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Code of Record

MARVEL Project Code of Record

The INL is a U.S. Department of Energy National Laboratory
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CONTENTS

1. SCOPE

This Code of Record identifies the codes, standards, and procedures necessary to design, develop, construct, and startup the Microreactor Applications Research Validation and Evaluation (MARVEL) Project at the Materials and Fuel Complex (MFC) Transient Reactor Test (TREAT) Facility and the Idaho National Laboratory (INL). The MARVEL Project is an INL test microreactor funded by the United States Department of Energy (DOE) via the Microreactor Program (MRP). The goal of the project is to establish an operational nuclear applications test bed that can generate combined heat and power to enable integration and R&D with end-user technologies, as well as allow microreactor technologists to test next-generation control systems. The microreactor is a thermal reactor utilizing Uranium Zirconium Hydride (UZrH) fuel with review and authorization by the Department of Energy Idaho Operations Office (DOE-ID) for National Environmental Policy Act (NEPA) compliance, safety review, and supplemental readiness assessments for startup and operation. To enable rapid deployment, the MARVEL reactor will reside in the Transient Reactor Test (TREAT) Facility and utilize the existing operating Category B reactor facility, approved facility safety basis, operating crews, and recent re-start experience.

Consistent with U.S.DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, DOE Order 420.1C, *Facility Safety*, and DOE-STD-1189, *Integration of Safety into the Design Process* for nuclear facilities, a project Code of Record (COR) is being developed. DOE O 420.1C distinguishes between an invoked standards, which is specifically listed in DOE O 420.1C and an applicable standard, which is an applicable DOE technical standard or industry code or standard for which it has been determined by the contractor that it will be used or will be applied for a specific facility/site to meet the design, construction, and operational requirements described in this DOE O 420.1C. DOE O 420.1C invoked standards are:

- DOE-STD-1189-2016, *Integration of Safety into the Design Process*
- DOE-STD-3007-2017, *Preparing Criticality Safety Evaluations at DOE Nonreactor Nuclear Facilities*
- Institute of Electrical and Electronics Engineers (IEEE) 379-2014, *IEEE Standard for Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems,*
- IEEE 384-2008, *IEEE Standard Criteria for Independence of Class IE Equipment and Circuits*
- IEEE/IEC 60780-323, *IEC/IEEE International Standard – Nuclear Facilities – Electrical Equipment Important to Safety – Qualification*, 2016 Edition.

2. LIMITATIONS

This Code of Record does not govern the activities of the TREAT Facility nor the TREAT microReactor EXperiment Cell (T-REXC) project.

2.1 ASME Code Exceptions and Equivalencies

There are no code exceptions to construction of the MARVEL reactor in the traditional sense, meaning there are no technical aspects that fail to meet a code requirement. However, due to the novel design of the MARVEL reactor, not every aspect or system can be precisely covered by the existing ASME Boiler and Pressure Vessel Code. In those cases, which are identified below, (with concurrences received) the ASME Boiler and Pressure Vessel Code is applied as follows.

2.1.1 Guard Vessel

The category in Division 5 that best describes the Guard Vessel function is a Class B pressure vessel, which is equivalent to Division 1 Class 2 pressure vessel. Therefore, the best fitting design and analysis criteria for the guard vessel are in Section III Division 5 Subsection HC Subpart B, using the rules for elevated temperature pressure vessels containing hazardous substances.

HCB-3310(b) states the HCB design criteria do not explicitly address fatigue damage from cyclic service in the creep regime. Ratcheting analysis and creep fatigue analyses will be performed according to guidance in subsection HBB. The use of HBB-3200 will be for the fatigue analysis only, with the balance of the analyses as well as the material, design, fabrication and installation, examination, testing and overpressure protection will be performed per the rules of Subsection HC Subpart B.

2.1.2 ASME N Stamp

The MARVEL Reactor will be constructed in accordance with ASME Section III requirements. At the time during which fabrication and procurement processes for MARVEL were being initiated, there were no suitable contractors identified who would be qualified to provide an N-stamp for a Section III Division 5 Class A pressure vessel and an ASME N-stamp will therefore not be provided for the Reactor. Equivalent quality assurance provisions shall be included in the fabrication specifications for the vessel to provide an equivalent level of safety in accordance with 10 CFR 851 Appendix A Section 4 (c).

