to the less than 1mm measurement and until 25 m after the occurrence. The gap must be measured at 1mm intervals, however, the record may be reduced to include only the computed functional description of the stator pack surface.

§ 5.7 SAFE ACCESS AND EGRESS

Based on the specific requirements of Part 11 on safe access and egress, special structures, appurtenances, walkways, ladders, etc., may be required. These structures shall be inspected as part of the periodic overall structural adequacy inspection as required in part 5.5.(c).

§ 5.8 GUIDEWAY SECURITY AND INTRUSION MITIGATION

(a) Fencing should be used to restrict access to guideway pylons (if access ladders are built into the pylon), emergency access/egress stairways, walkways, and maintenance and emergency access roads where the presence of outsiders could pose a threat to the safe operation of the vehicles. The integrity of the fencing will be inspected for adequacy as part of the periodic overall structural adequacy inspection as required in part 5.5.(c).

(b) Overpass protection: For all locations where a road is carried over the maglev ROW, protection will be given to the ROW to prevent foreign objects from falling onto the guideway from the overpass. This could be in the form of netting, fencing, or other protection designed to catch foreign objects that fall or are thrown from the overpass. The integrity of this protection will be ensured by regular routine inspections.

(c) Despite these precautions, should foreign objects fall onto the guideway there must be a system to detect their presence before a vehicle arrives which would provide sufficient warning to the vehicle operator or central control that the vehicle's path is blocked so that appropriate action can be taken.

§ 5.9 VEHICLE TO GUIDEWAY CONTACT

(a) The guideway shall be capable of absorbing, without detrimental effects, interface loads listed in RW-MSB, Chapter 5, section 4, including those in section 4.7 without exclusion.

PART 6: COMMAND, CONTROL, AND COMMUNICATIONS

SUBPART A: GENERAL

§ 6.1 Purpose and Scope

This Part prescribes the requirements for the prototype Maglev system which are equivalent to Title 49 CFR Parts 233, 235 and 236, which govern signal and train control systems.

§ 6.3 Definitions

This subpart contains definitions relative to the Transrapid Maglev system type design.

[NOTE: This list is tentative and requires expansion. A procurement is underway at VNTSC whose aim is (among other things) to develop a generic set of definitions which are relevant to computer-controlled fail-safe/fault-tolerant systems of this type. A draft copy of this interim glossary is included for your information.]

emergency braking: vehicle braking effected by the safety braking system in order to stop at the next stopping point that can be reached safely after an emergency stop instruction is triggered. If the escape velocity is not achieved after restarting from a stopping place, the emergency stop then initiated may lead to stoppage of the vehicle outside a designated "stopping point."

fail-safe: ability of a technical system to remain in a safe state or to immediately switch to another safe state in the event of certain types of breakdown [1].

fault: inadmissible characteristic which can (but need not) lead to a failure of that system [2].

fault-tolerant: the system will continue to function normally in the presence of one or more faults [2].

hardware: the totality of all physical parts of a system [2].

operational control system (OCS): functions and installations whose purpose is the safety, control and guidance of vehicle operations, as well as intercommunication between them [1].

The OCS for the Transrapid system is also referred to as BLT II (Betriebsleittechnik) or BLM III, Phase 2 (Betriebsleittechnik f. Mehrfahrzeugbetrieb). Hereafter, "OCS" will be used to refer to these systems. The OCS is further subdivided into several subsystems which will be described in the appropriate sections in §6.5 System description.

programmed braking: causes the vehicle to come to a stop at a safe stopping point at a prescribed rate using deceleration profiles created by the on-board computer system. Programmed braking is also referred to as "service" braking (the braking system used in conventional passenger-carrying system operation for stopping at stations).

redundancy: presence of more functionally capable means in one unit than would be necessary to perform the required function [1].

reliability: the condition of a unit with regard to its suitability for meeting reliability requirements during or after predetermined intervals under given service conditions [1].

ROM: read-only memory. Software is programmed onto ROM modules during component design and/or installation. This software is not user-modifiable.

safe hover: property of a high-speed maglev train to be able to maintain its levitation function even in the event of the maximum conceivable breakdown and/or emergency at least to such an extent that limited and short-term continued forward motion is possible [1].

safe life: during the anticipated service life, neither the product as a whole, nor any of its critical subfunctions may fail [1].

safety: a state of affairs in which the risk is smaller than the tolerable risk [1].

software: the totality or part of the programming constituents of the system, including any documentation which relates to it [2].

stopping place system: the absolute ability to reach defined stopping points through safe hovering. The vehicle must be able, from any point along the line, even in the event of a failure of the force of propulsion, to utilize its

momentum to keep running to a preselected stopping point where it can undertake programmed braking. In the event of breakdown or emergency, the vehicle must be brought to a standstill at this preselected stopping point by initiating emergency braking. The length of this guideway segment is based on the vehicle length and the dispersion of the braking path (the deceleration profile).

vital: referring to hardware or software whose continued and proper operation is critical to sustained system safety.

§ 6.5 System description

(a) Operations control system (OCS)

The OCS of the Transrapid system is comprised of several subsystems as follows:

(1) Safe speed enforcement system

The safe speed enforcement system is designed to provide movement authorities to the vehicle(s) comprising the system and to intervene with appropriate countermeasures when a situation occurs such that safe execution of these movements is not likely. These systems normally include the functions which, in conventional railroad operations are referred to as automatic train operation (ATO) and automatic train protection (ATP). Assurance of safe speed enforcement basically involves communication with the service propulsion and braking systems and consists of the following subsystems:

- communication of movement authorities to the normal wayside service power controllers
- transmission of movement authorities to the on-board computer
- service propulsion and braking system
- verification of safe movement by decentralized wayside controllers
- the emergency brake (vehicle-borne eddy-current brakes) [4].

(2) On-board control system (BLF)

The on-board control system (BLF, Betriebsleittechnik Fahrzeugseitige) comprises those subsystems which are vehicle-borne and have safety-critical functions and includes the following:

- the vehicle-side safety system (FSI) whose functions include:

- determination of speed, position, running direction and orientation,
- engagement of the emergency (eddy-current) brakes,
- transmission of propulsion shutoff signal to the decentral safety system,
- release and monitoring of door and on-board control systems,
- determination of control, propulsion and diagnostic data,
- two-way communication of safety engineering data and evaluation with the decentral safety system,
- safety-engineering monitoring of the connection to the transmission computer.

- the vehicle-side control system (FST) which controls the display of the vehicle state variables in the operator's cab (speed, running direction, mode of operation and diagnostic information).

- the transmission coupling (FUE) is a safety-engineering microcomputer with transmission components for sending and receiving information from the vehicle-side computers to the rest of the system.

- the passenger emergency signal system <<NEED TO FIND A PLACE FOR THIS>>

(3) Decentralized train and guideway control units

The decentralized train and guideway control (DTGC) units, also referred to as BLD (Betriebsleittechnik Dezentrale) are distributed along the guideway in the vicinity of the electric substations which supply the system power. The main purpose of the DTGCs is to move the vehicle(s) along the guideway according to the operational specifications via control of the propulsion unit.

The DTGC is composed of several elements with the following functions:

- the guideway-side safety system (DSI)
- the guideway-side control system (without safety function) (DST)
- the transmission coupling (DUE) (same function as FUE above)
- the track element control module with coupling (WS) which safeguards and controls the moveable sections of the guideway.
- the propulsion coupling (AN) connects the propulsion control system with the DTGCs.

The DTGCs are located along the guideway in the vicinity of the power substations which supply guideway power. The DTGC has the following functions:

- reception and evaluation of vehicle data (location, speed, direction, vehicle status)
- transmission of the emergency braking command to the vehicle
- initiating propulsion shutdown when emergency brake is engaged or upon transmission failure
- setting of switches, and transmission of switch setting orders to the track element control module
- reading and evaluating the switch position information (or errors) from the track element control module
- communication of switch positions, open track segments, and permissible vehicle speed to the decentral control system
- determination of permissible vehicle speed from track, guideway and propulsion status [3].

(4) Track element control module (also referred to as WS, Wegelement Steuer-modul) (Interlocking system)

The track element control module controls the moveable sections of guideway given the specified technical, structural, and operational properties. Commands from the BLD are received by the WS, processed, and if necessary, converted into commands to the guideway elements. The WS module contains three microcomputers which operate on a 2-out-of-3 voting system. One WS module can activate up to four track segments. These tasks are accomplished via several safety-critical elements:

- the interlocking logic unit
- the switch position sensor
- the switch lock sensor
- the feedback communication loop for switch position and lock status
- the communication loop which carries requests to release switch lock mechanisms
- vehicle location and speed sensors
- communication loop for the vehicle location and speed information
- communication loop for vehicle movement authorities [4].

(5) Central control and monitoring facility (CCMF)

The central control and monitoring facility (CCMF), also known as the BLZ (Betriebsleitzentrale), is the command center whose function consists of communicating the speed profile for the desired train movement to the vehicle and wayside equipment [4]. The CCMF also performs operations planning and schedule management, including

diagnostics with the associated disruption elimination functions and system servicing and logistics. The operation data documentation functions are performed by the CCMF. The CCMF is not a safety critical element of the system.

(b) Communications system

The communication systems for the Orlando Maglev Project Transrapid system includes the following elements:

(1) Radio Communications System

Data transmission between the fixed and mobile components of the system is accomplished via radio in the 40 GHz range. The system consists of a radio center (at or near the DTGC), the stationary radio points (the antenna masts along the guideway) and the mobile radio (vehicle radio). The transmission coupling in the vehicle and DTGCs are each 2-out-of-3 voting computers. The transmission system is full duplex which means that it can send and receive information at the same time.

The radio communications system is used for both voice and data transmission. The transmission rate is approximately 512 kbit per second. Since safety-related data are being transmitted, very low bit error rates are permissible.

(2) Fiber-Optic Communication System

A fiber optic link connects the stationary DTGCs to each other and to the CCMF. This network is the so-called CP-16 ring which is operated in duplex to increase reliability.

§ 6.7 Location of relevant documentation.

As required for installation and periodic maintenance, all plans, circuit diagrams, modifiable software source code, diagnostic tools and instructions for their utilization shall be maintained at a central location established by the railroad. Documentation shall be legible, correct and updated in keeping with systemwide repairs and/or modifications. If electronic recordkeeping procedures are employed, a secondary independent system shall be used on a routine basis for maintaining backup/archive copies of these files. Any modifications performed must be authorized and documented as required by an appropriately validated configuration control plan as described in §2.9.1(f) and §2.11 (System Safety Plan Supporting Documentation).

§ 6.9 Protection of operational control system components.

(a) Security of components

OCS components (both vehicle-borne and wayside- or guideway-installed) shall be secured against unlawful entry or vandalism to the extent possible. If impossible to preclude these events, such devices, appliances or installations shall be equipped with electronic alarms which shall warn the CCMF of interference or intrusion and information regarding the specific location involved.

(b) Electromagnetic interference (EMI) and electromagnetic compatibility (EMC)

(1) Electromagnetic compatibility (EMC) of all electric and electronic components of the Transrapid maglev subsystems must be achieved. All system elements must be tolerant of the ambient EMI levels and limit EMI output to levels which can be tolerated by adjacent equipment and applications not related to the Transrapid system such as aviation systems associated with the Orlando International Airport.

(2) A detailed EMC plan for all subsystems (vehicle and wayside) is required. The plan must identify potential sources of EMI, systems which will be affected by EMI and the countermeasures taken where necessary to assure safe functioning of all electronic equipment both internal and external to the system.

(3) Testing for conducted and radiated emissions shall be conducted in accordance with MIL-STD-462 [5] as described in Part 3: Pre-Revenue Verification and Testing of System.

[NOTE: Part 10 contains more detail on EMC/EMI requirements.]

§ 6.11 Interference with normal functioning of device.

The normal functioning of any device(s) shall not be interfered with for the purpose of testing, replacement or other maintenance without first taking measures to provide for the safety of system operation which depends on normal functioning of such device(s).

§ 6.13 Operating characteristics of electronic, electromagnetic and electrical apparatus.

Operational control system apparatus, the functioning of which affects the safety of system operations, shall be maintained in accordance with the limits within which the device is designed to operate [6].

[NOTE: This may seem vague and/or difficult to enforce, but this is the same language which appears in 49 CFR §238.8 (honest).]

The mean time between failures (MTBF) of technical components of the operational control system shall be shown to be not more frequent than 8×10^{-08} per hour [3].

Fail-safe stator relays must be used to preclude stator switch sticking and to maintain the ability to remove guideway power.

§ 6.15 Adjustment, repair or replacement of component(s).

When any component of the OCS, the proper functioning of which is essential to the safety of system operation, fails to perform its intended function, or is not in correspondence with known operating conditions, the cause shall be determined and the faulty component shall be adjusted, repaired or replaced without undue delay [6].

§ 6.17 Safety-critical functions

Each safety-critical element of the operational control system must be designed to be fail-safe or have a safe life (see definition in §6.3) [5].

Safety-critical electronic systems shall have a means of continuous monitoring of system status [diagnostics].

Short-time breakdowns shall not bring the system to a stop. Reactions of the safety system to any breakdowns must be reversible, i.e. the system must return to normal operation when the cause of the reaction becomes nonexistent [11].

The operation control system must be suitable to control and monitor the envisaged operation safely at any time [11].

The following conditions must be met in order to permit automatically controlled operation of the system:

- data transmission between the vehicle and the decentral installations must be functional,
- vehicle and guideway safety, control and transmission systems must be functional and able to interface,
- the interfaces to the switch controllers and propulsion units must be functional, and
- visual displays of the vehicle control values and switch settings aboard the vehicle and at the CCMF must be available and in agreement.

The operation control system shall be designed to meet the principle that no human responsibility for safety is required [11].

§ 6.19 Failure Modes and Effects Analyses

A comprehensive failure modes and effects analysis (FMEA) must be performed on individual subsystems and on the overall system. Documentation requirements for this subpart appear in §6.7 [5].

§ 6.21 Loss of redundancy

Operation of the system must cease or proceed only at low speed (14 m/s) if there is any loss of redundancy in the fail-safe subsystems of the operational control system [5].

§ 6.23 Loss of communication

The system shall perform in a fault tolerant manner in the event of a communications failure in any portion of the system. Safety of the system shall under no circumstances depend on the continued operation of any communication system (whether radio, or fiber optic or copper cable) [5].

SUBPART B: Requirements of Subsystems

§ 6.25 Interlocking system

(a) The interlocking logic system must be fail-safe in its design. Achievement of fail-safety in this design must comply with DIN Standard 0831, Electric Railroad Signaling Systems.

[NOTE: The current system uses two sets of triple microprocessors and a two-out-of-three voting system. If two processors fail in the controlling microprocessor, control reverts to the second microprocessor and the emergency braking system is triggered. Currently, there is no equivalent standard in the United States for transit-type operations. Development of an FRA-specific methodology for safety validation of software used in high-speed and conventional rail applications is the subject of a current VNTSC procurement effort.]

(b) Vehicles can only be authorized to proceed over a section of guideway if the guideway is unobstructed and unoccupied and precautions have been taken to ensure that it remains so [5]. Examples of obstructions and occupancy include:

- Presence of another vehicle (another TR-07, or maintenance vehicle) on the guideway at a distance less than that required for the vehicle to come to a stop under normal (programmed) braking.

- Invalid or incorrect route locking (loss of route integrity) due to incorrect setting of guideway switches for proposed path of the vehicle.

(c) Non-emergency (routine) maintenance-of-way work may be performed only during non-revenue periods.

(d) The interlocking system must be designed such that switch unlocking commands cannot be issued unless

- no movement authority exists allowing a vehicle to traverse the switched guideway segment, and

- the train detection system indicates that no vehicle is approaching the switch.

(e) Sensing devices must be installed such that switch position and locked status is known at the DTGC at all times. These sensors and locks must ensure that alignment between the fixed and moveable sections of the guideway are within proper tolerances. Absence of this information on switch and lock status shall precipitate emergency braking of the vehicle.

[NOTE: Reference 5 cites ±2mm as the tolerance imposed on alignment of other guideway elements. There is no information as to whether or not this tolerance is acceptable for the flexible switch.]

(f) A vehicle location system is required to provide continuous information on vehicle location. The vehicle location system must provide the on-board systems with precise vehicle location and speed information. The vehicle location and speed detection systems must be highly reliable and fault-tolerant (redundant or having redundant components).

(g) Interlocking system shall be so designed such that movement of a vehicle from a terminal is possible only when all switches and or other moveable guideway elements are in the proper position. The interlocking system shall be designed such that conflicting vehicle movements are not permitted as well as assuring that all switches are in the proper position and locked prior to authorization of vehicle movement through the switch.

(h) Before departure (startup) from the station or terminal is allowed, the following conditions must be met:

- the position of the vehicle and the proposed speed for the run is known
- the emergency braking system is functional
- the transmission of a signal to the decentral system for safe vehicle propulsion

shutoff can be achieved
- all switches are properly set for the proposed route and the switch positions can be communicated to the vehicle.

(i) Interlocking system shall be so designed so as to preclude the possibility of multiple vehicle movements between stations during revenue operations.

(j) Interlocking system and inspection and maintenance operational procedures shall be so designed such that conflicting moves (intersection of vehicle routes) are not possible.

(k) The vehicle location system must be to able interface with maintenance equipment on the guideway to assure that vehicle movements through a work area are prevented or restricted and that the location of these maintenance vehicle is known to the control center. If normal control systems are unavailable, vehicle movements must be restricted.

(l) The guideway switch may be traversed only when it is safe to do so. This state shall be determined by the following conditions:

- the switch is safely closed at all setting points
- the guideway component alignment requirements have been met
- the closed position has been detected and reported
- the once-locked switch remains operable during breakdowns and breakdown warnings from switch subsystems
- untimely and undesired switch shunting cannot be initiated [1].

§ 6.27 Safe speed enforcement system

A system must be provided with the capability to ensure that minimum and maximum vehicle speed criteria are obeyed and which will initiate emergency braking of the vehicle should any of the following events occur:

(a) the predetermined maximum vehicle speed is exceeded

[NOTE: For the TR-07, the predetermined maximum vehicle speed is that which is stored in the read-only memory of the DTGC which is responsible for that section of guideway. The emergency brake controller (a 2-out-of-3 processor voting scheme which is part of the DTGC) continuously compares the actual vehicle speed and location with the predetermined profile. If this speed is exceeded, emergency braking is initiated [5].]

(b) discovery of faults in the emergency braking system itself by diagnostic systems

(c) faults in the electromagnetic leviation or guidance system

(d) faults in the train-to-wayside radio communication link

[IMPORTANT: In order to execute emergency braking, the vehicle-borne eddy-current brakes are used if the primary propulsion/deceleration system is unavailable. In order for them to be used correctly, the wayside-controlled (DTGC) propulsion system must be shut off. It is unclear how this occurs especially in the event of failed communication between the vehicle and the wayside. Apparently, this is a vital element in that the system (either a relay or the software itself) detects the need to cut power in the event of communications failure since vehicle location information is lost. More importantly, when communication is interrupted the synchronization signal is also lost. Loss of synchronization can lead to very disastrous circumstances (see guideway stresses section in another Part).]

[ANOTHER NOTE: The eddy-current brakes are secure against failure (but not in the "fail-safe" sense) due to redundancy with high reliability and individual redundancy groups [13].]

(e) obstruction of the guideway by another vehicle (or other obstacle)

(f) Release of brakes after automatic emergency application shall not occur until a reset device has been operated, or the speed of the vehicle has been reduced to a predetermined rate, or the condition that caused the emergency application no longer affects the safe movement of the vehicle [6].

§ 6.29 Central control and monitoring facility and operator consoles

(a) Operator consoles in the central control facility as well as aboard the vehicle must comply with the following DIN requirements:

DIN 33 400	Structure of working systems based on ergonomic findings; terms and general guidelines
DIN 33 401	Operator controls; terms, suitability, notes on structure
DIN 33 402	Human physical dimensions
DIN 33 403	Climate in the work place and in the working environment
DIN 33 413	Ergonomic considerations in display equipment
DIN 33 414	Ergonomic structure of control centers; seating in work places

(b) The central control and monitoring facility must contain appropriate equipment in order to continuously monitor and collect the following information:

- the position and speed of trains
- the position and status of switches
- the operational status of all subsystems
- the status of vehicles
- the diagnosis of vehicles subsystems
- the output of the gap sensor systems
- the output of the guideway devices which warn of seismic activity.

The central control facility shall perform continuous automatic documentation [functions equivalent to that of an event recorder] of system performance (the items defined above) as well as:

- the recording of all voice communication between the vehicles, terminals and the central control and monitoring facility, and

- printer documentation of all vehicle starts/stops, switch position and guideway occupancy status [8].

- all failures of safety-of-operation equipment must be identified and reported in real time.

