

PAYLOAD FACILITY CONTAMINATION CONTROL IMPLEMENTATION PLAN

APPROVAL PAGE

for

**Payload Facility Contamination
Control Implementation Plan**

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ABBREVIATIONS AND ACRONYMS

The following abbreviations and acronyms are used in this plan.

CCAFS	Cape Canaveral Air Force Station
CCE	Contamination Control Engineer
CCZ	Class Clean Zone
CRE	Clean Room Engineer
CWA	Clean Work Area
DOP	Diethyl Phthalate
GSE	Ground Support Equipment
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
ISO	International Organization for Standardization
ISS	International Space Station
KSC	John F. Kennedy Space Center
M&P	Materials and Processes
mg	milligrams
MPPF	Multi-Payload Processing Facility
µm	micrometer/micron
NASA	National Aeronautics and Space Administration
NSTS	National Space Transportation Document
NSSD	NASA Spacecraft Services Depot
NVR	Non-Volatile Residue
PAC	Percent Area Coverage
PHSF	Payload Hazardous Servicing Facility
PMI	Preventive Maintenance Instructions
ppm	parts per million
PRACA	Problem Reporting And Corrective Action
PRD	Program Requirements Document
SSPF	Space Station Processing Facility
VAFB	Vandenberg Air Force Base
VC	Visibly Clean
v/v	volume/volume

SECTION I - INTRODUCTION

1.1 PURPOSE

This Payload Facility Contamination Control Implementation Plan describes the implementation of the contamination control requirements established in KPL-PLN-50007, *KSC Payload Facility Contamination Control Requirements/Plan*. It establishes the International Space Station (ISS) Spacecraft Processing (UB), Launch Services Program (VA), and Engineering and Technology (NE) standards for implementation requirements, and operations and maintenance rules for payload-related Clean Work Areas (CWAs) and/or International Organization for Standardization (ISO) Class Clean Zones (CCZs) (per ISO 14644-1, *Cleanrooms and Associated Controlled Environments – Part 1: Classification of Air Cleanliness*) at the John F. Kennedy Space Center (KSC), the KSC areas at the Cape Canaveral Air Force Station (CCAFS), and the KSC areas at Vandenberg Air Force Base (VAFB). This plan also establishes the methods to be used to monitor and maintain the environmental and cleanliness conditions in the CWAs/CCZs and assigns the responsibilities for the implementation at KSC, CCAFS, and VAFB.

1.2 SCOPE

This plan addresses the National Aeronautics and Space Administration (NASA) payload facilities at KSC, CCAFS, and VAFB. The payload processing facility at CCAFS is Hangar AE and the payload processing facility at VAFB is Building 836, Lab 1. The payload facilities at KSC are the Space Station Processing Facility (SSPF), the Multi-Payload Processing Facility (MPPF), the Payload Hazardous Servicing Facility (PHSF), and the NASA Spacecraft Services Depot (NSSD).

1.3 AUTHORITY

This plan describes the implementation of KPL-PLN-50007. (Deviations or variances can be obtained through a memo until this plan is formally revised.)

1.4 REFERENCES

- a. KPL-PLN-50007 *KSC Payload Facility Contamination Control Requirements/Plan*
- b. NSTS SN-C-0005 *Specifications Contamination Control Requirements for the Space Shuttle Program (NASA Legacy Document)*
- c. ISO 14644-1 *Cleanrooms and Associated Controlled Environments—Part 1: Classification of Air Cleanliness*
- d. IEST-STD-CC1246E *Product Cleanliness Levels – Applications, Requirements, and Determination*
- e. NASA NPR 8570.1 *NASA Energy Management Program*
- f. KNPD 8500.1 *KSC Environmental Management*
- g. KSC-PLN-3442 *Ground Operations Processing Non-Flight Materials and Equipment Approved for Use in Clean Work Areas*
- h. FED-STD-209 *Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones (Legacy Document)*

1.5 DEFINITIONS

Definitions of terms used in this plan are contained in Appendix F.

Table 1-1. Visibly Clean (VC) Criteria (Per IEST-STD-CC1246E)

Below are the various VC levels that are available for the payloads during payload integration/launch vehicle operations at launch sites. These VC levels can also apply to pertinent GSE/tools. The VC definition in Section 1.5 is applicable to this table with the understanding that light intensity and inspection distances are specified herein.

IEST-VC-Distance-Lighting, distance expressed as meters, lighting as lumens/m². Magnification requirements may be expressed instead of distance, and UV may be added to the lighting.