An appropriately qualified individual will be identified by the Project to perform the functions of the Authorized Nuclear Inspector (ANI).

2.1.3 Unqualified Braze Material

All MARVEL Reactor source material governed by ASME Section III will be procured from ASME Section III Material Organizations or Certificate Holders. However, braze material not furnished by a Material Organization or Certificate Holder may alternatively be accepted for use in the MARVEL Reactor pressure boundary by executing a commercial grade dedication (CGD) of the braze material per INL Process Map KB0015988, such as CGI-1291, “BNi-5 Braze Powder for Nuclear Pressure Boundaries.” The CGD plan shall use the guidance of ASME Section III, Division 1, NCA-4255.5 (2021 ed.). A Material Organization or Certificate Holder need not perform the CGD acceptance activities.

2.1.4 ASME Section XI

The ASME Boiler and Pressure Vessel Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components” is only applicable for pre-service inspections to the MARVEL Reactor Vessel due to the short (~2 year) design service life and the expected high radiation levels in the vicinity of the vessel which would preclude access.

3. OWNERSHIP

The TREAT Engineering Manager is the owner of this COR. The MARVEL Cognizant System Engineer is responsible for the overall development and maintenance of the COR.

4. COR Details

Applicable regulations, executive orders, and DOE orders are summarized in the following subsections.

4.1 Regulations

[115284] 10 CFR 830 Subpart A, "Quality Assurance Requirements" *Code of Federal Regulation*, Office of the Federal Register

[112201] 10 CFR 830, “Nuclear Safety Management,” Subpart B, “Safety Basis Requirements,” *Code of Federal Regulations*, Office of the Federal Register.

[112202] 10 CFR 835, “Occupational Radiation Protection,” *Code of Federal Regulations*, Office of the Federal Register.

[112203] 10 CFR 851, “Worker Safety and Health Program,” *Code of Federal Regulations*, Office of the Federal Register.

[112204] 29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations*, Office of the Federal Register.

[112205] 29 CFR 1926, "Safety and Health Regulations for Construction," *Code of Federal Regulations*, Office of the Federal Register.

[112206] 40 CFR 61, Subpart H, "National Emissions Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," *Code of Federal Regulations*, Office of the Federal Register.

[112207] 41 CFR 101, "Federal Property Management Regulation," *Code of Federal Regulations*, Office of the Federal Register.

[112208] 48 CFR 970, Section 970.5223-1, "Integration of Environment, Safety, and Health into Work Planning and Execution," Code of Federal Regulations, Office of the Federal Register.

[112209] IDAPA 58.01.01, "Rules for the Control of Air Pollution in Idaho," Idaho Administrative Code

4.2 Department of Energy Directives

[112211] DOE Order 226.1B, "Implementation of Department of Energy Oversight Policy," U.S. Department of Energy.

[112212] DOE Order 414.1D, Chg 2, "Quality Assurance," U.S. Department of Energy.

[105375] DOE O 420.1C, Chg 3 (LtdChg), "Facility Safety", U.S. Department of Energy, 2019

[112213] DOE Order 435.1, Admin Chg. 1, "Radioactive Waste Management," Change 1, U.S. Department of Energy.

[112214] DOE Order 436.1, "Departmental Sustainability", U.S. Department of Energy.

[112215] DOE Order 458.1, Admin Chg. 3, "Radiation Protection of the Public and the Environment," Change 3, U.S. Department of Energy.

[112216] DOE Order 460.1D, "Hazardous Materials, Packaging and Transportation, Safety and Security, Work Processes" U.S. Department of Energy.

[112217] DOE Order 471.6, Chg. 3, "Information Security," U.S. Department of Energy.

[112218] DOE Order 473.3, “Protection Program Operations,” U.S. Department of Energy.

[107769] DOE-STD-1020-2016, "Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities", U.S. Department of Energy, 2016.

[112219] DOE-STD-1027-2018, “Hazard Categorization of DOE Nuclear Facilities,” U.S. Department of Energy, November 2018.

[105374] DOE-STD-1066-2016, "Fire Protection", U.S. Department of Energy, 2016

[112220] DOE-STD-1073-2016, “Configuration Management Program,” U.S. Department of Energy.

[112221] DOE-STD-1090-2020, “Hoisting and Rigging,” U.S. Department of Energy.

[112222] DOE-HDBK-1092-2013, “Electrical Safety,” U.S. Department of Energy.