This log of operations and communications must be retained for the period of one year for the purpose of analysis in the event of a failure or accident. The documentation requirements of § 6.7 are applicable.

(c) The central operation control facility must be capable of continuous simultaneous communication with all vehicles in the system (necessity of addressing) [11].

§ 6.31 On-board control system

- the emergency braking system must have redundant power supply (battery back-up).

- the emergency braking system must have a diagnostic feature which can test it prior to the consist departing from the terminal.

- the safety computer system must have a safe life power supply.

§ 6.33 Decentral train and guideway control units

- ROM records of speed profile in the DTGCs shall be designed such that they are only physically replaceable by ROM modules of *like kind.*

  [NOTE: This means that each ROM module is keyed in a particular configuration such that, if the ROMs need to be replaced, only ROMs of identical kind (having the same key configuration) can be used. This precludes installing incorrect speed profiles for a particular location. QUESTION: ARE THERE ROMs OR RAMs AT THE DTGC?? PROGRAMMABLE FROM OCS??]

§ 6.35 Communications system

- A communication system must be available and capable of transmitting the vehicle location and speed information to the wayside DTGCs for further communication to the central control and monitoring facility. A sufficient number of wayside radio receivers must be installed in order to ensure continuous communication between the vehicle and at least two independent receivers. The signal modulation technique chosen for the vehicle-to-wayside and vehicle-to-guideway communication must be immune to Doppler shift caused by vehicle operation at any speed within the design regime. In the event of loss of communication with the wayside DTGCs, emergency braking procedures must be initiated.

- Wayside and on-board communications systems must be monitored continuously for correct operation.

- Continuous voice communication between the vehicles in the system and the operator(s) at the central control and monitoring facility must be available [1]. Loss of voice communication with the vehicles in the system will initiate emergency braking of the moving vehicle(s).<<IS THIS TRUE???>>

- The integrity of the transmission of safety-relevant information via radio shall be achieved according to the principles of Reference [9]. The probability that a code word is distorted and not recognized as incorrect must be less than 10^{-06} per year (residual error probability). [10]

- A fault-tolerant communications link must be present between adjacent substations providing electrical power to guideway to assure that the power supply is continuous.

SUBPART C: Inspections and Testing of Operational Control System

§ 6.37 Testing and Inspection.

The following inspections and tests shall be performed in accordance with the specifications of the owner/operator/manufacturer, subject to the approval of the FRA, to determine if the apparatus and/or equipment is maintained in condition to perform its intended function. Any component which fails to meet this requirement shall be removed from service and shall not be returned to service until its operating characteristics are in accordance with the limits within which the device is designed to operate. In the absence of a failure to function as designed, the subsystems which are regulated by this Part shall be tested as provided in Sections 6.39 through 6.49.

§ 6.39 Interlocking system

The interlocking system shall be tested when installed and at any time when modification to the control system which operates the switch(es) is affected. Modification in this sense shall include any coding changes to software whose operation is vital to the safe operation of the guideway switch(es), or replacement of hardware in the controlling elements of the guideway switch(es).

A complete system test and documentation of the conduct and outcome of each element of the test shall be accomplished once a year.

Fault-monitoring systems (diagnostics) shall be tested daily prior to commencement of revenue operations for proper functioning and test equipment shall be provided for this purpose.

§ 6.41 Safe speed enforcement system

The electronics which regulate the speed of vehicles on the system will be tested daily prior to commencement of revenue operations and shall consist of a complete check of all subsystems via available diagnostic equipment. Revenue operations may not begin until any faults discovered in safety-critical subsystems have been repaired or removed. Fault reporting will be conducted as described in §6.57.

The position-finding system shall be maintained and functionally tested annually. The INKREFA

sensors which form a part of the position-finding system shall be checked semi-annually [12].

If repair or replacement of components of the position-finding system (or components which are electrically connected to the position-finding system) are required, comprehensive functional testing of the entire system shall be deemed necessary [12].

§ 6.43 Central control and monitoring facility

Control systems which exist in the central control and monitoring facility will be tested daily prior to commencement of revenue operations and shall consist of a complete check of all subsystems via available diagnostic equipment. Revenue operations may not begin until any faults discovered in safety-critical subsystems have been repaired or removed. Fault reporting will be conducted as described in §6.57.

§ 6.45 On-board control system

(a) The on-board control system, which includes the subsystems described in §6.5 shall be inspected and tested daily prior to commencement of revenue service. Inspection shall consist of complete diagnostic check via available equipment.

The departure test shall be accomplished using one of the following means:

- Operation over guideway elements. Test shall involve the departure of one consist from either terminus and arrival at the other. This test shall be accomplished under normal revenue operating parameters, however, the consist will carry no passengers,
- Operation over a test circuit (test section of guideway),
- Use of portable test equipment, or;
- Use of on-board test equipment.

(b) Results of these tests shall be recorded on a standard form prepared by the railroad and shall indicate the date and time of the conduct of each test, the results of each test, the equipment which was tested, the results of the test, and a description of any repairs, replacements or adjustments made and the condition of the equipment at the completion of the test. Each record shall be signed by the individual who conducted the test and filed in a central location as determined by the railroad and retained for no less than one year [6].

(c) Diagnostic (status checks) of all on-board systems and communications link will be

accomplished prior to each revenue service departure from a terminal. Each consist shall be tested to determine that vehicle equipment is responsive to wayside equipment and shall be cycled to determine that each system element functions as intended [6].

§ 6.47 Decentral train and guideway control units

The decentral train and guideway controllers (DTGCs) will be tested daily prior to commencement of revenue operations and shall consist of a complete check of all subsystems via available diagnostic equipment [NOTE: This test will most likely involve a remote-control operation]. Revenue operations may not begin until any faults discovered in DTGCs have been repaired or removed. Fault reporting will be conducted as described in §6.57.

§ 6.49 Guideway switch

The guideway switch(es) will be tested daily prior to commencement of revenue operations and shall consist of a complete check of all subsystems via available diagnostic equipment. In addition, exercise of the switch(es) will occur to verify that the switch position and locked sensors are properly functioning and communicating their status. Revenue operations may not begin until any faults discovered in the guideway switch operation have been repaired or removed. Fault reporting will be conducted as described in §6.57.

SUBPART D: Criteria for safety validation of computer-related components

[NOTE: Many technical requirements for systems of this type have been developed, but no one set of these instructions provides a complete and authoritative guide on how to design, develop, install and maintain these systems [5]. VNTSC has initiated a contract with Battelle-Columbus Laboratories whose goal is to begin the development of an FRA-specific methodology for hardware and software validation in railroad/high-speed rail applications. The contract was awarded on November 14, 1992 and the final draft methodology should be ready by early 1994. A copy of the Statement of Work of this procurement is included for your information.]

§ 6.51 Hardware and software design documentation

Complete documentation shall be maintained for hardware and software design, and the procedures used to assure fail-safe performance. The Failure Modes and Effects Analysis (FMEA) must be thoroughly documented and be kept available for review by proper authorities. The FMEA will conform to the guidelines of [7]. This documentation shall include that covering generic design of each subsystem or component as well as that implemented in the specific application which is covered by this Rule of Particular Applicability.

[NOTE: Maybe add a sentence that requires development of a list of command, control and communications systems failure possibilities (scenarios) and how the present system design mitigates them. This type of exercise is often required in RFPs from transit agencies for new systems. MÜ8004 has a list of which failures must be taken into consideration when carrying out proof of safety. It may make sense to require development of such a list by MTI, make it subject to inspection and require that the proof of safety be based on this list. From the list, an S&TC enforcement manual could be developed containing defect classifications for maglev systems. Any comments on that?]

§ 6.53 Software design

The development and implementation process of safety-critical software for systems covered by this Part shall include appropriate verification and validation procedures as described in:

DIN VDE 0801	Principles for computers in systems with safety functions
MÜ 8004	Principles for technical approval in signaling and communication technology

Software (especially that resident in embedded subsystems) should be written in a well-structured language. Software compilers shall be appropriately validated via the appropriate standards cited above.

Software components for technical installations of the OCS shall be operationally proven. If this is not possible, the software elements must be verified by a suitable development, analysis and testing method in order to demonstrate that these components are so free of faults that they can cause no hazardous conditions [3].

[NOTE: This is difficult. Probably the best *guide* for this process at this time would be the TÜV document [2] since there is no U.S. document (as yet) which covers the same topic in as much detail.]

§ 6.55 Hardware design

The design of computer hardware for application to the transportation systems covered by this Part shall conform to the requirements specified in:

DIN VDE 0801	Principles for computers in systems with safety functions
MÜ 8004	Principles for technical approval in signaling and communication technology
DIN VDE 0831	Electrical equipment for railway signalling

In the event of conflict among these documents, VDE 0801 shall take precedence over MÜ 8004, and MÜ 8004 shall take precedence over VDE 0831. This Rule shall take precedence over all other documents.

Faults in technical installations of the OCS may not present a hazard. Components for which freedom from systematic faults cannot be proven due to their complexity must be operationally proven in terms of their design, and the quality of their production or function must be documented using established means [3].

[NOTE: Reference [2] has some good guidelines in this area (although it is really only a guide, it references all the appropriate DIN Standards. An issue arises as a result of our use of German standards in this Rule. MÜ 8004 as well as other German standards refer to DB and other German authorities as the user, certifier, safety enforcer, etc. When MÜ 8004 or a similar German document is used in connection with our rule, the term "DB" would need to be replaced with:

"Maglev Transit, Inc."	if the reference to "DB" in the original German document refers to the system user
"FRA"	if "DB" refers to the responsible safety enforcement agency, or
"Maglev Transit, Inc." or "FDOT-HST"	if "DB" refers to the certifying or safety approval agency (since FRA does not approve or certify equipment)

We may need to introduce some language into the Rule (some kind of table of equivalences) to designate who is the responsible entity in the US for the actions taken by DB, BZA or other authority in the referenced German standards.]

§ 6.57 Maintenance

Records must be kept of all faults identified in safety-critical systems. These records must document the following information (as a minimum):

- the fault
- when and where it occurred
- the corrective action taken to remedy the problem
- the outcome of the corrective action [was the problem resolved?]
- a determination as to whether or not the problem was of a systematic [having to do with flaws or deficiencies in the system design] or random nature.

These records must be kept available for review by the FRA for a period of one year from the date of occurrence of the system fault.

All maintenance work and modifications performed on the operational control system (and all subsystems) must be recorded and be available for inspection by the FRA.

A log of all calibration and adjustment settings for all safety-related equipment must be maintained for review by the FRA.

All systems, subsystems and components newly installed during maintenance or modifications to the system shall be tested prior to resuming service.

[NOTE: Because of the nature of hardware and software, it is particularly important to verify that the correct hardware/software is implemented at the correct location. A good configuration management process (like quality control) is necessary. This is addressed in § 2 System Safety Plan.]

Where the occurrence of faults is more frequent than anticipated in the system safety plan, the problem must be investigated and appropriate remedial action taken [5].

Qualifications and initial and periodic testing procedures must be established for maintenance personnel who work on any safety-critical system.

Software must be valid and correct. The extent of inspections of software is to be adapted to the safety level of railroad signaling.

All measures of maintenance shall be carried out only in accordance with Maintenance Manuals to be written by the system developer and the operator and to be approved by FRA before starting commercial operation, and by especially trained personnel only. All maintenance work to be supervised from a safety viewpoint [11].

SUBPART E: Command, control and communications systems reporting requirements

§ 6.59 Accidents resulting from operational control system failure

The railroad to which this Part applies shall report to the Federal Railroad Administration by toll-free telephone number (800-424-0201) whenever it learns of an accident or incident resulting from a failure of an element of the OCS as defined above that results in any condition which is hazardous to the movement of the vehicle(s) which comprises the system or its passengers.

§ 6.61 Operational control system reports

The railroad shall report within fifteen days each failure of any appliance, device or system to function that results in any condition which is hazardous to the movement of the vehicle or its passengers. Form FRA F6180-14, "Signal Failure Report" [or a suitable alternate as developed by the railroad] shall be used for this purpose and completed in accordance with the instructions printed on the form.

[NOTE: FRA may want to consider development of a new form which would specifically cover this system.]

§ 6.63 Annual reports

No later than April 1 of each year, railroad shall file a report for the preceding calendar year on Form FRA F6180-47, "Signal Systems Annual Report," [or a suitable alternate as developed by the railroad] in accordance with the instructions and definitions on the reverse side thereof.

[NOTE: FRA may want to consider development of a new form which would specifically cover this system.]

SUBPART F: Instructions governing applications for approval of a material modification of the operational control system or relief from the requirements of this Part

[NOTE: This subpart reflects the content of Part 235.]

§ 6.65 Changes requiring filing of an application

The following changes or material modifications to the operational control system (which will be assumed to consist of the subsystems described in §6.5 above) shall require filing of an application for FRA approval:

- Any modification or change to the vital (as defined above) software which controls automatic vehicle operation, movement, speed, dispatching or station stopping.

- Any modification or change to the programmed braking subsystem which will effect the computer-generated braking profiles developed on-board the vehicle.

- Any modification or change of vital (as defined above) hardware components of the control systems.

[NOTE: This may appear somewhat severe since component boards will likely switched out for cause on a routine basis and replaced with identical hardware. This element needs a little more thought.]

§ 6.67 Contents of applications

The application may be submitted by letter and shall contain the following information:

- A complete description of the proposed changes as they would affect the existing facilities.

- The reason for the proposed changes.

- The approximate dates of the beginning and completion of the project.

- Changes in operating practices due to the modification(s) (whether temporary or permanent).

- Whether the safe operation of the system will be affected and if so, how

- Whether the proposed changes will conform to this Rule of Particular Applicability which governs the system.

§ 6.69 Additional required information

Additional information as required by the regulating authority will be provided by the applicant upon request.

§ 6.71 Filing procedure

- Applications (or requests for reconsideration of an application) shall be submitted by an authorized officer of the railroad.
- The original and two copies of the application (with supporting documentation) shall be filed.
- The application and all correspondence shall be addressed to the Associate Administrator for Safety, Federal Railroad Administration, Washington, DC 20590.
- A separate application shall be filed for each project.

§ 6.73 Notice

The FRA will post public notice of the filing of an application or a request for reconsideration of an application in the FRA Office of Public Affairs and will mail copies to all interested parties.

§ 6.75 Protests

49 CFR Part 235.20 applies.

End Notes for Part 6

[1] High-Speed Maglev Trains; German Safety Requirements. RW MSB (Translation of German Regelwerk Magnetschnellbahnen Sicherheitstechnische Anforderungen). DOT/VNTSC/FRA-92-1, March 1991.

[2] "Microcomputers in Safety Technique: An Aid to Orientation for Developer and Manufacturer", H. Hölscher and J. Rader, TÜV Study Group on Computer Safety, Munich, 1986. ISBN 3-88585-315-9.

[3] BLM Phase II System Description. Status 06/91. BMFT-TV 8743 A2 TB06. Doc. No. BS-910-816-0271. **PROPRIETARY.**

[4] "Maglev Signal/Control Assessment", a report to the Transportation Systems Center. Arthur D. Little, Inc., Cambridge, MA, January 1990. Reference No. 61231-30.

[5] Maglev Regulations Analysis, revised draft final report to the Volpe National Transportation Systems Center, Arthur D. Little, Inc., Cambridge, MA, January 1992. Reference No. 63057.

[6] 49 CFR Part 236.

[7] MIL-STD-882B: System Safety Program Requirements.

[8] Application Submission for the Magnetic Leviation Demonstration Project to the Florida High Speed Rail Transportation Commission. Maglev Transit, Inc., Tallahassee, Florida, (1989?).

[9] UIC Code 738R. Processing and transmission of safety information. Second edition, 1/1/1990. International Union of Railways.

[10] Interim Commentary on Overall Safety Certificate. Radio Transmission. TVE-BLT II. TÜV Rheinland, 09/16/91, Report No.: 947/B 91/140. BG-920121-0291.

[11] "Requirements Specification Overall System," NVS/1433/07/91, Thyssen Henschel.

[12] "Expert Opinion on the INKREFA and the b/v Sensor System as Part of the Position Finding System of the TR 07 Within the Framework of the BLT II." TÜV Rheinland, 7/12/89, Report No.: 947/B 89/229. BG-900314-174.

[13] "Eddy-current Brake System for the TR07 Vehicle," Technical Report. Thyssen-Henschel, Product Division, New Transportation Technology. Doc. No. AS 900314 168.

REFERENCES WHICH WOULD BE NICE TO HAVE:

Protocols of the Test Ride of 12-14-1989, Doc. No. NTA/Wi/tp 3172/12/89 (Thyssen Henschel) Date: 12-18-1989.

PART 7: QUALIFICATION AND TRAINING OF EMPLOYEES

[**This draft rule is designed to incorporate by reference as much of 49 CFR 240 as practical.**]

SUBPART A--GENERAL

§ 7.1 Purpose and Scope

(a) The purpose of this part is to ensure that only qualified persons operate a magnetically levitated train (hereafter referred to as maglev or maglev train).

(b) This part describes minimum Federal safety requirements for the eligibility, training, testing, certification and monitoring of all system operators and on-board operators of maglev trains.

[** Designations of positions, i.e., system operators, etc. come from Safety of High Speed Magnetic Levitation Transportation Systems, German High-Speed Maglev Train Safety Requirements - Potential for Application in the U.S., Interim Report, February, 1992, DOT/FRA/ORD-92/2, page 8-1. Training for other positions, such as on-board attendants who will need training in emergency procedures and possibly operating rules, should be dealt with separately, since certification is unlikely. **]

(c) The qualifications for system operators and on-board operators prescribed in this part are pertinent to any person who operates a system control center for maglev trains or performs the functions of an on-board operator of maglev trains, unless that person is excluded by a provision of this part, regardless of the fact that a person may have a job classification title other than that of system operator or on-board operator.

§ 7.3 Applicability

(a) This part applies exclusively to the planned Florida maglev demonstration project.

§ 7.5 Construction

(a) Incorporate the language of § 240.5(a), as written

(b) Incorporate the language of § 240.5(b), as written

(c) FRA does not intend that, by the use of the designations "system operator" or "on-board operator" in this part, to preempt or otherwise alter the terms, conditions or interpretation of

existing collective bargaining agreements that employ other job classification titles when identifying persons authorized by the railroad to perform the functions herein ascribed to the system operator or the on-board operator.

(d) Incorporate the language of § 240.5(d), changing "a railroad" to "the railroad"

(e) Incorporate the language of § 240.5(e), as written

§ 7.7 Definitions

As used in this part --

Incorporate the following definitions from § 240.7, as written:

Alcohol
Controlled Substance
Drug
FRA Representative
Knowingly
Railroad
Substance Abuse Disorder

Incorporate the following definitions from § 240.7, changing "a railroad" to "the railroad":

Current Employee
EAP Counselor
Medical Examiner
Railroad Officer
Segment

Incorporate the following definition from § 240.7, deleting "or another railroad":

Newly Hired Employee

[** The following definitions contained in § 240.7 either have no application in this part, must be changed (as rewritten in this section) or must be replaced by similar but different terminology (as presented in the remainder of this section): **]

Instructor Engineer (Operator Instructor)
Joint Operations (not relevant)
Locomotive (Control Car)
Locomotive Engineer (On-board Operator and/or System Operator)
Types I, II and III Simulators (not relevant)

Control Car - That unit of a magnetically levitated train containing the equipment required for communications with the systems control center, the on-board equipment for monitoring the status of train function and train controls that may be manipulated by the on-board operator.

On-board Operator - Any person whose duties and responsibilities, while on a maglev train that is moving or expected to move, include the following:

(1) Manipulation of any control affecting the movement or operation of the train; not including doors, thermostats for cabin temperature control or other controls not related to train movement;

(2) Communication of train readiness to move to the system control center;

(3) Monitoring of the guideway ahead of the moving train and the status of on-board systems while the train is moving; and,

(4) Implementation of on-board emergency procedures, when needed; except for those persons who move trains in service areas for inspection, maintenance or repair purposes.

Operator Instructor - A person who:

(1) Is a qualified system operator or on-board operator, as applicable, under this part;

(2) Has been selected by the railroad to teach others proper maglev train handling procedures and/or system control center procedures; and,

(3) Has demonstrated an adequate knowledge of the subjects under instruction.

System Control Center - The system control center provides all primary control functions for maglev train operations. All normal maglev train movements, including station stops, are computer controlled. The control center contains this control equipment, backup systems, system monitors, communication equipment and controls for manual override, if conditions warrant.

System Operator - The person responsible for operation of the System Control Center including train movements, execution of emergency procedures and instructions to on-board crews.