Level	Distance (a) (b) (c)	Light Intensity (a)	NASA Legacy SN-C-0005 Equivalence
VC-0.5-1000	0.25 to 0.5 m (approximately 6 to 18 in.)	≥1000 lumens/m ² (≥100 ft.-candles)	Visibly Clean Highly Sensitive (VCHS)
VC-1-500	0.5 to 1 m (approximately 18 in. to 3 ft.)	≥500 lumens/m ² (≥50 ft.-candles)	Visibly Clean Sensitive (VCS) (g)
VC-2-500	1 to 2 m (approximately 3 to 6 ft.)	≥500 lumens/m ² (≥50 ft.-candles)	Not Applicable
VC-3-500	1.5 to 3 m (approximately 4.5 to 9 ft.)	≥500 lumens/m ² (≥50 ft.-candles)	Visibly Clean Standard (VC)
VC-10×-1000 (example of user-defined level)	Use 10× magnification	≥1000 lumens/m ² (≥100 ft.-candles)	Not Applicable
VC-0.5-1000-1500UV (example of user-defined level)	0.25 to 0.5 m (approximately 6 to 18 in.)	≥1000 lumens/m ² white light ≥1500 lumens/m ² and standard UV black-light (d) (e) (f)	Not Applicable

Notes:

- (a) Vision must be normal 20/20 or corrected to normal, not magnified, except when specified in the level designation.
- (b) Distance specified in the level designation is the maximum. Minimum inspection distance is one half the maximum except there is no minimum inspection distance when magnification is required.
- (c) For all VC levels, areas of suspected contamination may be inspected at closer distances for confirmation; when a surface is not accessible for visual inspection at the specified distance, closer inspection or use of inspection aids such as wipes or mirrors is permitted.
- (d) This designation requires two inspections of the surface at different lighting conditions. When using UV light (3200-3900 angstroms wavelength), the room lighting must be dimmed for effective viewing.
- (e) Greater sensitivity can be achieved if grazing incidence light is used in a darkened room.
- (f) Ultraviolet light can damage the human eye. Proper eye protection shall be worn to prevent eye damage. Consult with Safety to learn what steps must be taken to avoid eye damage.
- (g) NSTS SN-C-0005 (NASA Legacy Equivalence) Visibly Clean Sensitive (VCS) required inspection at a distance of 0.6 to 1.2 m (2 to 4 feet). VC-1 in this standard most closely matches the VCS inspection distance, but does not completely include it. The light intensity is the same.

SECTION II

MONITORING PROGRAM

2.1 GENERAL

The following section describes the environmental monitoring required in a CWA/CCZ whenever flight hardware is present and the methods of monitoring, analysis, and data reduction. Other methods of monitoring are available to customers if defined in their requirements. Table 2-1 provides the cleanliness requirements for the five CWA levels or ISO CCZ classes and Table 2-2 assigns one of these levels/classes to each payload facility and CWA/CCZ at KSC, CCAFS, and VAFB.

2.1.1 ENVIRONMENTAL REQUIREMENTS. Environmental requirements are applicable when flight hardware is present or in the preparation for flight hardware arrival. Payload requirements documentation for KSC (i.e. Program Requirements Document (PRD)) supersedes the requirements of this document. In the interest of energy conservation, Heating Ventilation and Air Conditioning (HVAC) equipment set-points shall be adjusted not more than 3 °C (6 °F) below the upper temperature requirement and 5% below the upper relative humidity requirement. In accordance with KSC energy conservation policies (NASA NPR 8570.1 and KNPD 8500.1), temperature and relative humidity limits shall be relaxed to the most efficient possible during non-processing periods, consistent with the protection of materials and equipment within the facility.

2.2 AIRBORNE PARTICLES

Airborne particle counts shall be measured with light scattering automatic particle counters. Counts shall be measured, as a minimum, in the size range of 0.5 microns and larger and of 5.0 microns and larger. Monitoring shall begin before the commencement of payload operations and continue through completion.

2.3 PARTICLE FALLOUT

Particle fallout samples shall be placed in selected locations within the CWAs/CCZs. At a minimum of once monthly, particle fallout filters/wafers will be removed and replaced. The filters shall be examined microscopically or filters/wafers scanned by automatic techniques. The number of particles and fibers shall be determined, as a minimum, in the (micron) size ranges: 50-100, 100-250, 250-500, 500-750, 750-1000, and >1000. Results are expressed as the number of particles and fibers (within the specified size range) per square foot/meter per day or as Percent Area Coverage (PAC). The data shall be converted per IEST-STD-CC1246E, *Product Cleanliness Levels - Applications, Requirements, and Determination*, to the average number of particles and fibers (in each size range) per square foot/meter for each 24-hour period. The Percent Area Coverage (PAC) can then be calculated and the level determined.