[112223] DOE-HDBK-1169-2003, “Nuclear Air Cleaning Handbook,” U.S. Department of Energy.

[112224] DOE-STD-3007-2017, “Preparing Criticality Safety Evaluations at Department of Energy Nonreactor Nuclear Facilities,” U.S. Department of Energy. [DOE O 420.1C invoked standard]

[112225] DOE-STD-3020-2015, “Specification for HEPA Filters Used by DOE Contractors,” U.S. Department of Energy.

[112226] DOE-STD-3024-2011, “Content of System Design Descriptions,” U.S. Department of Energy.

4.3 Design Code of Record

The design criteria for facility modifications or new construction are summarized in the following subsections. Additional codes and standards may be mandated by higher-level documents and are not listed.

4.3.1 General Design

[112230] ASME NQA-1-2008/2009a, “Quality Assurance Requirements for Nuclear Facility Applications.”

[112231] IBC, “International Building Code,” 2018 Edition.

[112232] INL-STD-139, “INL Engineering Standards,” Idaho National Laboratory, TOC-139.

[112233] INL-STD-142, “INL Nuclear Engineering Standards,” Idaho National Laboratory, TOC-142.

[112234] NFPA 101, “Life Safety Code,” 2021 Edition.

[112235] NRC RG 1.232, SFR-DC, Appendix B, 2018, “Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors,” U.S. Nuclear Regulatory Commission.

[112236] TOC-802, “INL Weld Manual,” Vol. 1, Table of Contents, Revision 65, April 2023 and TOC-803, "INL Weld Manual", Vol. 2, Revision 9, September 2021

[112237] SDS-119, “Safety Design Strategy for the Microreactor Applications Research, Validation and Evaluation Project (MARVEL),” Rev. 0, December 2021.

[112247] ASME, “Boiler and Pressure Vessel Code”, Section III, Division 5, 2021 Edition.

[117598] ASME, “Boiler and Pressure Vessel Code”, Section VIII, 2021 Edition.

The following paragraph from LRD-14704 allows use of code editions subsequent to the editions identified in 10CFR851:

3.2.2 Code of Record – For systems where design commences on, or after, July 2, 2018, the code of record shall be in accordance with the applicable code editions listed in Section 3.2.3. Editions of codes and standards subsequent to those listed in Section 3.2.3 may be implemented without reconciliation. Newer versions of listed codes and standards provide an appropriate level of worker protection. [10 CFR 851, DOE HQ Guidance]

4.3.2 Civil, Structural, and Architectural

[112239] American Institute of Steel Construction (AISC) 325, AISC SCM, "Steel Construction Manual," Fifteenth Edition, July 2017.

[112240] AISC 360, "Specification for Structural Steel Buildings," 2016 Edition.

[112241] AISC Design Guide 27, "Structural Stainless Steel," 2013 Edition.

[112242] ANSI/AISC N690, "Specification for Safety-Related Steel Structures for Nuclear Facilities."

[112243] ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 2016 Edition.

[112244] American Welding Society (AWS) D1.1, "Structural Welding Code – Steel," 2020 Edition with 2021 Errata.

[112245] AWS D1.6, "Structural Welding Code – Stainless Steel," 2017 Edition.

4.3.3 Mechanical

4.3.3.1 Piping

[112249] American Society of Mechanical Engineers (ASME) A13.1, "Scheme for Identification of Piping Systems," 2015.

[112250] ASME B16.5, "Pipe Flanges and Flanged Fittings," 2020 Edition

[117541] ASME B31.1 "Power Piping"

[112252] ASME B31.3, "Process Piping," 2022 Edition.

[112251] ASME B31.9, "Building Services Piping", 2020 Edition.

The following paragraph from LRD-14704 allows use of code editions subsequent to the editions identified in 10CFR851:

3.2.2 Code of Record – For systems where design commences on, or after, July 2, 2018, the code of record shall be in accordance with the applicable code editions listed in Section 3.2.3. Editions of codes and standards subsequent to those listed in Section 3.2.3 may be implemented without reconciliation. Newer versions of listed codes and standards provide an appropriate level of worker protection. [10 CFR 851, DOE HQ Guidance]

4.3.3.2 Potable Water and Sewer

N/A

4.3.3.3 Heating, Ventilating, and Air Conditioning and Ducting

[112257] ASME AG-1, "Code on Nuclear Air and Gas Treatment," American Society of Mechanical Engineers, 2019.