[** There are no known simulators which may be used for training on maglev systems. Therefore, they are neither defined nor addressed in this draft. If there is a likelihood that a simulator may be built, language can be inserted to require that FRA approve its use for training in any program to certify operators. **]

§ 7.9 Waivers

Incorporate the language of § 240.9, as written

§ 7.11 Consequences for Noncompliance

Incorporate the language of § 240.11, as written

§ 7.13 Information Collection Requirements

[** If OMB has approved the requirements of § 240.13, delete (a) and incorporate (b), without the letter designation, and substitute sections 7.15 through 7.89 for the § 240 references. **]

SUBPART B--COMPONENT ELEMENTS OF THE CERTIFICATION PROCESS

[** Since there are no existing supervisors, on-board operators or system operators who are qualified or certified, provision must be made for the training and certification of the initial group. It is assumed here that this initial training and certification must be the responsibility of the manufacturer and installer of the system to be built, at the time it is built. Also, issues related to "grandfathering" qualified engineers, to classes of railroad, and to the great variation in types of service provided by conventional railroads, that had to be considered in the development of 49 CFR 240, do not apply. The diversions from 49 CFR 240 in the following sections are for these reasons. **]

§ 7.15 Certification Program Required

(a) Prior to the beginning of operations,the railroad must:

(1) Have in effect a written program for certifying the qualifications of system operators and on-board operators, in accordance with the provisions of this Part;
(2) Have the program approved by FRA in accordance with § 7.17; and,
(3) Have a sufficient number of supervisors, on-board operators and system operators certified in accordance with the FRA approved program to operate the system safely.

(b) The railroad's certification program required in § 7.15(a) must include:

(1) A procedure for designating any person it determines to be qualified as a supervisor of system operators and/or on-board operators that complies with the criteria established in § 7.19.
(2) A designation of the classes of service that it determines will be used in compliance with the criteria established in § 7.21;
(3) A procedure for evaluating prior safety conduct that complies with the criteria established in § 7.23;

(4) A procedure for evaluating visual and hearing acuity that complies with the criteria established in § 7.35;
(5) A procedure that provides for training that complies with the criteria established in § 7.37;
(6) A procedure for knowledge testing that complies with the criteria in § 7.39;
(7) A procedure for skill performance testing that complies with § 7.41; and,
(8) A procedure for monitoring operational performance that complies with the criteria established in § 7.43.

§ 7.17 Program Approval by FRA

(a) The railroad shall submit it's written program and a description of how it's program conforms to the specific requirements of this Part to FRA for approval in accordance with the procedures contained in appendix B at least 60 days before commencing training.

[** § 7.15 requires that the railroad have a sufficient cadre of trained and certified supervisors and operators prior to beginning operations. This should be based on the FRA approved program fulfilling the requirements of this part. **]

(b) That submission shall identify the name, affiliation and qualifications of the persons to serve as the instructors and certification officials of the railroad's initial cadre of supervisors, instructors, system operators and on-board operators, with qualifications statements referencing the requirements of sections 7.19, 7.23, 7.27, 7.31, 7.39 and 7.41 of this Part.

(c) Incorporate the language of § 240.13(c), changing "a railroad" to "the railroad", "thirty days" to "sixty days" and change "the required filing date (or actual filing date)" to "the filing date"

(d) Incorporate the language of § 240.13(d), changing "a railroad" to "the railroad"

(e) If the railroad intends to materially modify it's program after receiving initial FRA approval, it shall submit a description of how it intends to modify the program in conformity with the specific requirements of this Part at least 30 days prior to implementing such a change.

(1) A modification is material if it would affect the program's conformance with this Part.
(2) The modification submission shall contain a description that conforms with the pertinent portion of the procedures contained in appendix B.
(3) The modification submission will be handled in accordance with the procedures of paragraphs (c) and (d) of this section as though it were a new program.

§ 7.19 Criteria for Selection of Supervisors of Operators

(a) The railroad's program shall include criteria and procedures for implementing this section.

(b) The railroad shall examine any person it is considering for qualification as a supervisor of system operators or on-board operators to determine that he or she:

(1) Knows and understands the requirements of this part;
(2) Can appropriately test and evaluate the knowledge and skills of system operators or on-board operators, as applicable;
(3) Has the necessary supervisory experience to prescribe appropriate remedial action for any noted deficiencies in training, knowledge or skills of a person seeking to obtain or retain certification; and,
(4) Is a certified system operator or on-board operator, as applicable.

§ 7.21 Criteria for Designation of Classes of Service

(a) The railroad's program shall state classes of service, provided for in paragraph (b) of this section, that it will cover for on-board operators.

(b) The railroad may issue certificates to on-board operators for any or all of the following classes of service:

(1) All service on-board operators
(2) Maintenance service on-board operators
(3) Student on-board operators

(c) The following constraints apply to each class of service for on-board operators:

(1) All service on-board operators may operate in all train movement situations, with or without passengers;
(2) Maintenance service on-board operators may only operate in train service areas and on test runs scheduled to occur during periods when there is no active or scheduled revenue passenger service on the segment (block) of guideway to be used; and,
(3) Student on-board operators may operate a maglev train only under direct and immediate supervision of an on-board operator instructor.

(d) The railroad shall state which of the classes of service provided for in paragraph (e) of this section that it will cover for system operators.

(e) The railroad may issue certificates for either or both of the following classes of service for system operators:

(1) System operators
(2) Student system operators

(f) The following operational constraints apply to each class of system operator service:

(1) System operators are fully qualified under the provisions of this part to operate the system control center in all operational situations; and,
(2) Student system operators may operate only under direct and immediate supervision of a system operator instructor.

(g) The railroad is authorized to impose additional conditions or operational restrictions on the service that an on-board operator or a system operator may perform beyond those identified in this section, provided those conditions or restrictions are not inconsistent with this Part.

§ 7.23 General Criteria for Eligibility Based on Prior Safety Conduct

(a) The railroad's program shall include criteria and procedures to implement this section.

(b) The railroad shall evaluate the prior safety conduct of any person it is considering for qualification as a system operator or as an on-board operator and the program shall require that a person is ineligible if the person has an adverse record of prior safety conduct as provided in § 7.29, § 7.31, or § 7.33.

(c) Incorporate the language of § 240.109(c), as written

(d) Incorporate the language of § 240.109(d), changing "§ 240.113 through § 240.119" to "§ 7.27 through § 7.33" and "§ 240.217" to " § 7.61".

(e) Incorporate the language of § 240.109(e), changing "a railroad" to "the railroad" and, in (2), "§ 240.115, § 240.117, and § 240.119" to "§ 7.29, § 7.31 and § 7.33", respectively.

(f) Incorporate the language of § 240.109(f), changing "a railroad" to "the railroad" and "§ 240.119" to "§ 7.33".

(g) Incorporate the language of § 240.109(g), changing "§ 240.215" to "§ 7.59".

(h) Incorporate the language of § 240.109(h), changing "locomotive engineer" to "system operator or on-board operator".

(i) Incorporate the language of § 240.109(i), changing "§ 240.111" to "§ 7.25", "§ 240.113" to "§ 7.27" and "a railroad's" to "the railroad's".

§ 7.25 Individual's Duty to Furnish Data on Prior Safety Conduct as Motor Vehicle Operator

(a) Incorporate the language of § 240.11(a), changing "§ 240.201" to "§ 7.45", "§ 240.109(h)" to "§ 7.23(h)"and, in (2), "that railroad" to "the railroad".

(b) Incorporate the language of § 240.111(b), as written

(c) Incorporate the language of § 240.111(c), as written

(d) Incorporate the language of § 240.111(d), as written

(e) Incorporate the language of § 240.111(e), as written

(f) Incorporate the language of § 240.111(f), deleting "prospective certifying" in (1)

(g) Incorporate the language of § 240. 111(g), changing "§ 240.109(d)" to "§ 7.23(d)"

(h) Incorporate the language of § 240.111(h), as written

§ 7.27 Individual's Duty to Furnish Data on Prior Safety Conduct as an Employee of a Different Railroad

(a) Incorporate the language of § 240.113(a), changing "§ 240.201" to "§ 7.45" and "§ 240.109(h)" to "§ 7.23(h)"

(b) Incorporate the language of § 240.113(b), as written

§ 7.29 Criteria for Consideration of Prior Safety Conduct as a Motor Vehicle Operator

(a) Incorporate the language of § 240.115, changing "Each railroad's" to "The railroad's"

(b) Incorporate the language of § 240.115(b), changing "a railroad" to "the railroad"

(c) Incorporate the language of § 240.115(c), changing "§ 240.119(d)(3)" to "§ 7.33(d)(3)" and "§ 240.119(b)" to "§ 7.33(b)

§ 7.31 Criteria for Consideration of Operating Rules Compliance Data

(a) Incorporate the language of § 240.117(a), changing "Each railroad's" to "The railroad's"

[** Three sets of conditions are relevant in this section. They are: (1) the potential need to consider the safety record of an applicant who was formerly a locomotive engineer on a conventional railroad; (2) safety conduct, as a system operator; and (3) safety conduct, as an on-board operator. The language of § 240.117 has been changed in this section to accommodate these added requirements. Most particularly, § 240.117(e) has become § 7.31 (e), (f) and (g), with the subsequent paragraphs redesignated, as appropriate. **]

(b) A person who has demonstrated a failure to comply, as described in paragraph (e), (f) or (g) of this section, with railroad rules and practices for the safe operation of trains shall not be currently certified as a system operator or on-board operator of maglev trains.

(c) A certified system operator or on-board operator who has demonstrated a failure to comply, as described in paragraph (f) or (g) of this section, with railroad rules and practices for the safe operation of maglev trains shall have their certification revoked.

(d) Limitations on consideration of prior operating rule compliance data. In determining whether a person may be or remain a certified system operator or on-board operator of maglev trains, the railroad shall consider as operating compliance data only
conduct described in paragraph (e), (f) or (g) of this section that occurred within a period of 60 consecutive months prior to the determination. A review of an existing certification shall be initiated promptly upon the occurrence and documentation of any occurrence of conduct described in this section.

(e) The railroad shall consider violations of the rules and practices of railroads that previously employed, as a locomotive engineer, the person being considered for certification that involve:

(1) Failure to control a locomotive or train in accordance with a signal indication;
(2) Failure to adhere to limitations concerning train speed;
(3) Failure to adhere to procedures for the safe use of train or engine brakes;
(4) Entering a track segment without proper authority;
(5) Failure to comply with prohibitions against tampering with mounted safety devices; and,

(6) Incidents of noncompliance with 49 CFR 219.101; however, such incidents shall be considered a violation only for the purposes of subsections (2) and (3) of paragraph (h) of this section.

[** Information is currently limited on the duties of the system operator and the on-board operator, as is the division of duties. Assumptions are; (1) all normal train movements will be computer controlled; (2) the system control operator will have the ability and responsibility to change operating parameters such as desired speed and station stops, as conditions warrant; (3) controls for direct (hands-on) handling of train movements under unusual or emergency conditions will exist in the system control center and on-board the train; and, (4) there will be no wayside signals. Information on operating rules and practices is also limited. These are being addressed in Part 9 of this rulemaking. Given these constraints and assumptions, the violations to be considered for revoking certification of system operators and on-board operators must be based upon what little is known, assumptions based on this knowledge and what appears applicable from conventional practice. This is the background for the following paragraphs (f) and (g).**]

(f) The railroad shall consider violations of it's rules and practices by system operators that involve:

(1) Failure to adjust operating parameters, such as speed, and activate them in the system's computer control, as conditions warrant;
(2) Failure to continuously monitor system control center equipment when train movements are occurring;
(3) Failure to ensure that the train adheres to limitations concerning speed;
(4) Permitting a maglev train to enter a guideway segment without proper authority;
(5) Incidents of noncompliance with 49 CFR 219.101; however, such incidents shall be considered a violation only for the purposes of subsections (2) and (3) of paragraph (h) of this section.

(g) The railroad shall consider violations of it's rules and practices by on-board operators that involve:

(1) Failure to promptly report to the system operator malfunctions or irregularities in train performance or operation, as indicated by on-board instrumentation or from observation of the guideway ahead of the train;

(2) Failure to initiate emergency action when obstructions are observed on the guideway, failures or disruptions are observed in the guideway, or the train enters a segment of guideway without proper authority;

(3) Incidents of noncompliance with 49 CFR 219.101; however, such incidents shall be considered a violation only for the purposes of subsections (2) and (3) of paragraph (h) of this section.

(h) Incorporate the language of § 240.117(f), as written

(i) A period of ineligibility described in this paragraph shall:

(1) Incorporate the language of § 240.117(g)(1), as written
(2) Incorporate the language of § 240.117(g)(2), as written
(3) Be determined according to the following standards:
(i) In the case of a single incident involving violation of one or more of the rules or practices described in paragraphs (e)(1) through (5), (f)(1) through (4) or (g)(1) or (2), of this section, the person shall be ineligible to hold a certificate for a period of one month.
(ii) Incorporate the language of § 240.117(g)(3)(ii), changing "paragraph (e)" to "paragraphs (e), (f) and (g)"
(iii) Incorporate the language of § 240.117(g)(3)(iii), as written
(iv) Incorporate the language of § 240.117(g)(3)(iv), changing "subparagraph (e)" to "subparagraphs (e), (f) and (g)", and "§ 240.119" to "§ 7.33".

(j) *Future Eligibility To Hold Certificate.* Incorporate § 240.117(h), changing "paragraph (g)(2)" to "paragraph (i)(2)" (both occurrences), "§ 219.101" to "49 CFR 219.101", strike "of this chapter", "locomotive engineers" to "system operators or on-board operators, as appropriate,".

§ 7.33 Criteria for Consideration of Data on Substance Abuse Disorders and Alcohol Drug Rules Compliance

(a) Incorporate the language of § 240.119(a), changing "Each railroad's" to "The railroad's"

(b) *Fitness Requirement.*

(1) Incorporate the language of § 240.119(b)(1), changing "locomotive engineer" to "system operator or on-board operator"
(2) Incorporate the language of § 240.119(b)(2), changing "engineer" to "system operator or on-board operator"
(3) Incorporate the language of §240.119, changing "§ 240.115" to "§ 7.29", "§ 219.403" to "49 CFR 219.403" and striking "of this chapter"

(c) *Prior Alcohol/Drug Conduct: Federal Rule Compliance.*

(1) Incorporate the language of § 240.119(c)(1), changing "locomotive engineer" to "system operator or on-board operator" and "a railroad" to "the railroad"
(2) Incorporate the language of § 240.119(c)(2), changing "§ 219.101 or § 219.102" to "49 CFR 219.101 or 49 CFR 219.102" and "Part 219 of this chapter" to "49 CFR 219"
(3) Incorporate the language of § 240.119(c)(3), as written
(4) Incorporate the language of § 240.119(c)(4), changing: "§ 219.102 of this chapter" and "§ 219.102" to "49 CFR 219.102"; "§ 219.101 of this chapter" and "§ 219.101" to "49 CFR 219.101"; "§ 219.405" to "49 CFR 219.405"; "engineer" to "system operator or on-board operator"; and, "part 219" to "49 CFR 219"

(d) *Future Eligibility TO Hold Certificate Following Alcohol/Drug Violation.* Incorporate the language of § 240.119(d), from the beginning to section (1)(iii), as written

(1)(iii) Incorporate the language of § 240.119(d)(1)(iii), changing, "Subpart H of this Part" to "Subpart H of 49 CFR 219"
(2) Incorporate the language of § 240.119(d)(2), changing "An engineer" to "A system operator or on-board operator"
(3) Incorporate the language of § 240.119(d)(3), changing "part 219 of this chapter" to "49 CFR 219"
(4) Incorporate the language of § 240.119(d)(4), changing "part 219 of this chapter" to "49 CFR 219" and "§ 219.303(c)" to "49 CFR 219.303(c)"
(5) Incorporate the language of § 240.119(d)(5), changing "§ 219.104(d)" to "49 CFR 219.104(d)"
(6) Incorporate the language of § 240.119(6), changing "locomotive engineer" to "system operator or on-board operator"

(e) Incorporate the language of § 240.119(e), changing "§ 219.403 of this chapter" to "49 CFR 219.403" (two occurrences), "an engineer" to "a system operator or on-board operator", and "certified locomotive engineer" to "certified system operator, on-board operator,"

§ 7.35 Criteria for Vision and Hearing Acuity Data

(a) Incorporate the language of § 240.121(a), changing "Each railroad's" to "The railroad's"

(b) Incorporate the language of § 240.121(b), changing "locomotive engineer" to "system operator or on-board operator"

(c) Incorporate the language of § 240.121(c), adding at the end of (3) ", CRT displays and control center display boards".

(d) Incorporate the language of § 240.121(d), as written

(e) Incorporate the language of § 240.121(e), changing "a railroad's" to "the railroad's", "operate a locomotive" to "perform the tasks of a system operator or on-board operator, as appropriate," and "locomotive engineer" to "system operator or on-board operator"

§ 7.37 Criteria for Initial and Continuing Education

(a) Incorporate the language of § 240.123(a), changing "Each railroad's" to "The railroad's"

(b) The railroad shall provide for the continuing education of certified system operators and on-board operators to ensure that each maintains the necessary knowledge, skills and abilities concerning: personal safety; operating rules and practices; emergency procedures; relevant Federal safety rules; familiarity with the physical characteristics of the territory operated; and,

(1) for system operators,
  (i) condition and capabilities of system control center equipment and software; and,
(2) for on-board operators,
  (i) condition and capabilities of train and on-board equipment, and
  (ii) methods of safe train handling from on-board.

(c) If the railroad elects to train a previously untrained person to be a system operator or an on-board operator, it shall provide initial training which, at a minimum:

(1) Incorporate the language of § 240.123(c)(1), as written
(2) Incorporate the language of § 240.123(c)(2), as written
(3) Incorporate the language of § 240.123(c)(3), as written
(4) Is subdivided into segments or periods of appropriate duration to effectively cover the following subject matter areas for system operators:
  (i) personal safety;
  (ii) operating rules and practices;
  (iii) emergency procedures;
  (iv) compliance with Federal safety regulations;
  (v) physical characteristics of the guideway and territory to be controlled; and,
  (vi) function and capabilities of control center equipment and software.

(5) Is subdivided into segments or periods of appropriate duration to effectively cover the following subject matter areas for on-board operators:
(i) personal safety;
(ii) operating rules and practices;
(iii) emergency procedures;
(iv) compliance with Federal regulations;
(v) physical characteristics of the guideway and territory to be operated;
(vi) condition and capabilities of the train and on-board equipment; and,
(vii) methods of safe train handling from on-board the train; and,
(6) Is conducted so that the performance skill component shall:
(i) be under the supervision of a qualified operator instructor located in the same system control center or train control compartment, as applicable, whenever possible; and,
(ii) place the student system operator or student on-board operator, as applicable, at the controls of the control center or the train, as applicable, for a significant portion of the time.

[** § 240.123(c)(5)(iii) doesn't apply **]

§ 7.39 Criteria for Testing Knowledge

(a) The railroad's program shall include criteria and procedures to implement this section.

(b) The railroad shall have procedures for testing a person being evaluated as a system operator, all service on-board operator and maintenance service on-board operator to determine that the person has sufficient knowledge of the railroad's rules and practices for the safe operation of maglev trains.

(c) The testing methods selected by the railroad shall be:
(1) Designed to examine a person's knowledge of the railroad's rules and practices for the safe operation of maglev trains;
(2) Objective in nature;
(3) Administered in written form;
(4) Inclusive of the following subjects for system operators:
(i) personal safety practices;
(ii) operating rules and practices;
(iii) emergency procedures;
(iv) compliance with Federal safety regulations;
(v) physical characteristics of the territory to be controlled; and,
(vi) control center equipment inspection and operation practices;

(5) Inclusive of the following subjects for all service on-board operators:
(i) personal safety practices;
(ii) operating rules and practices;
(iii) emergency procedures;
(iv) compliance with Federal safety regulations;
(v) equipment inspection practices;
(vi) physical characteristics of the guideway and territory to be operated; and,
(vii) on-board train handling practices;
(6) Inclusive of the following subjects for maintenance service on-board operators:
(i) personal safety practices;
(ii) operating rules and practices;
(iii) emergency procedures;
(iv) compliance with Federal regulations;
(v) equipment inspection practices; and,
(vi) on-board train handling practices;
(7) Incorporate the language of § 240.125(c)(5), as written; and,
(8) Incorporate the language of § 240.125(c)(6), as written

(d) Incorporate the language of § 240.125(d), as written

§ 7.41 Criteria for Examining Skill Performance

(a) The railroad's program shall include criteria and procedures for implementing this section.

(b) The railroad shall have procedures for assessing the performance skills of a person being evaluated for qualification as a system operator, an all service on-board operator or a maintenance on-board operator to determine whether the person has the skills to safely operate maglev trains, including the application of operating rules and practices, in the most demanding class or type of service that the person will be permitted to perform.