Table 2-1. KSC CWA/CCZ Environmental Requirements [1]

CLEAN WORK AREA LEVELS/ ISO CLASS CLEAN ZONES		Level #1	Level #2	Level #3	Level #4	Level #5
ISO14644 CLASS		ISO14644 Class 6.7	ISO14644 Class 7	ISO14644 Class 7.7	ISO14644 Class 8	ISO14644 Class 8.5
[FED-STD-209 Class (Legacy Document)]		(Class 5K)	(Class 10K)	(Class 50K)	(Class 100K)	(Class 300K)
PARAMETER	Air Flow	Laminar	Laminar	Non-Laminar	Non-Laminar	Non-Laminar
Maximum Airborne Particle Counts (ISO14644 - per m ³) [FED-STD-209 - per ft ³]	Req. ≥ 0.5 µm	176,000 [5,000]	352,000 [10,000]	1,760,000 [50,000]	3,520,000 [100,000]	11,100,000 [300,000]
	Req. 5.0 m	1,470 [35]	2,930 [70]	14,700 [350]	29,300 [700]	92,500 [1,000]
	Monitoring	Continuous	Continuous	Continuous	Continuous	Monthly
Temperature (°C) [°F] [3] [4]	Requirement	22±3 [71±6]	22±3 [71±6]	22±3 [71±6]	22±3 [71±6]	22±3 [71±6]
	Monitoring	Continuous	Continuous	Continuous	Continuous	Monthly
Relative Humidity (%) [3] [4] [5] [6]	Requirement	30 Min to 60 Max	30 Min to 60 Max	30 Min to 60 Max	30 Min to 60 Max	30 Min to 60 Max
	Monitoring	Continuous	Continuous	Continuous	Continuous	Monthly
Maximum Particle Fallout [2]	Goal	Level 200	Level 200	Level 500	Level 750	N/A
	Monitoring	Continuous	Continuous	Continuous	Continuous	N/A
Maximum NVR (mg/0.1m ² /month)	Requirement	1	1	1	1	N/A
	Monitoring	Continuous	Continuous	Continuous	Continuous	N/A
Maximum Volatile Hydrocarbons (ppm) (v/v)	Requirement	15	15	15	15	N/A
	Monitoring	Monthly	Monthly	Monthly	Monthly	N/A
Minimum Positive Pressure [7]	Requirement	0.05 in H ₂ O	0.05 in H ₂ O	0.05 in H ₂ O	0.02 in H ₂ O	N/A
	Monitoring	Continuous	Continuous	Continuous	Continuous	N/A
Minimum Air Changes [3]	Requirement	20/Hour	20/Hour	6/Hour	4/Hour	2/Hour
[1] During periods of operation [2] Levels per IEST-STD-CC1246E for a 24 hour period [3] Program Specific Requirements may supersede these requirements [4] HVAC set-points and equipment operation shall be relaxed during non-processing periods. [5] No work will be performed on ESD sensitive equipment below 30% Relative Humidity levels [6] No emergency notification required if Relative Humidity levels fall below 30% during non-processing periods [7] Differential pressure of water minimum with all doors and pass-throughs closed (except when HVAC system is configured in a launch abort safety mode) NOTE: Continuous monitoring means data collection is continuous						

Table 2-2. Facility ISO Class Clean Zone (CCZ)/CWA Level

Facility	Location	ISO CCZ (CWA Level)
CCAFS AE	High Bay	Class 7/ Level 2
MPPF	High Bay	Class 8/ Level 4
	Low Bay	Class 8/ Level 4
	Airlock	Class 8.5/ Level 5
NSSD	Cable Fabrication/Flight Repair (Room 1220 & 1235)	Class 8.5/Level 5*
	Flight Assembly (Room 1248A)	Class 7.7/Level 3*
	Sew Shop (Room 1015)	Class 8/Level 4*
	Photonics Lab (Room 1220A)	Class 8/Level 4*
PHSF	High Bay	Class 8/ Level 4
	Airlock	Class 8.5/ Level 5
SSPF	High Bay and Intermediate Bay	Class 8/ Level 4
	Test Stands and Specific Controlled Work Areas	Class 8/ Level 4
	Off-line Labs and Airlock	Class 8.5/ Level 5
VAFB Building 836	Lab 1 Laminar Flow Enclosure	Class 7 or 8 Level 2 or 4**

*Due to lack of humidifiers in the environmental control system, minimum humidity level cannot be regulated.