Neither the MARVEL nor the T-REXC HVAC designs currently incorporate any known ozone depleting chemicals, thus 40 CFR 82 is not directly applicable. Compliance will be re-evaluated upon incorporation of any design changes that introduce such chemicals.

4.3.3.4 Hoisting and Rigging

[112259] ASME B30.9 "Slings" 2010 Edition.

[112260] ASME B30.10 "Hooks" 2009 Edition.

[112261] ASME B30.11 "Monorails and Underhung Cranes" 2010 Edition.

[112262] ASME B30.20 "Below the Hook Lifting Devices" 2013 Edition.

[112263] ASME B30.26 "Rigging Hardware" 2010 Edition.

4.3.4 Fire Protection

4.3.4.1 National Fire Protection Association

[112266] NFPA 1, “Fire Prevention Code,” 2018 Edition.

[112267] NFPA 10, “Standard for Portable Fire Extinguishers,” 2017 Edition.

[112268] NFPA 13, “Standard for the Installation of Sprinkler Systems,” 2016 Edition.

[112269] NFPA 14, “Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems,” 2018 Edition.

[112270] NFPA 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances,” 2018 Edition.

[112271] NFPA 25, “Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems,” 2019 Edition.

[112272] NFPA 30, “Flammable and Combustible Liquids Code,” 2017 Edition.

[112273] NFPA 37, “Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines,” 2017 Edition.

[112274] NFPA 45, “Standard on Fire Protection for Laboratories Using Chemicals,” 2018 Edition.

[112275] NFPA 54, “National Fuel Gas Code,” 2017 Edition.

[112276] NFPA 55, “Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, and Tanks,” 2019 Edition.

[112277] NFPA 72, “National Fire Alarm and Signaling Code,” 2016 Edition.

[112278] NFPA 75, “Standard for the Protection of Electronic Computer/Data Processing Equipment,” 2016 Edition.

[112279] NFPA 80, “Standard for Fire Doors and Fire Windows,” 2018 Edition.

[112280] NFPA 80A,” Recommended Practice for Protection of Buildings from Exterior Fire Exposures,” 2016 Edition.

[112281] NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids,” 2019 Edition.

[112282] NFPA 170, “Standard for Fire Safety Symbols,” 2017 Edition.

[112283] NFPA 220, “Standard on Types of Building Construction,” 2017 Edition.

[112284] NFPA 221, “Standard for Fire Walls and Fire Barrier Walls,” 2017 Edition.

[112285] NFPA 232, “Standard for the Protection of Records,” 2016 Edition.

[112286] NFPA 262, “Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces,” 2018 Edition.

[112287] NFPA 484, “Standard for Combustible Metals,” 2018 Edition.

4.3.5 Electrical

4.3.5.1 General Facility Electrical Codes and Standards

[112290] NFPA 70, “National Electrical Code (NEC),” 2020 Edition.

[112291] NFPA 70E, “Electrical Safety Requirements for Employee Workplaces,” 2018 Edition.

[112292] NFPA 111, “Standard on Stored Electrical Energy Emergency and Standby Power Systems,” 2019 Edition.

4.3.5.2 Normal Power System Codes and Standards

[112294] Institute of Electrical and Electronics Engineers (IEEE)-C2, “National Electrical Safety Code,” 2017 Edition.

[112295] UL-508A, “Standard for Industrial Control Panels,” 2018 Edition.

[112296] International Electrical Testing Association NETA-ATS, International Electrical Testing Association, “Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems,” 2017 Edition.

4.3.5.3 Lighting System Codes and Standards

N/A

4.3.5.4 Grounding System Codes and Standards

[112300] IEEE-STD 142, “IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems,” 2007 Edition.

[112301] NFPA 77, “Recommended Practice on Static Electricity,” 2019 Edition.

4.3.5.5 Lightning Protection System Codes and Standards

[112303] NFPA 780, “Standard for the Installation of Lightning Protection Systems,” 2023 Edition.

4.3.5.6 Telephone System Codes and Standards

N/A

4.3.5.7 Instrumentation and Controls and Reactivity Control Systems Codes and Standards

[115089] IEEE/IEC 60780-323, "IEC/IEEE International Standard – Nuclear Facilities – Electrical Equipment Important to Safety – Qualification" 2016 Edition

[105371] IEEE 379-2014, IEEE Standard for Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems, Institute of Electrical and Electronics Engineers, 2014

[112307] IEEE-384, “IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits,” 1992 Edition. [DOE O 420.1C invoked standard]

[112308] IEEE-603, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations,” 2018 Edition.