(c) The testing procedures selected by the railroad shall be:

(1) Designed to examine a person's skills in safely operating a maglev train, including the proper application of operating rules and practices, when performing the most demanding class or type of service that the person will be permitted to perform;
(2) Conducted by a designated supervisor or instructor of system operators or on-board operators, as applicable;
(3) Designed to cover the following subjects during the test period for system operators:
(i) application of operating rules and practices;
(ii) compliance with Federal safety regulations; and,

(iii) monitoring, inspection and operation of control center equipment;
(4) Designed to cover the following subjects during the test period for on-board operators:
(i) application of operating rules and practices;
(ii) compliance with Federal safety regulations;
(iii) equipment inspection practices; and,
(iv) on-board train handling skills;
(5) Of sufficient length to effectively evaluate the person's ability to operate maglev trains, from the system control center or on-board the train, as applicable; and,
(6) Conducted when the person is at the controls of the system control center or those on-board the maglev train, as applicable, that is normally operated on the railroad and that is expected to be operated by the person after certification.

[** There are no known control center or control cab simulators. Therefore, they have not been considered for training or testing. **]

(d) Incorporate the language of § 240.127, changing "designated supervisor" (two occurrences) to "designated supervisor or instructor" and "train" to "train and/or system control center"

§ 7.43 Criteria for Monitoring Operational Performance of Certified Operators

(a) The railroad's program shall include criteria and procedures for implementing this section.

(b) The railroad shall have procedures for monitoring the operational performance of those it has determined as qualified as a system operator or an on-board operator for either all service or maintenance service.

(c) The procedures shall:

(1) Be designed to determine that the person possesses and routinely employs the skill to safely operate a maglev train, from a system control center or on-board the train, as applicable, including the proper application of the railroad's operating rules and practices for the safe operation of maglev trains;
(2) Be designed so that each system operator and each on-board operator shall be semi-annually monitored by a designated supervisor of system operators or on-board operators, as applicable;
(3) Be designed so that the system operator or on-board operator, as applicable, is either accompanied by the designated supervisor for a reasonable length of time or has his or her train control activities recorded by a train control event recorder located either on the train or in the control center, as appropriate.

(d) The procedure shall be designed so that the system operator or on-board operator, as applicable, being monitored is at the controls of the system control center or maglev train, as applicable, which the railroad normally requires the person to operate.

(e) The testing and examination procedures selected by the railroad for the conduct of a monitoring program shall be:

(1) Designed so that each system operator and on-board operator shall be given at least two unannounced tests during each calendar year and separated by a period of five to seven months.

(2) Designed to test system operator or on-board operator, as applicable, compliance with provisions of the railroad's operating rules or other mandatory directives that require response to degraded operating conditions (lower than normal operating speeds, stops between stations, delays due to guideway maintenance, obstructions on guideway, etc.).

[** The intent of § 240.129(e)(2) and (3) have been combined. **]

(3) Designed to test system operator or on-board operator, as applicable, compliance with the railroad's operating rules or other mandatory directives, the violation of which were cited by the railroad as the cause of train accidents or incidents in reports filed in compliance with Part 8 of this Chapter in the preceding calendar year.
(4) Incorporate the language of § 240.129(e)(5), as written
(5) Incorporate the language of § 240.129(e)(6), changing "engineer" to "system operator or on-board operator"

SUBPART C--IMPLEMENTATION OF THE CERTIFICATION PROCESS

§ 7.45 Schedule for Implementation

(a) No later than 90 days prior to the beginning of passenger carrying operations, the railroad shall designate to FRA in writing those persons it deems qualified to be supervisors and instructors of system operators and on-board operators. Each person so designated shall have demonstrated to the railroad through training, testing or prior experience that he or she has the knowledge, skills and abilities to be a designated supervisor or instructor of system operators or on-board operators, as applicable, in compliance with the provisions of this Part.

(b) No later than 30 days prior to the beginning of passenger carrying operations, the railroad shall designate to FRA, in writing, those persons it deems qualified as system operators and on-board operators. Each person shall have demonstrated to the railroad through training, testing or prior experience that he or she has the knowledge, skills and abilities to be a certified system operator or on-board operator, in compliance with the provisions of this Part.

(c) The railroad shall neither permit nor require any person to function as a system operator or on-board operator, following the date on which passenger carrying operations are initiated, who is not fully certified under the provisions of this Part.

(d) Each supervisor, instructor, system operator and on-board operator designated in compliance with paragraphs (a) and (b) of this section shall be issued certificates by the railroad in accordance with § 7.67 of this Part prior to the initiation of passenger carrying operations.

[** Other elements of § 240.201 do not apply. **]

§ 7.47 Determinations Required as a Prerequisite to Certification

(a) Prior to certifying or recertifying any person as a: supervisor or instructor of system operators or on-board operators; system operator; or on-board operator, the railroad shall, in accordance with it's FRA-approved program, determine in writing that:

(1) The individual meets the eligibility requirements of § 7.29, 7.31 and 7.33;
(2) The individual meets the vision and hearing acuity standards of § 7.35;
(3) The individual has the necessary knowledge, as demonstrated by successfully completing a test that meets the requirements of § 7.39;
(4) The individual has the necessary applied knowledge and operating performance skills, as demonstrated by successfully completing an operational performance test that meets the requirements of § 7.41; and,
(5) Where a person has not been previously certified, that the person has completed a training program that meets the requirements of § 7.37.

(b) The railroad may certify a person as a student system operator or student on-board operator after determining that the person meets the vision and hearing acuity standards of § 7.35. The railroad may subsequently certify that student as a system operator, all service on-board operator or maintenance service on-board operator (as appropriate) without further review of his or her acuity status, provided it determines that:

(1) The person successfully completed the training program that complies with § 7.37;
(2) The person meets the eligibility requirements of §§ 7.23 and 7.33; and,

(3) A period of not more than 24 months has elapsed since the student certificate was issued.

§ 7.49 Procedures for Determining Eligibility Based on Prior Conduct

(a) Prior to certifying or recertifying any person as a: supervisor or instructor of system operators or on-board operators; system operator; or on-board operator, the railroad shall determine that the person meets the eligibility requirements of § 7.29 involving prior conduct as a motor vehicle operator, § 7.31 involving prior conduct as a railroad worker and § 7.33 involving substance disorders and alcohol/drug rules compliance.

(b) Incorporate the language of § 240.205(b), as written

§ 7.51 Procedures for Making the Determination on Vision and Hearing Acuity

(a) Prior to certifying or recertifying any person as a: supervisor or instructor of system operators or on-board operators; system operator; or on-board operator, the railroad shall determine that the person meets the standards of visual and hearing acuity prescribed in § 7.35.

(b) Incorporate the language of § 240.207(b), changing "a railroad" to "the railroad" and, under (2)(ii), "operate a locomotive" to "function as a system operator or on-board operator, as applicable,"

(c) Incorporate the language of § 240.207(c), as written

(d) Incorporate the language of § 240.207(d), changing "§ 240.121" to "§ 7.35" and "operate a locomotive or train on that railroad" to "function as a system operator or on-board operator, as applicable, on the railroad"

(e) Incorporate the language of § 240.207(e), changing "operating a locomotive in locomotive or train service" to "on-duty as a system operator or on-board operator"

§ 7.53 Procedures for Making the Determination on Knowledge

(a) Prior to certifying or recertifying any person as a: supervisor or instructor of system operators or on-board operators; system operator; or on-board operator, the railroad shall determine that the person has, in accordance with the requirements of § 7.39 of this Part, demonstrated sufficient knowledge or the railroad's rules and practices for the operation of maglev trains.

(b) Incorporate the language of § 240.209(b), as written

(c) If a person fails to achieve a passing score under the testing procedures required by this Part, the railroad shall not permit or require that person to function as a system operator or on-board operator, as applicable, prior to that person's achieving a passing score during a reexamination of his or her knowledge.

§ 7.55 Procedure for Making the Determination on Performance Skills

(a) Prior to certifying or recertifying any person as a: supervisor or instructor of system operators or on-board operators; system operator; or on-board operator, the railroad shall determine that the person has demonstrated, in accordance with the requirements of § 7.41 of this Part, the skill to safely operate maglev trains, including the proper application of the railroad's rules and practices in the most demanding type of service that the person will be required or permitted to perform.

(b) Incorporate the language of § 240.211(b), as written

(c) Incorporate the language of § 240.211(c), changing "no railroad shall" to "the railroad shall not" and "a locomotive as a locomotive or train service engineer" to "a maglev train as a system operator or on-board operator"

(d) Incorporate the language of § 240.211(d), changing "No railroad shall" to "The railroad shall not" and "supervisor of locomotive engineers" to "supervisor or instructor of system operators or on-board operators, as applicable,"

§ 7.57 Procedure for Making the Determination on Completion of Training Program

(a) Prior to certifying or recertifying any person as a: supervisor or instructor of system operators or on-board operators; system operator; or on-board operator, the railroad shall determine that the person has, in accordance with the requirements of § 7.37 of this Part, the knowledge and skills to safely operate maglev trains in the most demanding class or type of service that the person will be required or permitted to perform.

(b) Incorporate the language of § 240.213(b), changing "a railroad" to "the railroad", "§ 240.123 of this part" to "§ 7.37 of this Part" and, under (3) "railroad" to "guideway"

§ 7.59 Retaining Information Supporting Determinations

(a) The railroad shall maintain a record for each certified: supervisor and instructor of system operators and on-board operators; system operator; and on-board operator or applicant for certification that contains the information the railroad relied upon in making the determinations required under § 7.47 of this Part to issue, deny or revoke certification.

(b) Incorporate the language of § 240.215(b), as written

(c) Incorporate the language of § 240.215(c), as written

(d) Incorporate the language of § 240.215(d), as written

(e) The information concerning demonstrated performance skills that the railroad shall retain includes:

(1) Incorporate the language of § 240.215(e)(1), changing "supervisor of locomotive engineers" to "supervisor or instructor of system operators or on-board operators, as applicable" and adding "and," after the semi-colon

[** § 240.215(e)(2) does not apply. **]

(2) Incorporate the language of § 240.215(e)(3), changing "engineer's performance" to " system operator's or on-board operator's performance, as applicable" and "§ 240.129" to "§ 7.43"

(f) Incorporate the language of § 240.215(f), changing "a railroad" to "the railroad", strike "relying", "engineer" to "system operator or on-board operator, as applicable,"

[** § 240.215(g) does not apply **]

(g) Incorporate the language of § 240.215(h), as written

(h) Incorporate the language of § 240.215(i), changing "any railroad" to "the railroad"

§ 7.61 Time Limitations for Making Determinations

(a) The railroad shall not certify or recertify a person as qualified as a system operator or on-board operator, if the railroad is making: [Incorporate the language of § 240.217(a)(1) through (4), as written]

[** § 240.217(b) and § 240.217(c), except (c)(1), do not apply. **]

(b) The railroad shall not certify a person as qualified as a system operator or on-board operator for a period of greater than thirty-six months.

[** § 240.217(d) does not apply. **]

§ 7.63 Denial of Certification

(a) Incorporate the language of § 240.219(a), changing "a railroad" to "the railroad"

(b) Incorporate the language of § 240.219(b), changing "§§ 240.115, 240.117 and 240.119" to "§§ 7.29, 7.31 and 7.33"

(c) Incorporate the language of § 240.219(c), changing "a railroad" to "the railroad"

§ 7.65 Identification of Qualified Persons

(a) The railroad shall maintain a written record identifying each person designated by it as a supervisor or instructor of system operators or on-board operators, as applicable.

(b) The railroad shall maintain a written record identifying each person designated by it as a certified system operator. That record shall indicate the class of service the railroad determines each person is qualified to perform and date of the railroad's certification decision.

(c) The railroad shall maintain a written record identifying each person designated by it as a certified on-board operator. That record shall indicate the class of service the railroad determines each person is qualified to perform and date of the railroad's certification decision.

[** § 240.221(c) does not apply. **]

(d) The listings required by paragraphs (a), (b) and (c) shall be updated at least annually.

(e) The records required under this section shall be kept at the railroad's headquarters and the system control center, and shall be available for inspection or copying by FRA during regular business hours.

[** § 240.221(f) seems unnecessary. **]

§ 7.67 Criteria for the Certificate

(a) As a minimum, each certificate issued in compliance with this Part shall:
(1) Identify the railroad;
(2) Incorporate the language of § 240.223(a)(2), changing "to operate a locomotive" to "as a system operator or on-board operator, as applicable"
(3) Incorporate the language of § 240.223(a)(3), deleting "either" and "or"
(4) Incorporate the language of § 240.223(a)(4), as written
(5) Incorporate the language of § 240.223(a)(5), as written
(6) Incorporate the language of § 240.223(a)(6), changing "locomotive engineers" to "system operators or on-board operators, as applicable,"
(7) Incorporate the language of § 240.223(a)(7), deleting "on", and changing "§ 240.129" to "§ 7.43" and "§ 240.303" to "§ 7.71"
(8) Incorporate the language of § 240.223(a)(8), as written

(b) The railroad shall designate in writing any person, other than a supervisor of system operators or on-board operators, as applicable, that it authorizes to sign the certificates described in this section. The designation can identify such persons by name or job title.

(c) Incorporate the language of § 240.223(c), changing "any railroad" to "the railroad"

(d) Incorporate the language of § 240.223(d), changing "any railroad" to "the railroad"

[** § 240.225, 240.227 and 240.229 do not apply. **]

SUBPART D--ADMINISTRATION OF THE CERTIFICATION PROGRAM

§ 7.69 Replacement of Certificates

Incorporate the language of § 240.301, changing "A railroad" to "The railroad" and "locomotive engineers" to "system operators and on-board operators"

§ 7.71 Operational Monitoring Requirements

(a) The railroad shall have a program to monitor the conduct of it's certified system operators and on-board operators by both performing operational monitoring observations and conducting unannounced operating rules compliance tests.

(b) The program shall be conducted so that each system operator and on-board operator shall be given at least two operational monitoring observations each calendar year by a qualified supervisor. The scheduling of observations is to be approximately evenly spaced during the year.

(c) The program shall be conducted so that each system operator and on-board operator shall be given at least two unannounced rules compliance tests during each calendar year. The scheduling of compliance tests is to be approximately evenly spaced during the year.

(d) The unannounced test program shall:

[** Wayside signals are not expected to exist. Therefore, § 240.303(d)(1) does not apply and an equivalent is not obvious. **]

(1) Test system operator or on-board operator, as applicable, compliance with one or more of the railroad's operating rules or other mandatory directives that require affirmative response by the operator being tested to conditions that are less favorable than those which existed prior to the initiation of test;
(2) Test system operator or on-board operator, as applicable, compliance with the railroad's operating rules or other mandatory directives, the violation of which were cited by the railroad as the cause of train accidents or incidents in accident reports filed in compliance with Part 8 of this chapter for the preceding year;
(3) Incorporate the language of § 240.303(d)(4), as written
(4) Incorporate the language of § 240.303(d)(5), changing "locomotive engineer" to "system operator or on-board operator"
(5) Incorporate the language of § 240.303(d)(6), changing "§ 240.215" to "7.59"

§ 7.73 Prohibited Conduct by Certified System Operators and On-board Operators

(a) It shall be unlawful for a system operator or on-board operator to:
(1) Incorporate the language of § 240.305(a)(1), changing "locomotive or train" to "maglev train" and "10 miles per hour" to "16 kilometers per hour (10 miles per hour)"

[** § 240.305(a)(2) does not apply. **]

(2) Incorporate the language of § 240.305(a)(3), changing "locomotive or train" to "maglev train" and "track" to "guideway"

(b) Each system operator and on-board operator who has received a certificate required under this Part shall:

(1) Have that certificate in his or her possession while on duty as a system operator or on-board operator, as applicable; and,
(2) Incorporate the language of § 240.305(b)(2), adding "or" at the end of (i), deleting "or" at the end of (ii), and deleting (iii)

(c) Incorporate the language of § 240,305(c), changing "locomotive engineer" to "system operator or on-board operator" and "locomotive or train" to "maglev train"

[** § 240.305(d) does not apply. **]

(d) Incorporate the language of § 240.305(e), changing "locomotive engineer's" to "system operator's or on-board operator's"

§ 7.75 Revocation of Certification

(a) The railroad shall revoke or deny a person's certificate as a system operator or on-board operator, as applicable, if during the certification or recertification interval, it acquires information which convinces it that the person no longer meets the qualification requirements of this Part.

(b) Incorporate the language of § 240.307(b), changing "§ 240.117 or § 240.119" in (5) to "§ 7.31 or § 7.33"

(c) Incorporate the language of § 240.307(c), as written

(d) Incorporate the language of § 240.307(d), as written

[** § 240.307(e) and (f) do not apply. **]

§ 7.77 Railroad Oversight Responsibilities

(a) No later than March 31 of each year following the initiation of operations the railroad shall conduct a formal annual review and analysis concerning the administration of it's program for responding to instances of poor safety conduct by certified system operators and on-board operators during the prior calendar year.

(b) Each review and analysis shall involve:

(1) Incorporate the language of § 240.309(b)(1), as written
(2) Incorporate the language of § 240.309(b)(2), changing "locomotive engineers" to "system operators and on-board operators"
(3) Incorporate the language of § 240.309(b)(3), deleting "of locomotive engineers"

[** § 240.309(b)(4) does not apply. **]

(c) Incorporate the language of § 240.309(c), changing "each railroad" to "the railroad"

(d) Incorporate the language of § 240.309(d), as written

(e) For reporting purposes, the nature of detected poor safety conduct shall be capable of segregation for study and evaluation purposes in the following manner:

[** § 240.309(e)(1) through (4) have been replaced by (1) below. **]

(1) Incidents involving each failure cited in § 7.29(f) and (g);

[** § 240.309(e)(5) does not apply. §§ 240.309(e)(6), (7) and (8) only apply to the degree that proper braking is required. They have been combined to achieve the desired intent. **]

(2) Incidents involving noncompliance with the railroad's operating rules involving braking or speed reductions;

[** The following is new because of the unique capabilities on maglev. **]

(3) Incidents involving noncompliance with the railroad's operating rules involving train acceleration;

[** § 240.309(e)(9) and (10) may not apply, but since that is currently unclear, they have been incorporated in this draft. **]

(4) Incorporate the language of § 240.309(e)(9), as written
(5) Incorporate the language of § 240.309(e)(10), as written

[** In the copy of 49 CFR 240 that I have, paragraphs are mislabeled from this point to the end of Subpart D (there are two (e)'s). This draft refers to the corrected references. **]

(f) Incorporate the language of § 240.309(f), changing "(d)" to "(e)"

(g) Incorporate the language of § 240.309(g), changing "(d)" to "(e)"

(h) Incorporate the language of § 240.309(h), changing"(d)" to "(e)"

SUBPART E -- DISPUTE RESOLUTION PROCEDURES

§ 7.79 Review Board

(a) Incorporate the language of § 240.401(a), changing "a railroad" to "the railroad"

[** Since no review board exists for maglev operations, § 240.401(b) and (c) have been combined and modified to provide for a special board to be appointed when needed. **]

(b) The Federal Railroad Administrator shall appoint a board to adjudicate such disputes which shall be composed of at least three FRA employees.