**May be operational at either ISO Class/CWA Level. Consult facility manager.

2.4 NON-VOLATILE RESIDUE

Non-Volatile Residue (NVR) witness plates shall be placed in specified places in the CWA/CCZ. The plates shall remain in the CWA/CCZ for one month. The appropriate analytical laboratory at KSC, CCAFS, or VAFB shall determine the NVR by standard gravimetric techniques. Results shall be reported in mg/0.1m² per month.

2.5 VOLATILE HYDROCARBONS

Volatile hydrocarbon samples shall be taken monthly, at a minimum, as required in Table 2-1. The samples may be taken from the same location in the CWA/CCZ. The support laboratory shall analyze these samples by flame ionization methods and report the results in parts per million (ppm) volume/volume (v/v) methane equivalent. Alternately, real time volatile hydrocarbon measuring systems based on flame ionization or photoionization techniques may be installed to respond to critical payload requirements.

2.6 TEMPERATURE AND RELATIVE HUMIDITY

Temperature and relative humidity values shall be measured and recorded at a predetermined area(s) within the CWA/CCZ. The equipment used shall be a continuous recording type. For each day, the temperature and humidity shall be determined for each hour. In addition, the high and low values for the day and the time at which they occurred shall be recorded.

2.7 POSITIVE PRESSURE

Pressure differential readings shall be taken at least once on each working day at each CWA/CCZ. The results in inches of water shall be recorded.

2.8 CLEAN ROOM VACUUMS

The exhaust air from the portable vacuum cleaners used in CWAs/CCZs shall be sampled periodically to verify that the exhaust air meets the airborne particulate requirements for that level/class CWA/CCZ.

2.9 CLEAN WORK STATIONS (FLOW BENCHES)

Every 6 months, clean work stations in use shall be certified by sampling the High Efficiency Particulate Air (HEPA) filtered air quality and flow rate. Air quality measurements shall verify that the airborne particle concentration is $\leq 350,000$ particles per m³ (10,000 particles per ft³), 0.5 μ m and greater. The flow rate shall be a minimum of 21.3 m/min (70 ft./min).

2.10 INITIAL CERTIFICATION OF CWA/CCZ FACILITIES

Following construction, initial cleaning, and activation phases in new CWA/CCZ facilities, the environmental capability must be certified per Table 2-1 prior to payload processing activities. This certification must demonstrate that facility cleanliness and HVAC systems are capable of maintaining CWA/CCZ parameters. This requirement applies to facilities being "Returned to Service" from major modifications, energy conservation modes, and following any suspension of the CWA/CCZ Environmental Monitoring Program. CWA/CCZ operations and maintenance requirements must be activated during the certification period. The Environmental Monitoring System will be activated no later than 3 weeks prior to flight hardware arrival. During certification activities, other operations in the CWA/CCZ must be limited to reduce the contamination impact. The certification process will require a minimum of 1 cycle (2 weeks or greater) of witness plates and environmental data collection. Data reports for KSC facilities shall be prepared by the contractor Contamination Control Engineer (CCE)/Materials and Processes (M&P) Engineer for review by the contractor Facility Management and NASA M&P Engineering. Data reports for CCAFS and VAFB facilities shall be prepared by the contractor Clean Room Engineer (CRE) or VAFB designee and provided to the NASA M&P Engineer. Baseline certifications of the CWAs/CCZs at KSC were performed per FED-STD-209, *Airborne Particulate Cleanliness Classes in Cleanliness and Clean Zones (Legacy Document)*, criteria.

SECTION III - OPERATIONS AND MAINTENANCE LEVELS

3.1 GENERAL

Three levels of operations and maintenance requirements are established by KPL-PLN-50007. In the Appendices A through C of this plan, specific minimum rules are presented for each of these levels. These rules apply consistently, without exception, to all controlled work areas actively processing flight hardware within the CWA/CCZ. The rules and suggestions for each level are divided into three sections: operational rules, CWA/CCZ cleaning rules, and Ground Support Equipment (GSE) cleaning rules. The operational section contains rules governing personnel attire, CWA/CCZ entry, CWA/CCZ operations, tools and fixtures, and materials. The CWA/CCZ cleaning section contains the rules for cleaning of the floors, walls, beams, ledges, ceiling, and walls above 3.7 m (12 ft.). The GSE cleaning section has rules for the cleaning of platforms, electrical panels, consoles, servicer units, cranes, hoists, etc. Appendix D provides rules covering clean room garment requirements. Appendix E contains guidelines for contamination control during contamination generating operations.

