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Work in Hazard Classification Areas

Original Signature on file

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Date

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Document History Log

Status/ Change/ Revision	Change Date	Originator/Phone	Description
Basic	04/20/09	Robert F. Gargiulo, x8-3842	Initial Release.
Rev A.	05/31/12	Robert F. Gargiulo, x8-3842	Revised to remove all references to the Hardware Assurance Test Contract (HATC). The HATC contract no longer exists.
Rev A.1	04/03/2014	S. Woolridge	Admin changes
Rev A-2	07/15/2016	Robert F. Gargiulo, x8-3842	Administrative changes. Removed references to FOSC, TOC, ITSC. Removed SPR 8715.3 Hot Work Permit Program, which was cancelled.
Rev A-3	02/27/2017	Rachel Harrison- Woodard x8-1682	Administrative changes, updated NFPA 55 & NPR 1441.1 document titles. Deleted reference ASTM 03-704097-31, obsolete.

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) Common Work Instruction (SCWI) defines the processes and procedures for performing work and operations in hazardous classification areas at SSC.

2.0 APPLICABILITY

This SCWI applies to all NASA, NASA Direct Contractor and NASA Direct Construction Contractor operations at SSC.

3.0 DOCUMENT CONTROL

This SCWI shall be updated and maintained in accordance with SPR 1400.1, *Document Preparation, Numbering, and Management*.

4.0 REFERENCES AND APPLICABLE DOCUMENTS

All references are to be the latest version unless otherwise specified.

- a. ANSI/ISA-TR12.6, *Wiring Practices for Hazardous Classified Locations Instrumentation, 1995*
- b. ANSI/ISA-12.12.01, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations*
- c. ASTM Manual 36, *Safe Use of Oxygen and Oxygen Systems: Handbook for Design, Operation, and Maintenance*
- d. NFPA 30, *Flammable and Combustible Liquids Code*
- e. NFPA 53, *Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres*
- f. NFPA 55, *Compressed Gases and Cryogenic Fluids Code*
- g. Electrical Hazardous Classification drawings (series 21000)
- h. NFPA 70, *National Electric Code*
- i. NFPA 496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*

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- j. NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*
- k. NPR 1441.1, NASA Records Management Program Requirements
- l. NPR 7123.1, *NASA Systems Engineering Processes and Requirements*
- m. NPR 8715.3, *NASA General Safety Program Requirements*
- n. SCWI-8838-0002, *SSC Hot Work Program*
- o. Form SSC-68, *Flame "Hot Work" Permit*
- p. SPR 1400.1, *Document Preparation, Numbering, and Management*
- q. SPR 1440.1, *Records Management Program Requirements*
- r. SPR 8715.1, *John C. Stennis Space Center Safety and Health Procedures and Requirements*
- s. SREF-8060-0003, *NASA SSC Engineering & Test Directorate (E&TD) Electrical Design and Operations Guide for Classifying Hazardous Locations and for Electrical Equipment and Wiring in Classified Locations*

5.0 RESPONSIBILITIES

Responsibilities are as follows:

- a. SSC Safety and Mission Assurance Directorate (SMA) shall establish processes and procedures to ensure work in hazardous classification areas is performed in a safe manner to protect the workers and facilities.
- b. The Center Operations Directorate and the Engineering & Test Directorate shall:
 - (1) Ensure systems are properly classified.
 - (2) Ensure all NASA SSC civil service employees and NASA SSC contractors abide by the requirements within this work instruction.
- c. NASA Direct Contractor organizations are responsible for abiding by the requirements of this work instruction. All NASA SSC Direct Contractor organizations shall develop written processes and procedures for work in hazardous classification areas for their operations and operations of their contracted efforts.

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6.0 PROCEDURES

6.1 Categories of Work

Work in hazardous classification areas fall within three categories:

- a. **Hot Work:** Work in which arcs, heat, sparks, and/or flames are intentionally used or produced as part of the work/process. Hot work shall be governed by SCWI-8838-0002, *Hot Work Program Procedure*.
- b. **Safe Work:** Work in a hazardous classification area with tools or operations that are intrinsically safe or rated for the specific hazardous classification. It also includes work in which no sources of arc, heat, sparks and/or flames, are generated or would potentially be present. Safe work may be performed with no special controls or procedures related to the hazardous classification area.
- c. **Controlled Work:** Work in a hazardous classification area with tools or equipment that are not intrinsically safe and/or are unrated for the specific environment. Such tools and equipment may include non-spark resistant tools, cameras, computers, and other electronic devices, which may produce heat or sparks unintentionally. Special procedures or controls are necessary to ensure the area, processes, and operations are safe as outlined in this SCWI.

6.2 Determination of the Location Classification

- a. Prior to commencing any work or operations with equipment that may intentionally or unintentionally produce sparks, flames, or heat, the hazardous classification of the location/area of work shall be determined.
- b. The hazardous classification shall be in accordance with NFPA 497 and NFPA 70. For reference, see SREF-8060-0003 and the Electrical Hazardous Classification drawings (series 21000).