[105372] IEEE 627-2019, IEEE Standard for Qualification of Equipment Used in Nuclear Facilities, Institute of Electrical and Electronics Engineers, 2019

[112309] IEEE-1023, “IEEE Recommended Practice for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations and Other Nuclear Facilities,” 2020 Edition.

[113561] IEEE-497, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," 2016 Edition.

5. DEFINITIONS

N/A

6. ACRONYMS

ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ATS	Acceptance Testing Specification
AWS	American Welding Society
CFR	Code of Federal Regulations
CGD	Commercial Grade Dedication

DC	Design Criteria
DOE	Department of Energy
HDBK	Handbook
IBC	International Building Code
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
INL	Idaho National Laboratory
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NQA	Nuclear Quality Assurance
RG	Regulatory Guidance
SDS	Safety Design Strategy
SFR	Sodium Fast Reactor
STD	Standard
TOC	Table of Contents

7. APPENDICES

Appendix A, IEEE 603 Compliance Strategy

Appendix A

IEEE 603 Compliance Strategy

IEEE-603, IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations, establish minimum functional and design requirements for the power, instrumentation, and control portions of safety systems for nuclear power generating stations. MARVEL is designed to comply with the intent of this standard. However, since this standard is written for power generation stations, some portions are not applicable to MARVEL. Also, since MARVEL is located in the TREAT facility, some limitations of the TREAT facility impact the ability for verbatim compliance with all aspects of this standard. Each requirement of this standard is addressed below. The headings are the same as in the standard. The majority of these requirements are verified by review of the I&C drawings.

7.1 Safety System Criteria

1. Single-failure criterion. The MARVEL safety related I&C system complies with the single failure criterion. This is demonstrated by ECAR-7517, MARVEL I&C FAILURE MODES AND EFFECTS ANALYSIS.

2. Completion of protective action. The MARVEL safety related I&C system complies with the completion of protective action criterion. This can be verified by review of the RPS circuits.

3. Quality. The MARVEL safety related I&C system complies with the Quality criterion through adherence to the INL Quality program.

4. Equipment qualification. The MARVEL safety related I&C system complies with the criterion for Equipment qualification as described in the response for IEEE-323 and IEEE-627.

5. System integrity. The MARVEL safety related I&C system complies with the System integrity criterion. The safety related I&C systems are designed to be completely deterministic.

6. Independence. The MARVEL safety related I&C system complies with the intent of the Independence criterion. Redundant portions of the safety related systems are independent of each other. Physical separation is maintained to the extent practical. The TREAT reactor building, control room, and the cables connecting the reactor building to the control room do not have the physical separation features typically found in commercial power plants. For example, the TREAT control room control panels do not have any provisions for separation of redundant trains or channels. The cables between the reactor building and the control room building are all in a single buried cable trench. The TREAT reactor

building instrument room is built on a raised floor, with no barriers for separation of cable trains or channels. The MARVEL safety related I&C system will be kept separate to the extent practical and within the limitations of the TREAT facility.

7. Capability for testing and calibration. This criterion requires capability for testing and calibration of safety system equipment shall be provided while retaining the capability of the safety systems to accomplish their safety functions. This criterion is written for commercial power stations that are expected to operate for long periods of time without shutdown. MARVEL is planned to operate only for a few days at a time, and to be regularly shutdown. This criterion explicitly allows for exception to testing and calibration during power operation are allowed where this capability cannot be provided without adversely affecting the safety or operability. The MARVEL safety related I&C system can be testing and calibrated when MARVEL is shutdown and maintain sufficient reliability. Therefore, this criterion of this standard is not applicable to MARVEL.

8. Information displays. This criterion has several requirements for the information displays. These requirements include that display instrumentation shall provide accurate, complete, and timely information pertinent to safety system status, that the displays are provided for manual actions required to accomplish a safety function, that there should be indication of operating bypasses, and so on. MARVEL has no manual actions required to accomplish any safety function. The MARVEL I&C System have no operational bypasses. The MARVEL I&C System is small and simple compared to a commercial nuclear power plant. The MARVEL I&C system does provide accurate, complete, and timely information pertinent to safety system status. In this way the MARVEL I&C system meets the intent of this criterion.