3.2 MAINTENANCE OF HVAC SYSTEMS

HVAC systems establish and maintain the CWA/CCZ environment for temperature, relative humidity, airborne particle concentration, differential pressure, and air changes per hour. Because the HVAC system is critical to the CWA/CCZ environment, Preventive Maintenance Instructions (PMI's) are required for all CWA/CCZ systems. As a minimum, quarterly, semiannual, and annual PMI's are required for cooling, heating, and air handler components. Filtration systems require annual PMI's that perform visual examinations of the final filter for physical damage, deteriorated gaskets, and filter media. Additionally, every five (5) years each HEPA filter shall be tested for pressure drop across the filter face. Filters indicating 1.25 or greater inches water pressure differential must be replaced unless superseded by design requirement. Newly installed HEPA filters (including replacement filters) will be tested by scanning the filter media with a probe/particle counter to verify proper installation. Additionally, air quality at the filter face shall meet an ISO Class 6.7 (Class 5000) airborne particle concentration at installation.

NOTE

Testing with Dioctyl Phthalate (DOP) is not permitted at KSC. HEPA filters procured for use in KSC, NASA CCAFS, or NASA VAFB facilities will not be DOP tested by the manufacturer or certifying agency.

SECTION IV - RESPONSIBILITY

4.1 GENERAL

The responsibility for the implementation of this plan lies in two areas. CWAs/CCZs at NASA CCAFS and NASA VAFB facilities shall use one system of implementation, while CWAs/CCZs at KSC shall use another. Both systems are outlined below.

4.2 CAPE CANAVERAL AIR FORCE STATION AND VANDENBERG AIR FORCE BASE

CWAs/CCZs at the NASA CCAFS and NASA VAFB facilities involved with the processing of payloads shall use the following implementation responsibility guidelines. The NASA M&P Engineer shall designate a contractor Clean Room Engineer (CRE) to implement the monitoring, inspection, operation, and maintenance programs as specified in this plan.

4.2.1 MONITORING PROGRAM.

The CRE shall be responsible for implementing the monitoring program as outlined in Section II of this plan, or in the customer requirements, whichever is more stringent. Should any of the parameters of the monitoring program be exceeded, the Clean Room Engineer shall take immediate corrective action as indicated.

- A. Determine the area/source of the contaminant by inspection and emergency sampling and analysis
- B. Take appropriate, specific remedial actions such as:
 - (1) Correct HVAC/filter system
 - (2) Concentrate cleaning on specific areas
 - (3) Curtail certain types of activities
 - (4) Reduce personnel limit
- C. Increase the facility housekeeping effort/frequency
- D. Increase the equipment cleaning effort/frequency
- E. Report exceeded parameters to the NASA M&P Engineer

4.2.2 INSPECTION, OPERATIONS, AND MAINTENANCE PROGRAMS.

The CRE is responsible for the inspection, operations, and maintenance programs contained in Appendices A through C of this plan. Any problem detected during the course of this program shall be reported to the NASA M&P Engineer.

4.3 KENNEDY SPACE CENTER

CWAs/CCZs at KSC shall use the following implementation responsibility guidelines. The Facility Management contractor and the Processing Management Contractor will ensure the implementation of the monitoring, inspection, operations, and maintenance programs as specified in this plan.

4.3.1 MONITORING PROGRAM.

The Facility Management contractor and the Processing Management Contractor (Contractor CCE/M&P Engineering) will ensure the implementation of the monitoring program outlined in Section II of this plan. Should any of the parameters of the monitoring program be exceeded, the applicable contractor(s) will ensure that immediate corrective action is implemented as stated below:

- A. Determine the area/source of the contaminant by inspection, emergency sampling, or analysis
- B. Take appropriate, specific remedial actions such as:
 - (1) Correct HVAC/filter system
 - (2) Concentrate cleaning on specific areas
 - (3) Curtail certain types of activities
 - (4) Reduce personnel limits
- C. Increase the facility housekeeping effort/frequency
- D. Increase the equipment cleaning effort/frequency
- E. Report exceeded parameters to the NASA M&P Engineer
- F. Contact contractor Contamination Control Engineer (CCE)/M&P Engineering if the facility environmental conditions degrade for more than 1 hour (continuous) from the parameters listed in Table 2-1. The contractor CCE/M&P will assist the Facility Management contractor in restoring the proper environment and protecting flight hardware within the facility.

4.3.2 INSPECTION, OPERATIONS, AND MAINTENANCE PROGRAMS.

The Facility Management contractor and the Processing Management contractor will ensure the implementation of the inspection, operations, and maintenance programs contained in Appendices A through C of this plan. A system must exist to immediately alert the Facility Management contractor and Processing Management contractor when facility environmental conditions approach or exceed the limits specified in Table 2-1. Out-of-specification facility environmental conditions will be reported on a Facility Anomaly Report. This report will be forwarded to the contractor CCE/M&P Engineer, NASA M&P Engineer, and the Payload Manager of affected flight hardware and/or critical GSE.