6.3 Process Controls

For hazardous classification areas, Safe Work may be performed with no special controls or processes. Hot Work will be performed in accordance with SCWI-8838-0002 or the contractor-approved program. Equipment appropriately rated for work in the hazardous location will be selected and used. Where this is not possible, the work must be classified as Controlled Work and the following controls shall be implemented as a minimum:

- a. **Initial Atmospheric Check:** An initial atmospheric check for flammable or combustible gases and/or vapors shall be made with a properly calibrated meter and/or fixed sensor or detector. If the meter is not specific to the gas or vapor in question, the operator will determine the proper response factor and adjust the meter readings as appropriate. If the portable meter or

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fixed sensor/detector(s) indicates any flammable/combustible readings, the operations will not commence until the source of the reading is identified (e.g. leak, meter drift/fault) and corrected, and/or an evaluation of the safety of the operation is made.

b. Continuous Atmospheric Check: Throughout the Controlled Work operation, continuous atmospheric monitoring shall be performed to detect leaks or a change in conditions. Continuous monitoring may be achieved by one or more of the following three means:

(1) Personnel monitors – the personnel performing the work may wear personal detection monitors or carry gas detection meters suited for the specific flammable/combustible material in question. Personnel shall terminate operations and move to a safe location outside of the hazardous classification area at any detection of gases/vapors. Controlled Work will only commence again once the source of gas/vapor is corrected or the cause of the reading is determined, and the operation is deemed safe to proceed.

(2) Area monitors – a properly calibrated meter placed between the most probable source of gas/vapor and the Controlled Work. If any reading on an area sensor/detector is experienced, personnel shall terminate operations and move to a safe location outside of the hazardous classification area. Controlled Work will only commence once the source of the gas/vapor is corrected or the cause of the reading is determined, and the operation is deemed safe to proceed.

(3) Point source detection – if the hazardous classification area is equipped with gas/vapor detection equipment with an audible alarm at the potential point source for flammable/combustible material leaks, this system may be used to perform continuous monitoring. A prime example is a properly calibrated hydrogen gas detection sensor located over a potential leak source such as a valve or instrument assembly. If the audible alarm is initiated, personnel shall terminate operations and move to a safe location outside of the hazardous classification area. Controlled Work will only proceed once the source/cause of the reading is identified and corrected, and the operation is deemed safe to proceed.

6.4 Process Flow

Figure 1 illustrates the overall process for work in hazardous classification areas.

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8.0 ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

8.1 Acronyms and Abbreviations

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ETD	Engineering and Test Directorate
NASA	National Aeronautics and Space Administration
NFPA	National Fire Protection Agency
NPR	NASA Procedural Requirements
SMA	Safety and Mission Assurance Directorate
SCWI	John C. Stennis Space Center Common Work Instruction
SREF	System Design Reference
SPR	John C. Stennis Space Center Procedural Requirements
SSC	John C. Stennis Space Center

8.2 Definitions

Class I, Division 1 (Class I Div. 1) Location - An area:

- a. In which ignitable concentrations of flammable gases or vapors can exist under normal operating conditions, or
- b. In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage, or
- c. In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors and might also cause simultaneous failure of electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition.

Class I, Division 2 (Class I Div. 2) Location - An area:

- a. In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems or in case of abnormal operation of equipment, or
- b. In which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operation of the ventilating equipment, or
- c. That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.

NOTE: In layman terms, the area classifications may be described as follows:

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- **Class 1, Div. 1** - Where ignitable concentrations of flammable gases, vapors, or liquids can exist all of the time or some of the time under normal operation conditions.
- **Class 1, Div. 2** - Where ignitable concentrations of flammable gases, vapors, or liquids are not likely to exist under normal operating conditions.
- **Class 2, Div. 1** - Where ignitable concentrations of combustible dusts can exist all of the time or some of the time under normal operation conditions.
- **Class 2, Div. 2** - Where ignitable concentrations of combustible dust are not likely to exist under normal operating conditions.
- **Class 3, Div. 1** - Where easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.
- **Class 3, Div. 2** - Where easily ignitable fibers are stored and handled.

Explosion-Proof Products: Products capable of containing an explosion. The term "explosion-proof" does not indicate that the product is capable of withstanding an external explosion, but only of withstanding an internal explosion without allowing flames or hot gases to escape from the housing to trigger an explosion in the surrounding atmosphere. The "explosion-proof" term is assigned to those products which are certified by the national rating agencies such as Underwriters Laboratories and Factory Mutual Research after meeting their specifications and passing their tests. Unless certified by one of these agencies, the product does not meet the "explosion-proof" requirements of the National Electrical Code.

Intrinsically Safe: ANSI/ISA RP12.6-1995 defines intrinsically safe equipment as, "equipment and wiring which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration." Intrinsically safe products receive their classification because their electrical power usage is below the level of power required to set off an explosion within a given hazardous area.

Hazardous Classification Rated Equipment: Equipment that either:

- Is intrinsically safe and is labeled as such by the Underwriters Laboratory, or
- Meets the NFPA 70, *National Electric Code*, requirements for a particular Class, Group, and Division for the location it is used in, or
- Meets the 'Purged and Pressurized' definition in NFPA 70, Article 500.2. NFPA 70 refers to NFPA 496 Standard for Purged and Pressurized Enclosures for Electrical Equipment for detailed purging requirements.

Non-Hazardous Classification Rated Equipment: Equipment that has not been labeled or designated as:

- Meeting the NFPA-70 requirements for a particular Class, Division and Group, or
- Intrinsically safe per the Underwriters Laboratory and does not meet the NFPA 70 and NFPA 496 purge requirements.