§ 7.81 Petition Requirements

Incorporate the language of § 240.403, with the following changes:

(a) "a railroad's" to "the railroad's"

(b) (3) insert "(iv) The petitioner's job title (system operator or on-board operator)", renumber existing (iv) and (v) accordingly

(b) (5) "that railroad's" to "the railroad's"

(c) "a railroad's" to "the railroad's"

(d) "a railroad's" to "the railroad's" and "§ 240.307" to "§ 7.75"

§ 7.83 Processing Qualification Review Petitions

Incorporate the language of § 240.405 with the following changes:

(d) "A railroad" to The railroad"

(e) "Locomotive Review Board" to "review board"

(f) "a railroad's" to "the railroad's"

§ 7.85 Request for a Hearing

Incorporate the language of § 240.407 with the following changes:

(a) delete "involved"

§ 7.87 Hearings

Incorporate the language of § 240.409 with the following changes:

(a) "locomotive engineer" to "system operator or on-board operator"
(f)(2) "§ 209.7 of part 209 in this chapter" to "49 CFR 209.7"

§ 7.89 Appeals

Incorporate the language of § 240.411, as written

APPENDIX A TO PART 7--SCHEDULE OF CIVIL PENALTIES

[** The following constitutes an equivalency table for the penalties listed in Appendix A of Part 240, as they apply to Part 7. Some do not apply and are so noted. There are also some errors in Part 240 Appendix A which are noted and corrected, as appropriate. **]

Change from:	To:
Subpart B - Component Elements	
240.101	7.15
240.103	7.17
240.105	7.19
240.107	7.21
(a)	(a) and (d)
240.109	7.23
240.111	7.25
240.113	7.27
240.115	7.29
240.117	7.31
240.119	7.33
240.121	7.35
240.123	7.37
240.125	7.39
240.127	7.41
(c)	(d)
240.129	7.43
Subpart C--Implementation Process	
240.201	7.45
(b) Failure to identify grandfathered engineers	(b) Failure to identify operators
(c) duplicated in (h-i)	
(d)	(c)
(e-g) does not apply	
(h-i) Failure to issue certificate to engineer	(d) Failure to issue certificate to operator

From:	To:
240.203	7.47
(a) is incorrectly attributed to 240.203, does not apply here	
(b)	(a)
(c)	(b)
240.205	7.49
240.207	7.51
240.209	7.53
there is no (a) in the appendix, and (c) is inappropriately attributed to 240.209	
(b)	(a)
(d)	(b)
(e)	(c)
240.211	7.55
there is no (a) in the appendix, and (c) is inappropriately attributed to 240.211	
(b)	(a)
(d)	(b)
(e)	(c)
240.213	7.57
240.215	7.59
240.217	7.61
(a,c)	(a,b)
240.219	7.63
240.221	7.65
(a-b)	(a, b and c)
(c)	(d)
the second (b) in the appendix, intended to be a (d), does not relate to 240.221	
(e-f)	(e)

From:	To:
240.223	7.67
240.225, 240.227 and 240.229 do not apply.	
Subpart D--Program Administration	
240.301	7.69
240.303	7.71
(b) Failure to observe each person annually	(b) Failure to observe each person semi-annually
(c) Failure to test each person annually	(c) Failure to test each person semi-annually
240.305	7.73
Certified engineer conduct	Certified operator conduct
(a) Failure of engineer to:	(a) Failure of operator to:
(a)(2) does not apply	
(a)(3)	(a)(2)
(c-d)	(c)
240.309 and 240.307 designations are reversed in the appendix, they are used below for the sake of continuity.	
240.309	7.75
240.307	7.77

APPENDIX B TO PART 7--PROCEDURES FOR SUBMISSION AND APPROVAL OF ON-BOARD OPERATOR AND SYSTEM OPERATOR QUALIFICATION PROGRAM

This appendix establishes procedures for the submission and approval of the railroad's program concerning the training, testing and evaluation of persons seeking certification or recertification as a system operator or on-board operator in accordance with the requirements of this Part (see §§ 7.15, 7.17, 7.19, 7.21, 7.37, 7.39, 7.41 and 7.43). It also contains guidance on how FRA will exercise it's review and approval responsibilities.

Submission by the Railroad

As provided for in § 7.15, the railroad must have a program for determining the qualifications of each person it permits to operate a maglev train, either as a system operator or on-board operator. In designing it's program, the railroad must take into account the guideway and terrain over which it operates, the characteristics of the train control system, both in the system control center and on-board the train, and the nature of operations to be conducted including train speeds, station stops and headways between trains. The railroad must submit it's program to FRA for approval as provided for in § 7.17. The program must be accompanied by a request for approval organized in accordance with this appendix. Requests for approval must contain appropriate references to the relevant portion of the program being discussed. Requests should be in writing on standard sized paper (8-1/2 x 11 inches) and can be in either letter or narrative format. The railroad's submission shall be sent to: Associate Administrator for Safety; Federal Railroad Administration; 400 Seventh Street, SW; Washington, DC 20590.

Organization of the Submission

Incorporate the language of this section from Appendix B of Part 240, as written.

Section 1 of the Submission: General Information

The first section of the request must contain the name of the railroad, the person to be contacted concerning the request (including the person's name, title, telephone number, and mailing address) and the identification, qualification and affiliation of the persons to serve as instructors and certification officials (see 7.17(b) of this Part).

If the affiliation of those who serve as instructors and certification officials is not the railroad, it is incumbent upon the railroad to ensure that the training and certification procedures submitted to and approved by FRA are adhered to.

This section must also state which class or classes of service the railroad will employ (see § 7.21).

Section 2 of the Submission: Selection of Supervisors

Incorporate the language of Section 2 of Appendix B to Part 240, with the following changes:

- o "§ 240.105" to "§ 7.19" (two occurrences)
- o "each railroad" to "the railroad"
- o "locomotive engineers" to "system operators and on-board operators" (three occurrences)
- o "a railroad" to "the railroad" (two occurrences)

- o "§ 240.105(b)" to "§ 7.19(b)"
- o "an engineer" to "a system operator or on-board operator"

Section 3 of the Submission: Training Persons Previously Certified

[** There are four unnumbered paragraphs in Section 3 of Appendix B to Part 240. In the following, they will be referenced in sequence, as though they were numbered. **]

1. Incorporate the language of paragraph 1 of Section 3 of Appendix B of Part 240, with the following changes:
   - o From "locomotive engineers" to "system operators and on- board operators" (two occurrences)
   - o From "§ 240.123(b)" to "§ 7.37(b)"
   - o From "each railroad" to "the railroad"
   - o add to "knowledge concerning" - "emergency procedures"
2. Incorporate the language of paragraph 2 of Section 3 of Appendix B of Part 240, with the following changes:
   - o "§ 240.123(b)" to "§ 7.37(b)" (two occurrences)
   - o "a railroad" to "the railroad"
   - o "engineers" to "system operators and on-board operators"
   - o in the parenthetical statement, delete "and" and "use of simulators"
3. Incorporate the language of paragraph 3 of Section 3 of Appendix B of Part 240, with the following changes:
   - o Replace the first sentence with the following: "Safe maglev train handling involves both abstract knowledge about the appropriate use of system control center and on-board control systems and the application of that knowledge."
   - o "each railroad" to "the railroad"
4. Replace the fourth paragraph of Section 3 of Appendix B to Part 240 with the following:

   "For example, system operators and on-board operators need to have their fundamental knowledge of maglev train operations refreshed periodically. The railroad needs to advise FRA how that need is satisfied in terms of the interval between attendance at such training, the nature of the training being provided and methods for conducting the training. Of particular concern to FRA is how the railroad acts to assure that system operators or on-board operators, as applicable, remain knowledgeable about safe maglev train handling procedures when the operator has been absent for a period of time. The railroad must have a plan for familiarization training that addresses the question of how long a person can be absent before needing more training and, once that threshold is reached, how the person will acquire the needed training. Similarly, the program must address how the railroad responds to changes such as the introduction of new technology, new operating rules and practices, or significant changes in operations."

Section 4 of the Submission: Testing and Evaluating Persons Previously Certified

The fourth section of the request must contain information concerning the railroad's program for testing and evaluating previously certified system operators and on-board operators. As provided in §§ 7.39 and 7.41, the railroad must have a program for the ongoing testing and evaluation of its system operators and on-board operators to assure that they have the necessary knowledge and skills concerning personal safety; operating rules and practices; emergency procedures; compliance with Federal safety regulations; physical characteristics of the guideway and territory to be operated; and, for system operators, control center equipment inspection and operation practices; and, for on-board operators, train equipment inspection practices and on-board train handling practices. Similarly, the railroad must have a program of ongoing testing and evaluation to assure that it's system operators and on-board operators have the necessary hearing and vision acuity as provided for in § 7.35.

Sections 7.39 and 7.41 require that the railroad rely on written procedures for determining that each person can demonstrate his or her knowledge of the railroad's rules and practices, and skill at applying those rules and practices, for the safe operation of a maglev train. Section 7.39 directs that, when seeking a demonstration of a person's knowledge, the railroad must employ a written test that contains objective questions and answers and covers the subject matter listed in the first paragraph of this section. The test must accurately measure the person's knowledge in all these areas.

Incorporate the language of the third paragraph of Section 4 of Appendix B to Part 240, with the following changes:

- o "240.125" to "7.39" (two occurrences)
- o "a railroad" to "the railroad"
- o "engineers" to "system operators and on-board operators"

Section 7.41 directs that, when seeking demonstration of a person's skill, the railroad must employ a test and evaluation procedure conducted by a supervisor or instructor of system operators or on-board operators, as applicable, that contains an objective evaluation of the person's skills at applying the railroad's rules and practices for the safe operation of maglev trains. The test and evaluation procedure must examine the person's skills in terms of the following, for system operators: application of operating rules and practices; compliance with Federal safety regulations; and, monitoring, inspection and operation of control center equipment. The test and evaluation procedure must examine the person's skills in terms of the following, for on-board operators: application of operating rules and practices; compliance with Federal safety regulations; equipment inspection practices; and, on-board train handling skills. The test must be sufficient to effectively examine the person's skills while operating a maglev

train in the most demanding type of service which the person is likely to encounter in the normal course of events once he or she is deemed qualified.

Incorporate the language of the fifth paragraph of Section 4 of Appendix B to Part 240, changing the following:

- o "240.127" to "7.41" (two occurrences)
- o "a railroad" to "the railroad" (two occurrences)
- o delete the sentence "The section also gives a railroad the latitude to employ a Type 1 or a Type 2 simulator (properly programmed) to conduct the test and evaluation procedure." "engineers" to "system operators and on-board operators"

Incorporate the language of the sixth paragraph of Section 4 of Appendix B to Part 240, changing the following:

- o "240.121" to "7.35"
- o "a railroad" to "the railroad"
- o "locomotive" to "maglev train"
- o "train" to "maglev train"

Section 5 of the Submission: Training, Testing and Evaluating Persons Not Previously Certified

Unless the railroad has made an election not to accept responsibility for conducting the initial training of persons to be system operators or on-board operators, the fifth section of the request must contain information concerning the railroad's program for educating, testing and evaluating persons not previously trained as system operators and on-board operators. As provided for in § 7.37(c), if the railroad is issuing an initial certification to a person to be a system operator or on-board operator, it must have a program for training, testing and evaluating it's operators to assure that they acquire the necessary knowledge and skills concerning: personal safety; operating rules and practices; emergency procedures; relevant Federal safety rules; familiarity with the physical characteristics of the territory operated; and, for system operators, condition and capabilities of system control center hardware and software; and, for on-board operators, condition and capabilities of train and on-board equipment, and methods of safe train handling from on-board.

Section 7.37 establishes a performance standard and gives the railroad latitude in selecting how it will meet that standard. The railroad must describe in this section how it will use that latitude to assure that it's system operators and on-board operators will acquire sufficient knowledge and skill and demonstrate their knowledge and skill concerning the safe discharge of their maglev train operating responsibilities. This section must contain the same level of detail concerning initial training programs as that described for each of the components of the overall program contained in sections 2 through 4 of this appendix. The railroad may authorize another entity to

perform the actual training effort. The railroad may submit a training program developed by that authorized trainer, but the railroad remains responsible for assuring that such training providers adhere to the training program submitted. If the railroad elects to rely on other entities to conduct training away from the railroad's operating territory, it must indicate how the student will be provided with the required familiarization with the physical characteristics of it's guideway and environs.

Section 6 of the Submission: Monitoring Operational Performance by Certified System Operators and On-board Operators

This section of the request must contain information concerning the railroad's program for monitoring the performance of it's system operators and on-board operators. As provided for in § 7.43, the railroad must have a program for the ongoing monitoring of it's system operators and on-board operators to assure that they operate maglev trains in conformity with the railroad's operating rules and practices, including methods of safe train handling and relevant Federal safety rules.

Section 7.43 requires that the railroad semi-annually observe each system operator and on-board operator demonstrating his or her knowledge of the railroad's rules and practices and skill at applying those rules and practices for the safe operation of maglev trains. Section 7.43 directs that the observation be conducted by a designated supervisor of system operators or on-board operators, as applicable, but provides the railroad latitude in selecting the design of it's observation procedures (including the duration of the observation process, reliance on event recorders, and the specific aspects of performance to be covered). The railroad must describe in this section how it will use that latitude to assure that it's monitoring program accurately discerns the skills of their system operators and on-board operators to safely discharge their maglev train operation responsibilities. If the railroad intends to employ train operation event recorders to comply with this monitoring requirement, it shall indicate in this section how: it anticipates determining what person was at the controls in the control room and on-board the train; what person was responsible for each control action; and what operational constraints, if any, were applicable to the train's movement.

Section 7 of the Submission: Procedures for Routine Administration of the Certification Program

[** There are three unnumbered paragraphs in Section 7 of Appendix B to Part 240. In the following, they will be referenced in sequence, as though they were numbered. **]

1. Incorporate the language of paragraph 1 of Section 7 of Appendix B to Part 240, changing the following:
   - o "locomotive engineers" to "system operators and on-board operators"

2. Incorporate the language of paragraph 2 of Section 7 of Appendix B to Part 240, with the following changes:
   - o "Section 240.109" to Section 7.23"
   - o "each railroad" to "the railroad"
   - o "Sections 240.115, 240.117 and 240.119" to "Sections 7.29, 7.31 and 7.33"
   - o "a railroad" to "the railroad" (three occurrences)
   - o "yet leave" to "yet leaves"
   - o "Sections 240.203, 240.217 and 240.219" to "Sections 7.47, 7.61 and 7.63"
   - o "...who will be authorized to conclude that a person is or is not qualified..."
   - o "§§ 240.205, 240,207, 240.209, 240.211 and 240.213" to "7.49, 7.51, 7.53, 7.55 and 7.57"
   - o delete "Sections 240.225 and 240.227 permit reliance on qualification determinations made by other entities and permit a railroad latitude in selecting the procedure it will employ to assure compliance with these provisions. Similarly, § 240.229 permits use of railroad selected procedures to meet the requirements for certification of engineers performing service in joint operating territory."
   - o "Section 240.301 and 240.307" to "7.69 and 7.75"

3. Incorporate the language of paragraph 3 of Section 7 of Appendix B to Part 240, as written.

FRA Review

[** There are three unnumbered paragraphs in the FRA Review section of Appendix B to Part 240. In the following, they will be referenced in sequence, as though they were numbered. **]

1. Incorporate the language of the first paragraph of the FRA Review section of Appendix B to Part 240, changing the following:
   - o "...railroads generally already have existing programs that..." to "the railroad"
   - o "a railroad" to "the railroad"
   - o "section § 240.103" to "§ 7.17"

2. delete the second paragraph of the FRA Review section of Appendix B to Part 240, in it's entirety

3. replace the third paragraph of the FRA Review section of Appendix B to Part 240 with the following:

> "FRA's review and approval process will focus on determining the validity of the reasoning relied on by the railroad for selecting it's approach and the degree to which that approach is likely to be effective in producing system operators and on-board operators who have the knowledge, skill and ability to safely operate maglev trains."

APPENDIX C TO PART 7--PROCEDURES FOR OBTAINING AND EVALUATING MOTOR VEHICLE DRIVING RECORD DATA

[** The introductory paragraph of Appendix C to Part 240 has been rewritten to reflect the necessary inference involved in including system operators and on-board operators under the requirements of section 4(a) of the Railroad Safety Improvement Act of 1988. **]

The purpose of this appendix is to outline the procedures to individuals and railroads for complying with the requirements of section 4(a) of the Railroad Safety Improvement Act of 1988. This legislation referred specifically to locomotive engineers, who control conventional trains, but is extended to system operators and on-board operators because they control maglev trains. These requirements are contained in §§ 7.23, 7.25 and 7.49 of this Part. Those provisions require that the railroad consider the motor vehicle driving record of each person prior to issuing him or her certification or recertification as a system operator or on-board operator.

Incorporate the language of the second introductory paragraph of Appendix C to Part 240, with the following change:

- o "a railroad" to "the railroad"

Access to State Motor Vehicle Driving Record Data

Incorporate the language of the section with the above title in Appendix C to Part 240, with the following changes:

- o "locomotive engineers" to "system operators or on-board operators"
- o "locomotive operator" to "system operator or on-board operator"

The National Driver Register

Incorporate the language of the section with the above title in Appendix C to Part 240, with the following change:

- o "engineer" to "certification"

Access to NDR Data

Incorporate the language of the section with the above title in Appendix C to Part 240, with the following changes:

- o "locomotive engineer" to "system operator or on-board operator"
- o "prospective engineer" to "prospective system operator or on-board operator"

Requesting NHTSA to Perform the NDR Check

Incorporate the language of the section with the above title in Appendix C to Part 240, with the following change:

- o "locomotive engineer" to "system operator or on-board operator"

Requesting a State Agency to Perform the NDR Check

Incorporate the language of the section with the above title in Appendix C to Part 240, with the following change:

- o "locomotive engineer" to "system operator or on-board operator"

Actions When a Probable NDR Match Occurs

Incorporate the language of the section with the above title in Appendix C to Part 240, with the following changes:

- o "engineer candidate" to "certification candidate"
- o "a railroad" to "the railroad" (two occurrences)
- o "prospective engineer" to "prospective system operator or on-board operator"
- o "§ 240.219" to "§ 7.63"

APPENDIX D TO PART 7--IDENTIFICATION OF STATE AGENCIES THAT PERFORM NATIONAL DRIVER REGISTER CHECKS

Incorporate the language of Appendix D to Part 240, with the following changes:

- o "§ 240.111" to "7.25" (two occurrences)
- o "locomotive operator" to "system operator or on-board operator"
- o "locomotive engineer" to "system operator or on-board operator"
- o "As of December 31, 1989..." to "As of August 31, 1992..."

APPENDIX E TO PART 7--RECOMMENDED PROCEDURES FOR CONDUCTING SKILL PERFORMANCE TESTS

[** This appendix is expected to be revised several times as more details of the characteristics of the Florida maglev operation become available. Therefore, only the basic considerations are provided in this first draft of the proposed rule. **]

FRA requires (see §§ 7.41 and 7.55) that system operators and on-board operators be given a skill performance test prior to certification or recertification and establishes certain criteria for that test. The railroad is given discretion concerning the manner in which to administer the required testing. FRA has afforded this discretion to allow the railroad latitude to tailor their testing procedures to specific operational realities. This appendix contains FRA's recommendations for the administration of skill performance testing that occurs during train operations. These recommendations, if followed, will ensure a thorough and systematic assessment of system operator and on-board operator performance.

The Need for a Systematic Approach

There are numerous criteria that should be monitored when a designate supervisor or instructor of system operators or on-board operators, as applicable, is observing a person to determine whether that individual should be certified or recertified as a qualified system operator or on-board operator. The details of those criteria vary for different classes of service. At a minimum, the supervisor or instructor should concentrate on several general areas during any appraisal, these include: application of the railroad's rules, other mandatory directives and practices; compliance with Federal safety regulations; and, monitoring, inspection and operation of equipment.

In order to effectively evaluate operators, it is necessary to have something against which to compare their performance. In order to hold a system operator or on-board operator accountable for compliance, the railroad must have adequate, and clearly stated, operating and safety rules and practices, and emergency procedures. If the railroad fails to have adequate and clearly stated rules, practices and procedures, it will experience difficulty in establishing an objective method of measuring an individual's skill level and assessing their performance. This objective methodology should establish standards of performance for each aspect of train operations such as speed control, acceleration and deceleration rates and train positioning at stations. It is essential to have such standards so that the system operator or on-board operator and anyone reviewing their work will know what the performance of the certification candidate is being measured against.

Evaluating the performance of certain operation skills tend to occur in all situations. For example, it would be rare for a supervisor or instructor to observe any operator for a reasonable period of time and not have some opportunity to review that operator's compliance with some basic safety rules, operating rules and equipment usage. As the complexity of the operation increases, so does the number of items that the operator must comply with. Therefore, FRA recommends that reviewing supervisors and instructors employ a written aid to help record events and procedures that, as a minimum, should be observed when conducting skills performance tests. FRA is providing the following information to assist the railroad in developing such a written aid to ensure meaningful testing. When conducting a skills performance test, a supervisor or instructor should be alert to the following:

- Prior to the beginning of operations:
  - Does the operator have the necessary reference materials (operating rules, safety rules, emergency procedures, other mandatory directives, etc.)?
  - Are pre-operation inspections properly conducted?
  - Does the operator comply with applicable safety rules and procedures?
  - Does the operator read special bulletins and instructions?
- During operations, does the operator:
  - Comply with applicable operating rules and practices?
  - Comply with applicable Federal rules?
  - Monitor information displays?
  - Monitor the guideway in front of the train (on-board operators only)?
  - Properly control train speed, including acceleration and deceleration rates?
  - Display familiarity with the physical characteristics of the guideway and it's environs?
  - Properly position the train at station stops?
  - Properly respond to and report unusual conditions?

This list should be modified as necessary to reflect operating practices and conditions that may be different from those envisioned prior to the beginning of operations by the railroad.

The need for Objectivity, Use of Observation Form

It is essential that the railroad conducts performance skills testing in the most objective manner possible, whether this testing is for initial qualification or periodic retesting. There will always be some potential for the subjective views, of the examining supervisor or instructor, to enter into evaluations concerning the competency of a particular individual to handle the position of system operator or on-board operator. Steps must be taken to minimize the risk that personality factors adversely influence the testing procedure.