Minor, temporary environmental parameter excursions of temperature, relative humidity, and/or airborne particle count are considered normal and non-reportable events, if the excursion meets the following criteria:

- Duration is less than 30 minutes.
- Temperature and relative humidity exceed specification no more than 5% of the limit value.
- Airborne particle counts exceed specification no more than two times the limit value.
- During planned/scheduled facility outages.

NOTE

Contractor CCE/M&P Engineering will be notified within 24 hours of all environmental excursions that violate payload requirements. Contractor CCE/M&P Engineering will notify the NASA M&P Engineer and the contractor Payload Manager of the affected hardware and initiate Problem Reporting And Corrective Action (PRACA), if required.

4.4 PAYLOAD CLEANLINESS

Payload cleanliness is the responsibility of the customer or agency using the payload facilities at KSC, CCAFS, and VAFB. The build-up of visible particulate contamination can be expected during normal processing operations in most CWAs/CCZs. The rate of particle fallout is dependent upon the housekeeping efforts practiced by the customer, the processing contractor, and the facility support personnel. The inspection and cleaning suggestions in this section should assist payload personnel in this effort.

4.4.1 PAYLOAD INSPECTIONS

Frequency of payload inspections, during active processing, shall be scheduled in accordance with mission specific requirements documents as determined by the payload's visual cleanliness level requirement.

Frequency of payload inspections during periods of inactivity shall be performed at the discretion of NASA or contractor CCE/M&P Engineering as coordinated with the payload customer.

4.4.2 CLEANING METHODS AND MATERIALS

- A. Each customer or agency should develop cleaning methods and procedures applicable to their hardware.
- B. Cleaning solvents and materials may be used unless prohibited by the CWA/CCZ material use restrictions referenced in the appendices of this document or by safety requirements.
- C. Payload cleaning operations should be coordinated with the Facility Management contractor or Clean Room Engineer to implement additional housekeeping efforts within the CWA/CCZ. This will prevent the spread of contamination to other payloads or areas of the CWA/CCZ.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

1.0 CWA/CCZ OPERATIONAL RULES

THE FOLLOWING ARE THE OPERATIONAL RULES FOR CLEAN WORK AREAS/ISO CLASS CLEAN ZONES AT KSC, CCAFS, AND VAFB:

1.1 PERSONNEL ATTIRE

- A. Watches, rings, and other jewelry must be removed or taped.
- B. Cleanroom coveralls, hoods, and booties must be worn to gain access to the CWA/CCZ, and garments will be kept snugly fastened while inside the CWA/CCZ (Nomex garments must be worn in close proximity to ordnance operations). Persons with long hair will wear hoods; persons with facial hair will wear eye-hoods or caps and beard covers.
- C. Garments worn outside the CWA/CCZ or garment change room, or during contaminant-generating operations, must be exchanged for clean garments.
- D. Garments shall be changed every 3 working days or sooner should they become visibly soiled.
- E. Remove contents of upper pockets.
- F. Eye glasses shall be tethered.

1.2 CWA/CCZ ENTRY

- A. A mechanical shoe cleaner shall be used prior to entering the garment change room.
- B. All personnel shall enter the CWA/CCZ through an air shower in facilities equipped with one.
- C. Only the proper numbers of personnel are allowed in the air shower at a time, and only one door of the air shower shall be open at a time.
- D. All personnel shall be trained in clean room practices.
- E. Tacky mats will be maintained at the entrance to the CWA/CCZ and at other locations around work stands or other platforms.
- F. All equipment shall be cleaned prior to entering.
- G. Cosmetics or external medications will be limited in the CWA/CCZ.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

1.3 CWA/CCZ OPERATIONS

- A. Particle generating operations such as platform installation or adjustments, sanding, drilling, welding, and painting, will be rigidly controlled. Consult Appendix 'E' for contamination control guidelines. Identified particle generating operations are platform work, crane operations, door operations, and work stand work.
- B. CWA/CCZ users will be responsible for assistance in maintaining clean room conditions.
- C. No unnecessary operations will be performed within the CWA/CCZ.
- D. No hair combing or cleaning of fingernails.
- E. Equipment powered by internal combustion engines will not be operated in the CWA/CCZ unless authorized by the contractor facility manager and exhaust is ducted outside the facility.