9. Control of access. The MARVEL safety I&C system complies with this requirement.

10. Repair. The MARVEL safety I&C system complies with this requirement.

11. Identification. The MARVEL safety I&C system complies with this requirement.

12. Auxiliary Features. The MARVEL safety I&C system do not have Auxiliary features as described in this standard. Therefore, this criterion is not applicable to MARVEL.

13. Multi-unit stations. MARVEL will be located in the TREAT reactor building and will use some TREAT systems such as electric power. However, TREAT and MARVEL will not be operated simultaneously. In this sense MARVEL meets the intent of this criterion.

14. Human factors considerations. MARVEL will comply with this criterion. MARVEL is very small and simple compared to a commercial power reactor, so the human factors are also much less complex.

15. Reliability. MARVEL meets the intent of this criterion. MARVEL is very small and simple compared to a commercial power reactor so detailed reliability analysis is not required. Adequate reliability of the safety related I&C systems is achieved through redundancy, use of the INL QA program, and application of the INL design process. In this way MARVEL meets the intent of this criterion.

16. Common-cause failure. The MARVEL safety related I&C system meets the intent of this criterion. Components for the safety related I&C system will be purchased, controlled, and designed using the INL QA program and procedures. Any components that cannot be purchased as safety related will be evaluated under the INL Commercial Grade Dedication process. CGI-1223 addresses the Seismic Sensor. Compliance with the other criterion of this standard and other standards, as described herein, ensure that the probability of a CCF is sufficiently low. In this way MARVEL complies with the intent of this criterion.

7.2 Sense and Command Features -- Functional and Design Requirements

17. Automatic Control. The MARVEL safety related I&C system complies with this criterion.

18. Manual Control. The MARVEL safety related I&C system meets the intent of this criterion. The MARVEL safety related I&C system has only one (1) manual control function, Reactor Scram. The buttons for this function are redundant, and in that sense can be initiated at the division level. MAREL has no Engineering Safety System, Decay Heat Removal System, or similar systems as a commercial power reactor would have.. The MARVEL manual scram buttons are located consistent with the requirements of this section of IEEE-603. In these ways MARVEL complies with the intent of this criterion.

19. Interaction between the sense and command features and other systems. This criterion is not applicable to the MARVEL safety related I&C system. The MARVEL safety related I&C system has only one automatic scram, actuated by seismic sensors. The MARVEL safety related I&C system shares no sense and command features with other systems.

20. Derivation of system inputs. The MARVEL safety related I&C system complies with this criterion.

21. Capability for testing and calibration. The MARVEL safety related I&C complies with the intent of this criterion. This criterion has two clauses:
(1) Checking the operational availability. The MARVEL safety related I&C has only one function with input sensors, the seismic scram function. The operability of these seismic sensors will be verified with periodic calibration of the sensors.
(2) Assuring the post-accident operational availability. The MARVEL safety related I&C only input, the seismic sensors, have no required functions post-accident. This criterion will be considered for the other sensors, as appropriate.

22. Operating bypasses. This criterion is not applicable. The MARVEL safety related I&C has no operating bypasses.

23. Maintenance bypass. This criterion is not applicable. The MARVEL safety related I&C has no maintenance bypasses.

24. Setpoints. This criterion is not applicable. The MARVEL safety related I&C has no setpoints that are assumed in the SAR-420 Addendum 1Chapter 15 Safety Analysis. The setpoint for the seismic trip function will be set consistent with the existing TREAT seismic sensors.

7.3 Execute Features -- Functional and Design Requirements

25. Automatic control. The MARVEL safety related I&C system complies with this criterion.

26. Manual control. The MARVEL safety related I&C system complies with this criterion as described in number 18 above.

27. Completion of protective action. The MARVEL safety related I&C system complies with this criterion.

28. Operating bypasses. This criterion is not applicable. The MARVEL safety related I&C has no operating bypasses.

29. Maintenance bypass. This criterion is not applicable. The MARVEL safety related I&C has no maintenance bypasses.

7.4 Power Source Requirements

30. The requirements in this section are not applicable to MARVEL. MARVEL has no Class 1E power systems. The MARVEL safety related I&C system scrams the reactor on loss of power and does not require power to perform the safety function.