One way to reduce the entry of subjective matters into the qualification procedures is through the use of a document that specifies those criteria to be used by the testing supervisor or instructor for evaluation. The use of an observation form will reduce but not eliminate subjectivity. Any skill performance test
will contain some amount of subjectivity. While compliance with operating rules and safety rules is clear in most cases, it is anticipated that maglev train operations will have options with few absolute answers. These actions which rely upon the judgement of the operator provide opportunities for subjectivity through differing differences of opinion between the supervisor or instructor and the operator. An example is the rate of acceleration when leaving a station. In instances where such judgement may differ, an acceptable range of actions should be identified. The recommended observation form should provide for both actions which are either correct or incorrect and those for which some latitude is permitted on the basis of the operator's judgement.

Observation forms should include the time and location that the observer started and ended the observation. FRA believes that there should be a minimum duration for all performance skills examinations. The railroad may select test period duration based upon the detailed characteristics of their operation. But, the period must be "of sufficient duration to effectively evaluate the person". FRA suggests that the test period be expressed in terms of the number of runs or the number of miles operated. FRA also suggests that the observation form contain a section for written comments of the observer.

PART 9: OPERATING RULES AND PROCEDURES

§ 9.1 Purpose

Given the relatively high operating speed of the Florida Maglev Demonstration Project and the highly automated nature of the Transrapid maglev transportation system, unique demands are placed on the various components of the system. Although many elements utilized to maintain safety are automated the operational rules and procedures play a key role in maintaining and enhancing the safety of the system.

Through the requirements of this part, the Federal Railroad Administration learns the condition of, and advises on changes or additions as necessary, to the operating, maintenance, inspection, and emergency preparedness rules and practices with respect to the Florida Maglev Demonstration Project. The rules and practices covered by this part include the training and testing procedures of all employees involved with the movement of vehicles, including train operators and on-board attendants, central control staff and all maintenance staff to ensure their skills in following the rules and practices are adequate to maintain the safety of the system.

§ 9.3 Filing and Review of Operating, Maintenance and Emergency Preparedness Rules and Operating Procedures

(a) Six months prior to commencing any operations of levitating vehicle(s) on the guideway and one year prior to commencing any revenue passenger carrying operations the owner/operator shall file with the Federal Railroad Administrator a copy of its code of operating, maintenance and emergency preparedness rules, timetables and timetable instructions.

(b) The rules and procedures submitted under this part shall address all safety related issues raised in Parts 2 through 8, 10 and 11 of this rule.

At a minimum the rules and procedures submitted under this part shall cover all possible normal and abnormal operational situations that the system safety plan, developed under § 2, outlines as necessary to plan for, including normal and emergency startup and shutdown procedures for the system. System tasks and functions, types of operation, and methods of handling malfunctions during system operation shall be covered. Topics covered shall include but not be limited to;

[** this list should be checked against Part 2, to see if it belongs there or if not is not unnecessarily repetitive of information in that part **]

Automated Systems / Operator Interface - operator role, method of monitoring operator alertness and control transfer guidelines and procedures including movement of vehicles in the vehicle maintenance area and protection of personnel in this facility from vehicle movement(s)

Operational Restrictions - weather and other environmental factors, loss of communication, monitoring and response plans, guidelines and procedures

Maintenance of Way - operational rules, procedures, testing and inspection requirements including movement of maintenance and inspections vehicles and protection of maintenance of way personnel

Operational Control System - rules, procedures, testing and inspection requirements

Power Distribution - rules, procedures, testing and inspection requirements including guideway electrification safety

Emergency preparedness - rules shall address the following: response and mobilization by the owner/operator and outside emergency organizations to an emergency, the recovery and restoration of normal operations, and passenger information relating to emergency procedures shall also be addressed.

§ 9.5 Program of Operational Tests and Inspections; Recordkeeping.

Six months prior to commencing any operations of levitating vehicle(s) on the guideway the owner/operator shall file with the Federal Railroad Administrator a copy of its program of operational tests and inspections.

This program shall provide for operational testing and inspection under all anticipated operating conditions, including the emergency preparedness procedures planned for utilization by the system as defined in § 9.3b. Each operational test and inspection procedure shall be described, including the purpose, frequency, and the means and procedures used to carry it out. As part of this program the owner/operator shall periodically conduct operational, including emergency preparedness, tests and inspections to determine the extent of compliance with its code of operating, maintenance and emergency preparedness rules, timetables and timetable instructions.

A record of the date and place of each operations test and inspection performed in accordance with this program shall be kept. Each record must provide a brief description of the operational test or inspection, including the characteristics of the operation tested or inspected, and the results thereof. Records must be retained for two years and made available to representatives of the Federal Railroad Administration for inspection and copying during regular business hours.

[** a time period longer than the current one year in Part 217 is recommended given the unique and new nature of certain elements of this technology and system - rational for a two year period could be drawn from the two year period for record keeping required in Part 219.713 for drug testing **]

§ 9.7 Program of Instruction on Operating, Maintenance, Inspection, and Emergency Preparedness Rules

Six months prior to commencing any operations of levitating vehicle(s) on the guideway the owner/operator shall file with the Federal Railroad Administrator a copy of its program of instruction on operating, maintenance, inspection and emergency preparedness rules.

This program shall; describe the means and procedures used for instruction of the various classes of employees, state the frequency of instruction and the basis for determining that frequency, include a schedule for completing the initial instruction of all employees and provide for initial instruction of each employee hired after the program begins. As part of this program the owner/operator shall periodically instruct each employee on the meaning and application of the operating, maintenance and emergency preparedness rules.

This program shall include but not be limited to initial operational and emergency response training for all appropriate employees and outside response organization personnel; specialized emergency response training for certain groups of personnel, depending on their specific job requirements, and refresher and/or retraining courses for both of the above two items.

§ 9.9 Startup Procedures and Operational Plan

Six months prior to any operations of levitating vehicle(s) the owner/operator shall file with the Federal Railroad Administrator a program for startup procedures and an operational plan. These plans shall detail how safety will be maintained during the critical first days of operation of the facility and how the transition will be made to full revenue operation. These plans shall also detail job functions, position descriptions, and staffing levels to be utilized for operations for each planned operational scenario. The owner/operator shall develop startup procedures and operational plans and procedures for both non-revenue and revenue operations.

§ 9.11 Amendments to Submittals

After levitated vehicle operations have commenced any amendment affecting material submitted and reviewed by the FRA under § 9.3, § 9.5, § 9.7, or § 9.9 must be submitted to the Federal Railroad Administrator at least 60 days prior to the planned implementation date of the amendment.

§ 9.13 Review of All Submittals Under Part 9

Each submission of; operating, maintenance, and emergency preparedness rules, timetables, special instructions; program of operational tests and inspections; program of instruction on operating maintenance and emergency preparedness rules; startup procedures and operational plan, and amendments thereto submitted under § 9.3, § 9.5, § 9.7, § 9.9, and § 9.11 will be reviewed by the FRA for comprehensiveness, accuracy and clarity.

§ 9.15 Annual Report

Before March 1 of each year, the owner/operator of the Florida Maglev Demonstration Project shall file with the Federal Railroad Administrator a written report of the following with respect to its previous years activity. This report shall include a summary of the number, type, and result of each operational test and inspection conducted as required under § 9.5.

PART 10. OPERATING ENVIRONMENT

§ 10.1 Purpose and Scope

This part provides requirements for the design, development, test and operation of the Orlando maglev within the safe operability limits specific to its operating environment, and consistent with existing environmental safety and health regulations. Since the NEPA process is enforced by other federal and State agencies and assesses the effects of a maglev system on the environment, the FRA's primary regulatory concern is with both natural environmental factors impacts on maglev vehicle, guideway, other facilities and safe operation (e.g. lightning frequency and intensity, temperature and wind extremes), and with some technological environmental parameters (e.g. EMI/EMC and EMF addressed in Subparts B, C).

The maglev builder/operator is required to ensure that the safety envelope for normal or constrained maglev operation is adequate to prevent accidents, mitigate their consequences, and protect life and property (see Part 2, System Safety and Part 11. Emergency Preparedness). Safety under both normal and emergency operating rules must be assured for the full range of location-specific natural environmental factors (e.g. for Florida: extreme temperatures and humidity, severe storms and cross-winds, limestone basement cavitation). While no specific safe operability numerical limits for individual environmental parameters are set here, Subpart E refers to the German design and operation environmental limits, as adapted to the Florida Operating Environment. Man-made operating environment, electro-magnetic emissions, compatibility and interference issues are also addressed in Part 10:

Subpart A- General Environmental Safety Requirements

Subpart B- Electromagnetic Fields (EMF) Emissions and Exposure

Subpart C- Electromagnetic Interference and Electromagnetic Compatibility (EMI/EMC)

Subpart D- Lightning/Electrostatic Discharge (ESD)

Subpart E- Climatic Factors

§ 10.3 Definitions

The following technical terms and abbreviations are used in this section:

Direct Current (DC)- Steady electrical current, of stable polarity, typically supplied by an electric battery, or rectified from AC power generators.

Alternating current (AC)- Single phase or multi-phase, sinusoidally varying electric current, typically used in the US electrical power transmission and distribution grid.

Electric (E) and Magnetic (B) Fields, are the force fields generated by electrical voltage differences and currents, respectively, here abbreviated together as Electric and Magnetic Fields (EMF).

Extremely Low Frequency (ELF)- The frequency range extending from 3 to 300 Hz, which includes the power frequency (60 Hz), and harmonics thereof, typical of US electrical generation, transmission and distribution networks.

Very Low Frequency (VLF)- The frequency range (also termed "voice frequency", extending from 300 to 3000 Hz.

Electromagnetic Compatibility (EMC)- The absence or elimination of undesired EM interactions between electrically powered subsystems is termed EMC.

Electromagnetic Interference (EMI)- Effects of electromagnetic energy emitted by a system on other systems or subsystems, which may affect the safe operability of other subsystems.

Lightning - A high-voltage electrostatic discharge between an electrostatically charged cloud and the ground.

> [Optional: A lightning strike may consist of a succession of multiple strikes, each typically lasting about 80 microseconds, with a peak current as large as 500,000 A. There may be a succession of as many as 40 such multiple strokes over a one-second period. A direct strike can be highly destructive, causing melting or shattering of the object struck, with the potential of a subsequent fire. An indirect stroke, because of the magnitude of its rapidly changing electromagnetic field, can have destructive effects on sensitive electrical/electronic equipment.]

Electrostatic Discharge (ESD)- Uncontrolled discharge of static electrical charges generated whenever two dissimilar materials are in relative motion to each other (e.g., static charge produced by friction of an ungrounded maglev vehicle and the atmosphere; or occurring when

a bystander touches an ungrounded charged vehicle, or discharge due to atmospheric breakdown between an ungrounded maglev vehicle and a grounded installation).

§ 10.5 Safe Operability and Environmental Safety and Health Requirements

10.5.1 Subpart A- General

(a) It is the responsibility of the designer/owner/operator to design and operate the maglev system so as to protect the safety and health of employees and the public from known and suspected risk factors. This requires the adoption of inspection, maintenance and prudent avoidance interim operating practices, until the nature and extent of potentially adverse safety and health effects associated with the maglev system are qualitatively and quantitatively understood. It is also expected that the operator will cover any residual risk due to extreme or unforseen environmental conditions through third party insurance coverage (see Part 1.13), or by ceasing operations when unsafe.

(b) Safe operability ranges shall be specified for each of the following natural environmental factors, and for combinations thereof, which may have potentially adverse effects on system operations, including, but not limited to those listed below, and further discussed in Subpart E:

(1) Wind
(2) Fog or Dust Storm (visibility range effects)
(3) Precipitation (Rain, Snow, Ice, Sleet and Hail)
(4) Lightning
(5) Temperature Extremes (thermal effects)
(6) Seismicity

10.5.2 Subpart B- EMF Emissions and Exposure

(a) Measurements of electric and magnetic fields (EMF) associated with maglev operation and an exposure assessment shall be performed by the operator as an integral part of the System Safety Program Plan (see part 2) and according to the tests under subpart (j) of Part 3, Pre-revenue Verification and Testing of Maglev System.

(b) The maglev operator shall comply with the Interim Guidelines for EMF exposure based on the International Recommended EMF Exposure Limits of Electric and Magnetic Fields at 50/60 Hz (Table 10-1) published by the International Radiation Protection Association/ Non-Ionizing Radiation Protection Committee (IRPA/INIRC).

(c) Verification that the maglev operator is in compliance with the 1990 Florida Department of Environmental Regulations (DER) limits for electric and magnetic fields from high voltage (69 kV and above, including substations) transmission lines, as well as with all other DER certification requirements, shall be the responsibility of the State of Florida Environmental and Transportation Authorities.

Current Florida requirements for power lines are that magnetic fields along power line right-of-ways do not exceed limits ranging from 150 to 250 mGauss as a function of line voltage, and that corresponding electric fields not exceed 8- 10 kV/m (see Table 10-2).

(d) To demonstrate compliance with the International Interim EMF Exposure Guidelines and with existing State limits on EMF emission from associated power lines, the maglev developer/operator shall:

(1) Define the maglev system power subsystems, and EMF measurement locations, as well as facility boundaries in relation to the public environment, so that EMF characteristics of interest can be compared with regulated limits with potential safety and health impacts.

(2) Perform electric and magnetic fields measurements in the quasi-static regions, where electric and magnetic fields have very long wavelengths (in excess of system size) and can be decoupled and treated separately: namely, Ultra-Low Frequency (ULF) (from static fields to 3 Hz), and Extra-Low Frequency (ELF) range (3-300 Hz). Standard IEEE/ANSI procedures shall be used to determine the intensity, spatial, frequency and temporal characteristics of associated EMF [1]. Broad band emissions and their variability (extending through Very-Low Frequency, 300-3000 Hz), as well as at higher frequencies in the Radio-Frequency (RF) bands employed for communications, signal and control systems shall also be measured for EMI/EMC assurance, during Pre-Operational Verification Testing (Part 3 (j)).

(3) Provide documentation for EMF data, analysis and findings, to show compliance within a reasonable margin of safety (RMS values within factors 10 or larger than current Guidelines).

(4) Undertake periodic EMF surveys, during prototype pre- operational testing (as prescribed in Part 3), to confirm baseline data obtained on EMF, under the full range of service operating and external environment conditions.

(5) If the margin of EMF compliance is small (within a factor of 10), the operator shall install a monitoring system of electric and magnetic field sensors at representative

locations (on-board the passenger vehicle, in the engineer compartment, in the control station, and near higher emission power subsystems).

(6) If the recommended IRPA/INIRC EMF limits are exceeded by more than a factor of 10, EMF mitigation and reduction strategies shall be identified and implemented. Warning signs shall be posted if and where necessary (e.g., near or within power substations or within the central control facility), to restrict access and/or to alert passengers or employees vulnerable to EMF.

(7) Transients and EMF emissions at other frequencies than ELF (3-300 Hz) (e.g. signal, control and communication bands for voice and data transmission) shall also be measured, and their effects investigated. If measured EMF emissions exceed either prescribed interim limits for extra-low frequencies (ELF) or higher frequencies, or indicate potential for interference with wayside or airport facilities (EMI), or with other maglev subsystems, the maglev developer/ operator shall define and implement appropriate mitigation options, based on a cost/benefit and risk comparability analysis.

(e) Certain types of cardiac pacemakers (e.g. reed switch types) and metallic implanted prosthetic devices, as well as magnetizable tools, are susceptible to either/or both direct current (DC) and alternating current (AC) magnetic fields. The maglev designer/operator shall protect persons with pacemakers or other susceptible prosthetic implants from both DC and AC magnetic field levels. The operator shall also measure static magnetic fields in and near maglev vehicle and guideway, accessible to people. The operator shall observe warning/ labeling guidelines for medical devices emitting static magnetic fields above .5 milliTesla, mT (or 5 Gauss, G), such as those for Magnetic Resonance Imaging (MRI), issued by the Center for Devices and Radiological Health of the Food and Drug Administration (FDA), which regulates the safety of home and office electrical devices).

[NOTE: Recommended exclusionary warning limits now vary between 5 G and 10 G for DC fields, but the National Council for Radiation Protection (NCRP), Measurements Scientific Committee 67 has not yet issued guidelines for users of prosthetic devices.]

(f) The maglev designer/operator shall also observe the American Conference of Governmental Industrial Hygienists (ACGIH) occupational exposure limits on both static and frequency-dependent electric and magnetic fields [2].

(1) The static magnetic fields limits in reference 2 are 60 milliTesla, or 600 Gauss for whole body over an 8-hour day, but up to 6 kGauss (or .6 Tesla, T) for extremities. However, for people with cardiac pacemakers, the recommended limit is 10 Gauss.

(2) The 60 Hz AC limit on Root Mean Square (RMS) average value of the magnetic field is also 1 milliTesla, mT (or 10 Gauss), but varies as a function of frequency, f as 60/f (in mT units). Since this limit exceeds the IRPA/INIRC 5 G limit by a factor of 2, the smaller of the two shall be observed.

(3) The corresponding 60 Hz electric field limit is 25 kV/m between 0-100Hz, and $2.5 \times 10^6/f$ kV/m above 100 Hz. These limits are higher than the current state limits on power line electric fields (Table 10-2), which are of order 8-10 kV/m. However, the ACGIH limit for 60 Hz electric field limits for people with cardiac pacemakers or other susceptible medical implants is below 2 kV/m. Again, consistent with prudent avoidance strategies and conservative assumptions, the lower of any available guidelines shall be observed by the maglev operator.

(g) The maglev operator shall also comply with limits on electric and magnetic field strengths and power density at radio frequencies (RF) used for Signal, Control and Communications systems (see Part 6), as specified in reference [3].

Table 10-1: IRPA/INIRC Recommended 50/60-Hz EMF Exposure Limits

EXPOSURE CHARACTERISTICS	ELECTRIC FIELD STRENGTH, kV/m	MAGNETIC FLUX, mT (a)
Occupational		
Whole Working Day	10	0.5
Short Term	30 (b)	5 (c)
For Limbs	--	25
General Public		
Up to 24hr/day	5	0.1
Few hours/day (d)	10	1

NOTES:

(a) To convert milliTesla (mT) to Gauss (G), multiply figures by ten; to convert mT to mG, multiply by 10,000. Earth's natural magnetic field background level is about .5 G.

(b) Short-term occupational exposure to average (root mean square, rms) electrical field strengths between 10 and 30 kV/m is permitted, provided the rms electric field strength does not exceed 80 kV/m for the whole working day.

(c) Maximum exposure duration is 2 hours per working day.

(d) These values can be exceeded for a few minutes per day, provided precautions are taken to prevent indirect effects.

TABLE 10.2 Existing State-Level Transmission Line Electric and Magnetic Field Limits*

AGENCY	JURISDICTION	60-Hz ELECTRIC FIELD LIMIT, kV/m Within R-O-W	60-Hz ELECTRIC FIELD LIMIT, kV/m At Edge of R-O-W	60-Hz MAGNETIC FIELD LIMIT, mG At Edge of ROW	COMMENTS
Florida Dept. of Environmental Regulation (1989)	69 kV and above, including substations	8 (≤230 kV) 10(500 kV)	2	150 (≤230 kV) 200 (500 kV) 250 (d.c. 500 kV) (a)	Codified regulation adopted after a public rulemaking hearing in 1989
Minnesota Environmental Quality Board (1976)	200 kV and above	8	None	None	Not codifed as formal regulation
Montana Board of Natural Resources and Conservation (1984)	Above 69 kV, with exception for lines 230 kV and below that are 10 miles or less (b)	7(c)	1 (d)	None	Codified regulation adopted after a public rulemaking hearing in 1984
New Jersey Commission on Radiation Protection (1981)	No formal transmission line routing process	None	3	None	Used only as a guideline for evaluating complaints
New York State Public Service Commission (1978 for E field) (1990 for B field)	125 kV and above and 1 mile or longer, or 100-125 kV and 10 miles or longer	11.8 7 or 11 (c)	1.6	200 (≤345 kV) (e)	Explicitly implemented in terms of a specified right-of-way width
North Dakota Public Service Commission	115 kV and above	9	None	None	Informal requirement
Oregon Energy Facility Siting Council (1980)	Above 230 kV, more than 10 miles, and routed through two or more political subdivisions	9	None	None	Codified regulation, adopted after a public rulemaking hearing in 1980

* Applied on a case-by-case basis unless otherwise noted

Notes for Table 10-2: (a) d.c. = double circuit (b) Exclusions/exemptions not specified
(c) At road crossings (d) Landowner may waive limit
(e) Interim standard

10.5.3 Subpart C - Electromagnetic Interference and Electromagnetic Compatibility (EMI/EMC)

The operator shall assure for maglev system design, construction, test and operation:

(a) Electromagnetic compatibility (EMC), by requiring equipment to limit generation of EMI to levels below established thresholds and by requiring that same equipment to operate in an environment where other equipment generates interference up to the threshold levels.