1.4 TOOLS, FIXTURES, AND EQUIPMENT

- A. Tools shall be stored in steel trays, molded plastic holders, or other non-particle-generating surfaces. They shall not be stored in wooden, cloth, or felt-lined containers.
- B. Tools used shall be corrosion resistant and constructed of minimum particulate-generating materials.
- C. Tools shall be cleaned to VC prior to entry into the CWA/CCZ.
- D. Use of metal abrading tools such as pipe wrenches, pliers, and knurled-jaw holding tools will be rigidly controlled in the CWA/CCZ.
- E. All cabinets, stools, benches, etc., shall be constructed of minimum particle-generating material.
- F. Business machines such as copiers, printers, plotters, facsimile machines, shredders, etc. are prohibited.
- G. Office equipment such as staplers, hole punches, pencils (wooden or mechanical), erasers, paperclips, chalk, etc. is prohibited.
- H. Use ball point pens for writing.
- I. Vacuum cleaners will be "clean room type," equipped with HEPA filters for exhaust air, or the facility vacuum system will be used. Attachments will be constructed of good quality, non-shedding materials.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

1.5 MATERIALS

- A. No tobacco products, food, beverages, or flame producing devices are allowed in the CWA/CCZ.
- B. Only paper products necessary for the current work operation shall be allowed in the CWA/CCZ. Clean room paper is required; however, if regular paper is necessary, these shall be kept in a closed plastic bag when not in use.
- C. Approved solvents are listed in applicable 'Non-Flight Materials and Equipment' documents (includes approved and restricted materials/equipment).
- D. Oils, grease, or lubricants, other than those approved for specific applications, shall not be permitted in the CWA/CCZ.
- E. Mops will be constructed of non-shedding, synthetic materials.
- F. Wipes will be constructed of cellulose foam or lint free cloths.
- G. Recommended cleaning solutions are Amway LOC[®], Clean Room Products HD Detergent[®], or 20% isopropyl alcohol in water.
- H. Aerosol spray cans are prohibited.
- I. Consult contractor documents for additional material restrictions in and around flight hardware.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

2.0 CWA/CCZ CLEANING RULES

THE FOLLOWING FACILITY ITEMS WILL BE CLEANED AT THE FREQUENCY AND WITH CLEANING METHODS DESCRIBED IN THIS APPENDIX.

2.1 CWA/CCZ FLOORS (INCLUDING ANTEROOMS, AIRLOCKS AND PLATFORM FLOORS)

- A. Floors will be inspected once weekly.
- B. Floors will be vacuumed daily using an installed system with external discharge or HEPA filtered portable system.
- C. Dust mops, brooms, or sweeping compounds will not be used in this CWA/CCZ.
- D. Floors will be damp mopped daily.
- E. Normally only water will be used for damp mopping; where stubborn soils are encountered, other cleaning solutions may be used (see paragraph 1.5 of Appendix A).
- F. When cleaning solutions other than water are used, follow with two clear water rinses.
- G. Users who require that facility personnel not work within a defined radius of their flight hardware must maintain that area themselves at the levels defined here.

2.2 CWA/CCZ WALLS AND LEDGES

- A. CWA/CCZ walls and ledges will be inspected once monthly and cleaned once weekly or as necessary to maintain the CWA/CCZ cleanliness standard (normally this requirement is interpreted as "accessible wall areas" from the floor to approximately a 3.7 m (12 ft.) height).
- B. Where stubborn soils are encountered, they will be cleaned by wiping with low lint cloths or foam wipes dampened with an approved cleaning solution.

2.3 CWA/CCZ WALLS AND LEDGES ABOVE 3.7 M (12 FT)

CWA/CCZ walls, ledges, exposed beams, plumbing, and other fixtures above 3.7 m (12 ft.) will be inspected as required and cleaned as necessary.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

2.4 CWA/CCZ CEILINGS

Ceilings will be vacuumed with an approved vacuum cleaner as required.

2.5 TACKY MATS

Tacky mats will be changed when their effectiveness has diminished or at least four times per shift during active periods.

2.6 CLEANING SCHEDULE

If cleanliness monitoring or inspections establish an increasing trend of contamination within the CWA/CCZ, an accelerated cleaning schedule may be required.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

3.0 GSE CLEANING RULES

THE FOLLOWING GSE ITEMS WILL BE INSPECTED AND CLEANED AT THE FREQUENCY AND WITH THE CLEANING METHODS DESCRIBED IN THIS APPENDIX.

3.1 PLATFORM STRUCTURES

- A. Fixed and moveable platforms or work stands and associated beams and structures will be inspected once weekly for surface cleanliness to level VC.
- B. This equipment will be cleaned at least once daily or as required to maintain CWA/CCZ standards.
- C. When stubborn soils are encountered, surfaces will be wiped clean using low lint or foam wipes moistened with an approved cleaning solution (see paragraph 1.5 of Appendix A).