(b) Failure-free operation of safety-critical electrical and communication systems in the presence of EM radiation, or safe operability: (i) Measurements shall be performed to detect electromagnetic radiation from the maglev system that could directly affect public safety by disrupting communications or control systems external to the system (e.g., Orlando Airport tower to aircraft, or FAA facility communications, or military and civil space activities from the USAF and the NASA National Ranges near Orlando). (ii) Measurements of radiation from the external environment (such as airport radar or aircraft VHF radio or Microwave Landing System, MLS), that could disrupt internal maglev system operation, shall also be made. If any undesirable interference is detected, a frequency control or management program shall be designed and implemented.

(c) The ability to function, without causing other system failures (internal and external) of all individual safety-critical subsystems subjected to typical and worst-case levels of electromagnetic interference (EMI) . Likewise, that any electrical safety-critical system having several subsystems continue to function in the ambient electromagnetic energy emitted from other system components.

(d) That both the presence and consequences of electromagnetic interference and compatibility shall be examined and documented in pre-operational testing (see Part 3 (j)).

(e) That any electronic systems within maglev which could be susceptible to interference from other sources (including passengers' hand held communication devices, such as ham radios, cellular telephones, and portable PCs with modems) shall be properly shielded. Due to the requirement to connect to commercial electrical grids, all maglev facilities and components, including wayside communication substation shall be compatible with signal and communication systems that share the same utility right-of-way.

(f) Compliance with existing FCC and other requirements for EMI susceptibility to external communications devices and installations [4]

(g) Compliance with the EMI/EMC MIL-STD 461B and MIL-STD 462 requirements, and with other relevant professional societies guidelines (IEEE, ANSI, RTCA) with regard to both emissions and susceptibility limits, for safety critical systems. [5]

(h) Perform recommended FTA and other EMI/EMC tests (see Sec. 3j, Pre-Operational Verification and Testing) for moving and stationary subsystems, based on research performed to assess radiated electromagnetic emissions of rail transit vehicles. [6]

(i) The maglev designer/operator shall meet the following EMI/EMC safe operability requirements:

(1) Preparation of an EMI/EMC Plan consistent with the RW MSB requirements, for the specific Florida operating environment.

(2) Compliance with the FCC requirements in 49 CFR, Part 15 [4], or demonstrate equivalence.

(j) Documented compliance with the RW-MSB German Safety Requirements, Ch. 10 (in FRA/ORD/92-1)[7] Lightning Protection, EMC, ESD, Sec. 3 on EMC; and with other DIN VDE referenced standards (e.g. 1076) are assumed, in addition or equivalent to the US standards aforementioned.

10.5.4 Subpart D- Lightning/Electrostatic Discharge (ESD)

Maglev systems use electronic and computer equipment which must be electrically isolated from surges due to lightning. Lightning strikes to facilities, maglev vehicles, communications systems, and guideway are a potential threat to equipment and passengers.

Lightning/ESD protection shall address all adequate preventive measures so that lightning strikes shall have no critical or even catastrophic consequences for passengers, the vehicle, and the wayside power, control, and communication systems. Electronic and computer equipment and all electrical subsystems must be protected from surges due to lightning. On-board personnel and passengers shall not be injured by lightning penetrating the passenger compartment or other areas of the train. Lightning shall not cause fire, equipment damage, or loss of safe hover. Power failure should not result from damage to the power supply, power distribution, or long-stator propulsion systems. Furthermore, vehicle and guideway switch control should not be lost if any part of the train communication system, which includes radio links to and from wayside stations, is disabled by lightning. Means will need to be incorporated in the system to discharge static buildup from high speed movement before passengers are allowed to enter or exit the vehicle.

(1) The Vehicle and Guideway - The maglev designer/builder/operator shall:

(a) Provide adequate lightning/ESD protection measures to assure both equipment protection and passenger safety during a lightning stroke. These shall include the safe control, immediately following a stroke, of a vehicle regardless of speed. The effects of lightning/ESD shall be minimized by approved methods of electrical shielding and grounding.

(b) Assure that all electrical components embedded in, attached to, or in close proximity to any guideway propulsion, levitation, guidance or other (eddy current brake) magnet structure, which is part of a lightning discharge path, shall be protected against over-voltage and over-current. The protection systems shall limit lightning damage, if any, to the magnet components only, and shall prevent damage to equipment connected to those components. In all cases of levitation failure due to lightning strokes, the skids shall support the vehicle and allow safe braking regardless of speed.

(c) Observe the German requirements for lightning protection, as listed and discussed in the RW MSB, Ch. 10, Lightning Protection, EMC, ESD, Sec. 2, Lightning Protection and Sec. 4, ESD and supporting DIN VDE 1076 standards cited therein, which requires post-lightning inspection of guideway but not of vehicle.[7]. The vehiccle should also be inspected for lightning damage, and repaired as needed.

(d) Observe, in addition to the above, the FAA requirements for protection of aircraft safety critical electronics and flight systems against direct and indirect hazards associated with lightning, contained in 14 CFR, Part 25.581 (since maglev is analogous to flight in many respects). FAA Advisory Circulars 20-136 (AC 20-136) and 20-53A (AC 20-53A) shall be used for guidance to comply with these requirements. AC 20-53A complements AC 20-136 by providing guidance for testing and analysis of both direct and indirect effects due to lightning.[9]

(2) Wayside, Command, Control and Communications - The maglev designer/builder/operator shall:

(a) Assure that protection from adverse lightning/ESD effects is provided in a manner similar to those in FAA Standard 019b [8] , and the lightning protection and ESD codes of the National Fire Protection Association (NFPA) [10]. Compliance is also required with the provisions of State and local building codes applicable to maglev guideways, stations, wayside structures, and central control facilities.

(3) General - In addition to (or in lieu of) the above requirements, the maglev developer/designer/operator shall:

(1) submit the results of an impulse test (or its equivalent) to demonstrate that the maglev vehicle is able to resist safely the direct and indirect effects of a typical Orlando area lightning stroke (see § 3.9-j-2). An Triggerd Lightning Test has been developed by Sandia National Laboratories **[documented in a 9/26/92 Memo by A.E. Barrington, Volpe Center,to Maglev Safety Project File]**. The German equivalent Impulse Test and lightning-incurred damage assessment to guideway gap sensors has been described in Ref. 11.

(2) Demonstrate either compliance with, or equivalence of the applicable RW MSB provisions to, the above RW MSB, FAA, ANSI/IEEE and NFPA requirements in terms of lightning/ESD protection, indicating the conditions and methods for grounding the maglev vehicle to minimize damage.

10.5.5 Subpart E- Climatic Factors

(a) The operator shall provide documentation to enable FRA verification of safety under the rules and criteria in the Operational Plan, that the maglev operation could withstand maximal wind speeds and other storm damage (e.g. flooding) typical of Orlando area hurricanes, tornadoes, and other severe storms by:

(1) Defining the "safety envelope" for normal, restricted or shut-down operation for each environmental parameter (e.g. average wind speed, gust velocity spectrum and maximum, lateral vs head-on wind speeds). It is noted that design and operation ranges for environmental parameters were specified in several technical documents [7,12,13]. The probability of occurrence for severe hurricanes and tornadoes in the Orlando area, and their wind speed, directional characteristics and damage patterns have been described in reference [14].

(2) Describing the necessary weather warning and advisory network, environmental monitoring sensors and data stream processing, as well as justification for individual environmental parameter values and combinations thereof (e.g., both rain and wind, or both high precipitation rates and lightning frequency and intensity) under all foreseeable environmental conditions requiring restricted or interruption of operations, to enable verification of safety for rules and criteria in the Operational Plan.

(3) Providing results and analysis of Pre-Revenue Verification and Testing, as prescribed in § 3.9-j-1.

(4) Detailing both prevention and mitigation measures (e.g., in the unlikely event - means of snow and ice removal) and emergency response procedures (e.g., in case of hail storms, and unusual electric storms interfering with communications and control systems) of adverse environmental impacts on maglev operation.

(b) Unusual types and amounts/ rates of precipitation shall not affect the operational safety of maglev system operation, nor undermine guideway support pillars and facilities foundations:

(1) Snow, Sleet and Hail: The design of vehicle and guideway components shall include measures for protection from damage due to snow, sleet and hail. Equipment used to detect the dangerous buildup of ice and snow on the guideway is also to monitor the buildup of sleet and hail. The system shall be designed to either accommodate or mitigate a continuous maximum sleet, snow, hail, or equivalent water precipitation. Means for removal of snow/sleet/ice buidup from vehicles, before entering service, will be required to eliminate snow, sleet and ice shedding onto any shared right-of-ways.

(2) Rain: A means for determining rainfall rates along the guideway is to be included in the system's overall weather monitoring scheme. Safety-critical systems shall remain fully operational and reliable under any rainfall level where vehicle operations are permitted. Associated requirements include: Adequate drainage capacity are to be available to prevent any buildup or pooling of water on the guideway for the specified minimum rain rate. Control, surveillance and communication sensors and antennas are to be adequately protected from the rain, and properly designed to accommodate the electromagnetic atmospheric propagation losses that occur for this same rain rate. Static electrical charges generated by the passage of the vehicle through rain will be safely discharged.

(c) The operator shall install interior climate control system within the maglev vehicle in order to provide a protective, safe and comfortable environment for passengers (e.g., clean air, hotel power sufficient to provide HVAC or heat, ventilation, light and air conditioning in case of power grid failure).

(d) Thermal Effects

(1) The maglev system design shall be capable of safe operation at the temperature extremes and temperature gradients experienced in Florida within elements of both the vehicle and the guideway.

(2) Sensors and other electronic devices shall be designed to operate within the full range of environmental temperatures for operation. Such equipment shall be protected by adequate ventilation, shielding from solar and other sources of radiation, and, where necessary, cooling and heating to keep local ambient temperatures within the range specified by the manufacturer.

[Note: Check for overlap with Part 5, Guideway, and remove if needed:

(3) Temperature extremes and temperature gradients, which may induce thermal loads and associated misalignment in the guideway structure, shall be monitored during Pre-revenue testing (see Part 3h). The support structure shall not be adversely affected by thermally induced stresses and deflections, and shall avoid less comfortable ride, or undesirable safety impacts. Likewise, adequate design shall prevent buckling, tensile fracture and fatigue failures at the guideway attachment points.

(4) The guideway design shall include a thermal analysis which accounts for heat transfer due to short and long wave radiation, conductivity, convection and eddy current heating. (including the heat pulse due to operating the emergency eddy current brake.[15] Diurnal solar loading of the guideway shall be computed [e.g,. by using an approach equivalent to that in Ref. 16] . The diurnal air temperature trace used in the analysis shall be based on local meteorological records, and represent the worst-case 24-hour temperature change that can be expected to occur once in 50 years in Florida.

(5) Consideration shall be given to the use of reflective surface coatings and the control of installation temperatures during the construction process to avoid or minimize adverse thermal effects. The NMI study on Thermal Effects in Maglev Guideway Structures study (BAA 106) and the American Concrete Institute standards [17] shall be consulted, where appropriate, for proper thermal design practices.

10.5.6 Subpart F- Seismicity

The probability of occurrence for earthquakes in the Orlando area, and their historical damage patterns have been described in references 12-14. The stability to seismic events and to other basement collapse (e.g., sinkhole formation) of the guideway and other maglev facilities (e.g. power supply substations and distribution system) must be assured, primarily by utilizing correct design principles and structural materials.

(a) During a design-level earthquake, a maglev guideway shall remain stable and perform within its elastic material limits, and all vehicles shall be capable of stopping safely and remaining on the guideway.

(b) Guideway design, as a minimum, shall satisfy those guidelines provided in the American Association of State Highway and Transportation Officials (AASHTO) and the most current revision to the Applied Technology Council (ATC) for seismic protection of highway bridges [18]. Seismic Performance Category "B" shall be adhered to as a minimum design requirement.

(c) Site specific maglev system and facilities designs shall:

(1) Satisfy the seismic performance category appropriate to the region in which the guideway is to be built;

(2) Avoid crossing known faults and seismically active areas;

(3) The ASCE standard for minimum design loads for buildings and other structures [19] shall be consulted for seismic loading of ancillary structures, such as stations, with "Zone 2" as defined there for minimum design.

(d) In addition to the above standards, the designer shall use, where appropriate, guidelines referenced in [20] and the DOT/FRA reports on the Safety of High Speed Maglev Systems (DOT/FRA/ORD-92/01 and 92/02), the German High-Speed Maglev Trains Safety Requirements study [7], and the German standards for guideway forces (DS 804, DS 899/59, DIN 1072 and UIC 651).

(e) The design shall include means for monitoring guideway and ground motion, and the alignment of critical guideway surfaces.

(f) A plan or strategy for integrity assurance of the guideway and other safety critical structural elements (e.g., power substations, switches, central control facility) shall be submitted as part of the structural design.

§ 10.7 Enforcement of Existing and Interim Regulations

[NOTE: Dan's edit wanted Enforcement section out, although the original outline required it, and Phil's edit left it in. There was a similar disagreement regarding Applicability section, which I have now removed. If the RCC Part 1 addresses every Part's enforcement aspects, some specifics could be moved to there.]

10.7.1 Subpart A- General

(a) The maglev designer/builder/operator shall provide all necessary technical documentation to the FRA regarding:

(1) the definition of normal and abnormal operating environment conditions;

(2) test results and analysis of system performance under both normal and abnormal environmental conditions.

(b) The conduct of audits, documentation reviews and inspections shall be facilitated, as necessary. The objective of such audits is to enforce this Rule of Particular Applicability, and to ascertain that the safety of the public, employees and maglev operations will be assured under all probable and possible environmental conditions.

(c) An audit shall involve not only access to documentation (e.g., System Safety Program Plan as described in Part 2, EMI/EMC Plan, Test results and in Part 3, Pre-Revenue verification and Testing), but also review of: maintenance and inspection practices after severe storms, procedures for inspection of guideway pillars and foundations, of guideway alignment, debris clearance, check-out of electrical systems, etc.

(d) Civil penalties, ranging from warnings to suspending operations and assessing fines, shall be assessed and applied by the FRA as appropriate, in case of:

(1) lack of cooperation with federal inspectors (by withholding information, wilful obstruction);

(2) finding of noncompliance with any of the safe operability requirements above, during any unscheduled or scheduled inspection or investigation following accidents;

(3) any complaint and subsequent finding of gross negligence, or willful misconduct jeopardizing the public safety.

(e) The operator shall provide to the FRA on request all and any available technical documentation and records (such as the basis and rationale for the design and operating rules, and pre-operational tests results) related to EMF and EMI/EMC safety issues, or face penalties.

10.7.2 Subpart B- EMF Emissions and Exposure

(a) The operator shall observe all above EMF requirements (IRPA/NIRPA, ACGIH, IEEE), and provide to the FRA proof of compliance.

(b) Compliance with the existing State of Florida limits on electric and magnetic fields at the center and at the edge of right-of-ways for high-voltage power transmission lines (Table 10-2) associated with the maglev system, facilities and operation shall not come under the FRA enforcement authority, but under appropriate Florida departments.

10.7.3 Subpart C- EMI/EMC

(a) The operator shall provide to the FRA technical measurements data and proof of compliance with the EMI/EMC Test Plan and other requirements specified in Parts 3 and 10.7, or face civil penalties.

[same or similar language as above for D, E and F, or all covered in General?]

10.7.4 Subpart D- Lightning/ESD

10.7.5 Subpart E- Climatic factors

10.7.6 Subpart F- Seismicity

End Notes for Part 10

[1] The IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines (ANSI/IEEE Std 644-1987) shall be used as a guide for performing Extra Low Frequency (ELF) measurements. Definitions of frequency bands should conform with IEEE Standard Dictionary of Electrical and Electronic Terms, ANSI/IEEE 100-1988, 4th Edition, IEEE, New York, NY.

[2] 1991-1992 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents, and Biological Exposure Indices]:

[3] IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (IEEE C95.1-1991, Revision of ANSI C95.1-1982)

[4] (a) Code of Federal Regulations, Title 47, Telecommunications, Part 15, Radio Frequency Devices, Federal Communications Commission, Office of the Federal Register, National Archives and Records Administration. October 1, 1990; and (b) Ball, W.C and C.K. Poarch, Telephone Influence Factor (TIF) and its Measurement. Paper 60-1195. Originally presented at AIEE Fall General Meeting, Chicago, IL, October 9-14, 1960.

[5] (a) Department of Defense, Military Standard: Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference (MIL-STD 461B). Washington, DC. April 1, 1980];

(b) the American National Standards Institute Society (ANSI) Standard C63.4 [American National Standards Institute (ANSI), American National Standard: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 1 kHz to 1 GHz (ANSI C63.4-1980), ANSI and IEEE, New York. May 1980];

(c) IEEE Standard 302-1969 [Institute of Electrical and Electronics Engineers (IEEE), Standard Methods for Measuring Electromagnetic Field Strengths for Frequencies below 1000 Mz in Radio Wave Propagation, Standards 302-1969. Revised and Redesignated in 1991: Field Strength in Radio Waves Propagation. Standard 291-91].

[6] (a) C. Edelson, Sing, F., and F. Holmstrom, The UMTA Rail Transit EMI/EMC Program: Overview and Summary. Prepared for UMTA, U.S. DOT by RSPA/TSC, Cambridge, MA. Final Report, Report No. UMTA-MA-06-0153-85-4. February 1987;

b) Holmstrom, F.R. and C. Edelson, Radiated Interference in Rapid Transit Systems, Volume I: Theory and Data. Prepared for UMTA, U.S. DOT by RSPA/TSC, Cambridge, MA. Final Report, Report No. UMTA-MA-06-0153-85-10. April 1988;

c) Holmstrom, F.R, Radiated Interference in Rapid Transit Systems, Volume II: Suggested

Test Procedures. Prepared for UMTA, U.S. DOT by RSPA/TSC, Cambridge, MA. Final Report, Report No. UMTA-MA-06-0153-85-11. June 1987.

[7] RW MSB, High Speed Maglev Trains; German safety Requirements. DOT/FRA/ORD-92/01 and DOT-VNTSC-FRA-92/1, January 1992, Ch. 10, Lightning Protection, EMC, ESD, Sec. 2, Lightning Protection and Sec. 4, ESD

[8] FAA a) CFR Title 14 Part 25.581, Lightning Protection of Flight Critical/Essential Electrical and Electronic Systems.
b) Lightning Protection, Grounding, Bonding, and Shielding Requirements for Facilities.. FAA-STD-019a, 9/26/85

[9] a) AC 20-136 Advisory Circular: Protection of Aircraft Electrical Electronic Systems against the Indirect Effects of Lightning;
b) AC 20-53A [Advisory Circular: Protection of Airplane Fuel Systems against Fuel Vapor Ignition due to Lightning.

[10] National Fire Protection Association (NFPA), Batterymarch Park, Quincy, MA 1990.:
a) NFPA77, Static Electricity.
b) NFPA 78, Lightning Protection Code, 1990

[11] "Lightning Current Paths and Their Damaging Effect on the TR-07", Thyssen Henschel Report No. 921128-0316, or NTL/1725/08/91.

[12] Thyssen Henschel "System Specification, Environment, Florida Project", NTP/2572/11/91.

[13] "Requirement Specification Overall System", NVS/1433/07/91, Sec 2.4 on Ecological Requirements.

[14] "Evaluation of the Probability of Occurrence of Earthquakes, Hurricanes and Tornadoes in the Vicinity of Orlando, FL", 1992 TMS report for VNTSC.

[15] CIGGT Report 86-13, Title? Vol? Fig. 8.1-2.1 provides an approach to modeling thermal gradients between the top and bottom of a bridge deck appropriate for the guideway support span.

[16] a) Thermal Effects in Maglev Guideway Structures, National Maglev Initiative BAA 106, Contract Number DTFR53-91-C-00077, Foster-Miller Corp., 1992, Waltham, MA.
b) Shapiro (AFGL-TR-87-0200) provided a method to predict diurnal solar loading effects on structure, which is in use by the Army Corps of Engineers.

[17] American Concrete Institute's Standards on Guideway and Bridge Design:
a) Analysis and Design of Reinforced Concrete Guideway Structures, ACI 358.1R-86, American Concrete Institute, 1986.
b) Analysis and Design of Reinforced Concrete Bridge Structures, ACI 343R-88, American Concrete Institute, 1988.

[18] American Association of State Highway and Transportation Officials (AASHTO) a) Standard Specification for Highway Bridges, 14th Edition,1989, Sect. 3.21.
b) " Guide Specifications for Seismic Design of Highway Bridges"; c) ATC 3-06 (NBS SP 510), "Seismic Design Guidelines for Highway Bridges", Applied Technology Council, 1981, Berkeley, CA.

[19] "Minimum Design Loads for Buildings and Other Structures", ANSI/ASCE 7-88, American Society of Civil Engineers, 1990, NY, Sect. 9 and Sect. 9 of the "Commentary".

[20] a) Section 2312 of Uniform Building Code, International Conference of Building Officials, 1985, Whittier, CA, Library of Congress Catalog No. 84-62480.
b) American Railway Engineering Association (AREA), Manual for Railway Engineering, Vols. I and II, 1990, Washington, D.C.

PART 11: EMERGENCY PREPAREDNESS

SUBPART A GENERAL

§ 11.1 BACKGROUND

Emergency preparedness focuses on the ability of the operating system organization to respond effectively to emergencies in a manner which protects the traveling public and system equipment and facilities. The level of the Florida Maglev Demonstration Project system preparedness will directly influence the severity of passenger casualties and/or system damage in an emergency. Coordination of response planning with local, regional, state, and other agency emergency response organization personnel is essential to ensure timely and effective response and minimize the consequences of an emergency.

§ 11.3 PURPOSE AND SCOPE

This part describes minimum standards for the development, documentation, and implementation of an emergency preparedness program by the Florida Maglev Demonstration Project. The intent of these standards is to assure that the system operator possesses the ability to respond to emergencies in a manner which minimizes the consequences. The standards address response planning and procedures, proper training of system operating organization and emergency response personnel, and provision of necessary equipment.

§ 11.5 REFERENCES

(a) The FRA has issued "Recommended Emergency Preparedness Guidelines for High Speed Rail and Maglev Trains." This guideline document contains extensive reference information and provides detailed recommendations for emergency planning and procedures and training programs. This guideline document is cited as a reference in several sections of this Part. **[Note: while the vehicle and facility emergency equipment and systems are also included in the Guidelines, they are disucssed in terms of recommendations rather than the specific requirements described in Subpart D of this part.]**

(b) The National Fire Safety Association has issued a standard "Fixed Guideway Transit Systems" (NFPA 130). This standard contains additional reference information and is cited in several sections of this Rule.

SUBPART B EMERGENCY PLANS AND PROCEDURES

§ 11.7 GENERAL

(a) The Florida Maglev Demonstration Project shall develop, document, and implement an emergency preparedness plan.

(b) The plan shall identify the overall capabilities of the Florida Maglev Demonstration Project system in terms of the planned response of operating system personnel and emergency response organization personnel, mobilization of the actual response to emergencies, and recovery from emergencies and restoration of normal operations.

(c) The plan will include the following elements: policy, scope, operating system functions and responsibilities, coordination agreements with emergency response organizations, procedural guidelines for specific emergencies, general response capability criteria, and supporting documentation.

(d) The plan shall identify participating emergency response organizations and jurisdictional boundaries.

(e) The plan shall contain a description of operating system and emergency response system personnel training programs related to emergency procedures and the use of emergency equipment.

(f) The plan shall contain a description of system emergency systems and equipment and their location.

(g) Copies of the plan shall be provided to designated command and response personnel for each located within the jurisdictional boundaries in which the Florida Mavlev Demonstation Project system operates.

(h) The operating system shall review and adapt as appropriate the recommendations contained in the FRA emergency guidelines previously cited. **[Don't know exactly how to word this, it's not a strictly a requirement, but a resource]**

§ 11.9 PROCEDURES

(a) As a minimum, the plan shall address the following activities:

(1) Reporting the emergency.

(2) Evaluating and establishing the parameters of the emergency.

(3) Notifying emergency response organization personnel.

(4) Dispatching operating system and emergency response personnel and equipment to the emergency site.

(5) Coordinating the activities of all response personnel.

(6) Protecting passengers, personnel, and equipment at the emergency site.

(7) Evacuating passengers, if necessary.

(8) Consideration of the special needs of elderly and disabled persons.

(9) Keeping passengers (and their families), operating system and emergency response personnel, and other agencies informed.

(10) Restoring normal operations.

(b) As a minimum, the plan shall describe procedures for the following types of emergencies:

(1) Passenger Fall or Illness.

(2) Mechanical or electrical failure or malfunction.

(3) Unplanned stop by train between stations or safe stopping areas.

(4) Collision/impact with object or obstruction.

(5) Vehicle, Guideway or other system fire.

(6) Collision with fire.

(7) Severe climatic conditions and natural disasters (snow [unlikely but is possible], freezing conditions, heat, high winds, flood, earthquake, etc.).

(8) Evacuation from elevated guideway segments.

§ 11.11 GENERAL RESPONSE CRITERIA

(a) As a minimum, the operating system plan shall address the following key response areas:

(1) Notification

(2) Communications

(3) Removal of power from vehicles

(4) Ventilation.

(6) Evacuation.

(7) Fire Fighting.

(b) The operating system shall formulate a decision-making process to determine the relative effectiveness of actions when passengers are involved in an emergency. As a minimum, the decision-making checklist contained in the FRA Emergency Guidelines provides suggested baseline questions which should be answered to ensure effective and timely response.

(c) The FRA Emergency Guidelines document contains additional reference material useful in developing and implementing emergency plans and procedures.

SUBPART C TRAINING

§ 11.13 GENERAL

The Florida Maglev Demonstration Project shall prepare and implement formal training programs which provide:

(a) operating system personnel with knowledge of the system emergency response plan and procedures, emergency systems and equipment, and emergency vehicles.

(b) Emergency response organization (Fire, Police, etc.) personnel knowledge of their own emergency plan and maglev system emergency plan and procedures; their own vehicles and equipment; and operating system vehicles, facilities, and emergency vehicles.

(c) Passenger awareness of operating system emergency plan and procedures, and system emergency equipment.

§ 11.15 OPERATING SYSTEM TRAINING

(a) All operating system personnel shall be provided with familiarization training in emergency procedures and use of equipment associated with their assigned duties, as part of initial operational training.

(b) All train operators/attendants and Central Control facility personnel shall attend specialized training sessions which include specific hands-on instruction in the use of appropriate emergency procedures and correct operation of equipment. These specialized training sessions shall be designed to teach employees the use of procedures and equipment they will be expected to carry out during an actual emergency:

(1) Utilization of the various communication capabilities, including direct phone line between Central Control and the fire alarm center and radio links between the fire alarm center and firefighters at the scene of the fire or at Central Control.

(2) Familiarity with use, application, and location of appropriate extinguishing equipment. (And procedures for reporting used and missing fire extinguishers, in order to ensure that they can be promptly refilled or replaced if missing.)

(3) Recognition and immobilization of passengers with head and back injuries; first aid treatment of hemorrhages, bruises, abrasions; cardio-pulmonary resuscitation (CPR); and treatment of respiratory blockages and convulsions.

(4) Location of ladders, access walkways, slides, and other evacuation devices as well as the correct procedures their use.

(5) Procedures for emergency evacuation of elderly and disabled passengers.

(6) Procedures for crowd control and panic prevention

(c) All train operators/attendants and Central Control facility personnel shall attend refresher and/or retraining on a yearly basis. This training shall:

(1) Inform employees of changes in procedures and equipment.

(2) Ensure that employee skills remain at a level which enables them to execute their responsibilities in an effective manner.

(3) Reinforce a segment of the program for an individual who has not performed properly.

(4) Recertify personnel in job positions (e.g., train operators/attendants).

(d) Training of personnel shall be conducted as necessary to cover shift assignment changes, area rotations, etc.

(e) The FRA Emergency Guidelines document contains additional reference material useful for developing and implementation operating system training programs.

§ 11.19 EMERGENCY RESPONSE ORGANIZATION TRAINING

(a) The operating system shall make training available to firefighters, local police, ambulance personnel/paramedics, and other emergency response personnel, in accordance with its "Inter-Organizational Emergency Procedures Agreement."

(1) The operating system shall provide the upper management staff of emergency response organizations with information regarding the coordination of activities associated with maglev emergencies.

(2) The operating system shall make training available for emergency alarm center personnel (fire/rescue dispatchers).

(3) Training shall include an overview of the operating system including orientation and familiarization with vehicles, facilities, equipment, and normal and emergency operating procedures. The following subjects shall be included:

(i) Utilization of the various communication capabilities, including direct phone line between Central Control and the fire alarm center, and radio links between the fire alarm center and firefighters at the scene of the fire or at the Central Control facility.

(ii) Emergency drills and exercises involving all participating organizations to practice and reinforce emergency response and evacuation procedures.

(b) Training of personnel shall be conducted as necessary to cover shift assignment changes, area rotations, etc.

(c) The FRA Emergency Guidelines document contains additional reference material useful for developing and implementing emergency response organization training programs.

§ 11.21 REFRESHER TRAINING

Refresher training shall be conducted to:

(a) Inform employees of changes in procedures and equipment.

(b) Ensure that employee skills remain at a level which enables them to execute their responsibilities in an effective manner.

(c) Reinforce a segment of the program for individuals who have not performed properly.

(d) Recertify personnel in job positions (e.g., train operators, Central Control staff).

(e) The FRA Emergency Guidelines document contains additional reference material useful for developing and implementing emergency response organization training programs.

§ 11.23 EMERGENCY DRILLS AND EXERCISES

(a) Drills and exercises shall be conducted to reinforce classroom training in emergency response and passenger evacuation for its own personnel, as well as for emergency response organization teams that would respond in the event of an emergency.

(b) Drills and exercises shall include programs which teach personnel to identify the emergency and distinguish its unique demands, and to follow through with the appropriate responses.

(c) Frequency

(1) Drills and exercises shall be conducted prior to the start-up phase operations of any new extension.

(2) Drills and exercises shall be conducted at least once every year to ensure that all new operating system and emergency response personnel are familiar with the characteristics of operating system vehicles, facilities and emergency equipment. This frequency shall permit testing of new techniques, procedures, and equipment.

(d) Drills and exercises may be held during revenue service or non-revenue service periods (if they exist). These may be general notice drills, employee notice drills or no notice drills, depending on how many operating system and emergency response personnel, and passengers are informed beforehand.

(e) Drills and exercises shall be planned so as to minimize hazards which could create an actual emergency or cause injuries.

(f) Drills and exercises shall test the system's emergency communication, response and evacuation capabilities and procedures, and the operability and effectiveness of emergency equipment.

(g) Drills and exercises shall test any changes in operating and training and retraining procedures.

(h) A formal critique/evaluation process shall be used to maximize the value of the drill/exercise during its conduct. The following questions shall be answered:

(1) How long did it take for the first emergency response unit to arrive at the emergency scene.

(2) Were instructions audible and clear?

(3) What standard operating system or emergency response organization techniques could not be used because of the special characteristics of the vehicle or passengers.

(4) Did passengers get the appropriate help needed to evacuate the vehicle?

(5) How long did it take to completely evacuate the vehicle and/or extinguish a vehicle fire?

(6) What new techniques were improvised;

(7) What improvements could be made in the coordination of operating system personnel and the other participating organizations.

(8) What improvements to the operating system and emergency response organization procedures and/or emergency equipment are necessary.

(9) What special equipment might have been useful had it been available.

(10) What kinds of training might increase the preparedness of responding personnel.

(i) The FRA Emergency Guidelines document contains additional reference material useful for planning emergency drills and exercises.

§ 11.25 PUBLIC AWARENESS

(a) Passenger education and training should be conducted to make passengers aware of emergency procedures and enable them to respond properly in the event of an emergency.

(b) The operating system shall employ the following methods to improve the public's ability to respond to emergencies:

(1) Public involvement in emergency drills and exercises.

(2) Maglev safety and emergency procedures for passengers publicized on posters in stations and vehicles.

(3) Safety brochures for public dissemination.

(c) Information from these various sources must be consistent in content, sufficient for first-time users of the system (especially from posters), but not so overwhelming as to arouse undue concern.

(d) Passenger emergency preparedness training shall include information on:

(1) How to recognize and immediately report emergency situations to transit employees.

(2) How to recognize potential system hazards (fires, passage between car sections, etc.).

(3) How to recognize and operate appropriate emergency-related facility features and equipment, such as:

(i) Vehicle intercom to train operator.

(ii) Vehicle fire extinguishers.

[HOW MUCH OF BELOW SHOULD WE INCLUDE under passenger training requirements?

(iii) Vehicle side doors.

(iv) Vehicle end doors.

(v) Ladders, walkways, and slides for facilitating vehicle evacuation.

(vi) Devices for assisting evacuation and rescue of elderly and handicapped passengers.

(vii) Station emergency phones.

(viii) How to recognize and anticipate the potential special needs of fellow passengers (children, elderly, handicapped, etc.) during emergencies.

(e) The FRA Emergency Guidelines document contains additional reference material useful for developing and implementing passenger education and awareness.

SUBPART D EMERGENCY SYSTEMS

§ 11.27 VEHICLE

(a) Each passenger section shall have a first aid kit and rescue tools provided in locations which are clearly visible and labeled, yet protected from unauthorized use.

(b) Emergency Communications

(1) Passenger sections shall be equipped with an intercom system which allows persons to communicate with the on-board operator/train attendants and/or Central Control.

(2) This system as well as the public address system noted in Part 4, Subpart D, section 4.37.5 should be capable of operating in the case of normal power failure. ?

(c) Emergency Lighting

(1) Emergency lighting must be provided in vestibules and throughout aisles of sufficient number and wattage to adequately illuminate the interior of passenger sections for safe exit.

(2) Doors and openings designated as emergency exits must be provided with emergency lights.

(3) Emergency lighting shall consist of auxiliary lights housed in standard lighting fixtures or in supplementary fixtures and shall be activated automatically if the main power fails.

(4) Interior passenger car section lighting shall be capable of operation for at least 30 minutes following loss of the normal vehicle power supply.

(d) Emergency Access/Egress

(1) Each passenger car section shall be equipped with at least four emergency openings in addition to normal entry doors. Removal of the openings shall be capable of being accomplished from either inside or outside of the car section.

(2) Each door shall be capable of manual operation by both interior and exterior controls.

(3) Each passenger car section opening or door which can be used as an emergency exit shall be clearly marked by an emergency exit sign on both the outside and inside of the car section. Each emergency exit shall have instructions for its use clearly posted, on or next to the exit.

(4) Each passenger car section shall be equipped with equipment which enables passengers to evacuate from the vehicle to a point of safety within 30 minutes.

(i) The design and implementation of the evacuation equipment shall be coordinated with the local emergency response organizations, i.e., fire department, other rescue units, and police.

(ii) Equipment shall be provided which permits the evacuation of mobility-impaired persons.

[NOTE: This addresses the worst case of the vehicle not being able to reach a safe stopping area. What is the answer on bridges over highways or water, or if the guideway is more than 9 m (@ 30 ft) above ground See Guideway.]

(e) Vehicles shall be equipped with fire extinguishers which comply with the requirements contained in Part 4, Subpart D, section 33 of this Rule.

(f) Emergency lighting and communication systems shall be independent of the normal vehicle control and power supply system. **[How relate to battery?]**

§ 11.29 GUIDEWAY

As proposed for the Florida Maglev Demonstration Project, the majority of maglev guideway segments will be elevated. However, certain segments may be located at grade. The location of the maglev vehicle and guideway on an elevated or at grade structure affects the safety of passengers during an emergency evacuation.

(a) The operating system shall work together with local emergency response organizations to ensure that passenger evacuation can be accomplished, considering the entire local operating environment.

(1) As a minimum, access for emergency response organizations, egress for passengers, emergency lighting, ventilation, communications, graphics, and support equipment (i.e., access tools, fire extinguishers, etc.) shall be provided.

(2) Guideway segments located over lakes, swamps or wetlands, and on overpasses over highways shall be provided with designated stopping places which permit exiting to a point of safety.

> **NFPA 130 requires that a walk surface or other suitable means of egress be provided so that passengers can evacuate from a train at any point along a guideway and reach a station or wait for an evacuation train to arrive.**

(b) In the event of a breakdown or emergency between stations, the vehicle is required to maintain safe hover long enough to reach a station or designated stopping place **[Chapter 12 of RW MSB]**. The designated stopping places are required to allow danger-free egress options for persons in an emergency and shall meet the following requirements:

(1) Designated stopping places are required at specified **(? what distance, it's dependent on design capability to reach stopping place)** intervals along the maglev guideway. **[Chapter 12 of RW MSB]**

(2) Designated stopping places shall be located before danger points (e.g., open guideway at a bending switch) and between stations if the vehicle has insufficient kinetic energy to reach the next station in the event of an breakdown. **[Chapter 12 of RW MSB]**

(3) The egress areas at the designated stopping places shall be long enough to allow passengers to exit by way of all external train doors on one side. Variability of the programmed stop must be considered when determining the length of the stopping area necessary. **[Chapter 12 of RW MSB]**

(4) Stationary energy supplies shall be located at the designated stopping places **[Chapter 12 of RW MSB]**

(5) The length of the acceleration areas adjacent to the stations shall also be capable of being used for egress. **[Chapter 12 of RW MSB]**

(6) The designated stopping places shall meet the requirements for communications and access points for rescue services contained in Chapter 12 of the RW MSB. **(Would prefer to add requirements from NFPA 130 by reference:**

NFPA Fixed Guideway Transit Systems (NFPA 130) describes requirements exit doors and hatches, emergency lighting, fire extinguishers, standpipes, etc.

NFPA 130 requires that hinged or sliding access gates for surface trainways to be provided in security fences as deemed necessary by the local authority. These gates are to be two exit units wide, and the route and location of each gate must be clearly identified on or adjacent to the gate.

NFPA 130 requires that access to elevated trainways be from stations or mobile ladder equipment from roadways adjacent to the trainway. If no adjacent or crossing roadways exist, access roads must be provided at a maximum of 762 m (2,500 ft) intervals. If security fences are used, they must meet the same requirements as those for surface trainways, and graphics must be legible from the ground level outside the trainway.

NFPA 130 requires that system egress points for surface and elevated sections of the trainway be illuminated and meet detailed requirements, including NFPA 101, Life Safety Code, and the NFPA National Electrical Code.

(7) Designated stopping places shall be monitored and safeguarded against unauthorized access and boarding.

(c) An emergency (unplanned) stop may occur between designated stopping places. In the worst case, vehicle emergency braking could occur outside the egress area of a station or after restart from a designated stopping place.

(1) Depending on the location of the unplanned stop, i.e., at grade, on a bridge, or on an elevated guideway segment, one of the five evacuation options described in Chapter 12 of the RW MSB shall be used for passenger egress.

(i) Ladders transported on the vehicle can be used for at-grade, i.e, less than 1.5 m (5 ft), passenger evacuation.

(ii) For elevated guideways up to 20 m (66 ft), passenger evacuation will be onto parallel platforms with at least one stairway at each end.

(iii) For elevated segments which are 1.5 m (5 ft) to 9 m (30 ft) high, rescue slides are an alternative, if the terrain allows.

(iv) For elevated guideway segments greater than 20 m (66 ft) or from special structures such as bridges, passengers will disembark onto widened bridge supports.

(2) If the entire guideway or individual line segments are considered for use as a stopping place, evacuation options shall be provided for the entire segment in accordance with the requirements for designated stopping places (b). In addition:

(i) A line telephone linked to central control shall be provided at 500 m (1,650 ft) intervals. **[Shall this be provided at designated stopping places as well? not specifically called for in RW MSB]**

(ii) A third rail be provided on the guideway for connection to the vehicle to maintain auxiliary power after the train stops.

(iii) Options which could be considered acceptable for maglev vehicle evacuation include rescue trains, lifting platforms, and rescue boats. These options shall be coordinated with local emergency response organizations.

(iv) Alternative means of rescue for acceleration areas must be kept in or near stations. If they are kept outside the station, a permanent parallel road shall be built along the egress area.

(v) A means to evacuate elderly and disabled passengers shall provided.

§ 11.31 STATIONS

Stations provide the capability to evacuate passengers from a maglev train in an emergency and a means of access for emergency response personnel to a maglev train and the guideway.

[Several chapters of the RW MSB (including Chapter 12) specify safety requirements for stations related to emergencies. The RW MSB glossary defines the station as having a platform for normal operational passenger boarding and disembarkation, which corresponds to the length of the train. Additional installations, provided in both approach directions beyond the length of the platforms, are to be used to evacuate passengers, if necessary, and to provide access to repair personnel.

Stations are defined in the RW MSB as designated stopping points. We could just reference the requirements contained in the guideway section above. However, I believe that the NFPA 130 code should be referenced. There is an interface between the train and the station. The station might not be a point of safety unless exits are provided, and communications, firefighting, and lighting systems and equipment are also provided. NFPA 130 is an easy way to ensure station safety in terms of emergencies. Local building codes do not consider the unique aspects of transportation station platform design. See attached text. The following items are examples of station-related emergency preparedness

(a) Number, marking, and location of station emergency egress points

(b) Station lighting to identify normal and emergency exits

(c) Stations access for emergency response personnel.

(d) Means of communicating with central control staff and with passengers

(e) Means of evacuating individuals with disabilities.