3.2 ELECTRICAL PANELS AND CONSOLES

- A. Electrical and electronic panels and consoles will be inspected bi-weekly by the contractor facility manager for surface cleanliness to level VC.
- B. This equipment will be cleaned a minimum of once weekly or as required to maintain CWA/CCZ standards.
- C. When stubborn soils are encountered, this equipment will be wiped clean using low lint cloths or foam wipes moistened with water and an approved cleaning solution.

3.3 SERVICER UNITS

- A. Fluid and gaseous servicer units and pneumatic panels will be inspected bi-weekly for surface cleanliness to level VC.
- B. This equipment will be cleaned a minimum of once weekly or as required to maintain CWA/CCZ standards.
- C. When stubborn soils are encountered, this equipment will be wiped clean using low lint cloths or foam wipes moistened with water and an approved cleaning solution.

3.4 CRANES, HOISTS, FORKLIFTS, TUGS, ETC.

- A. Cranes and hoists with associated rails and structures and large CWA/CCZ airlock or bay doors will be inspected annually for surface cleanliness to level VC.

**APPENDIX A - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 1 & 2/CCZ CLASSES 6.7 & 7**

- B. Excess lubricants and greases will be removed from this equipment.
- C. This equipment will be cleaned as required to maintain CWA/CCZ standards.
- D. When stubborn soils are encountered and with the concurrence of cognizant engineering, this equipment will be wiped clean using low lint cloths or foam wipes moistened with detergent solution or an approved cleaning solvent.

3.5 CLEANING SCHEDULE

If contamination monitoring establishes an increasing trend of contamination within the CWA/CCZ, an accelerated inspection and cleaning schedule may be required.

APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8

1.0 CWA/CCZ OPERATIONAL RULES

THE FOLLOWING ARE THE OPERATIONAL RULES FOR CLEAN WORK AREAS/ISO CLASS CLEAN ZONES AT KSC, CCAFS, AND VAFB:

1.1 PERSONNEL ATTIRE

- A. Cleanroom coveralls, caps or hoods, and booties must be worn when ascending work platforms within all footprints actively processing flight hardware in the CWA/CCZ. CWA/CCZ cleanroom smocks and caps/hoods must be worn at ground level in the CWA/CCZ when within three feet of flight hardware. Garments will be kept snugly fastened while inside the CWA/CCZ (persons with long hair will wear hoods; persons with facial hair will wear eye-hoods or caps and beard covers).
- B. Garments worn outside the CWA/CCZ or garment change room, or during contaminant-generating operations, must be exchanged for clean garments.
- C. Garments shall be changed every 3 days or sooner should they become visibly soiled.
- D. Contents of upper pockets shall be removed.
- E. Eye glasses shall be tethered.
- F. Watches and jewelry shall be removed or taped.

1.2 CWA/CCZ ENTRY

- A. All personnel shall enter the CWA/CCZ through an air shower in facilities equipped with one. Where an air shower is not regularly used and personnel attire is allowed, personnel are required to change into clean room garments in designated areas in order to work on or near flight hardware.
- B. Only one door of the air shower shall be open at a time.
- C. A mechanical shoe cleaner shall be used prior to entering the change room – when applicable.
- D. All personnel shall be aware of contamination sensitive areas.
- E. Tacky mats will be maintained at the entrance to the CWA/CCZ and at other locations around work stands or other platforms.
- F. All equipment shall be cleaned prior to entering.

**APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8**

- G. Cosmetics or external medications will be limited in the CWA/CCZ.

1.3 CWA/CCZ OPERATIONS

- A. Particle generating operations such as platform installation or adjustments, sanding, drilling, welding, and painting will be controlled. Consult Appendix 'E' for contamination control guidelines. Identified particle generating operations are crane operations and work stand or platform movement.
- B. CWA/CCZ users will be responsible for assistance in maintaining clean room conditions.
- C. No unnecessary operations will be performed within the CWA/CCZ.
- D. No hair combing or cleaning of fingernails.
- E. Equipment powered by internal combustion engines will not be operated in the CWA/CCZ unless authorized by the contractor facility manager, and exhaust is ducted outside the facility.

1.4 TOOLS, FIXTURES, AND EQUIPMENT

- A. Tools shall be stored in steel trays, molded plastic holders, or other non-particle-generating surfaces. They shall not be stored in wooden, cloth, or felt-lined containers.
- B. Tools used shall be corrosion resistant and constructed of minimum particulate-generating materials.
- C. Tools and GSE shall be cleaned to VC prior to entry into the CWA/CCZ and periodically thereafter to maintain VC status.
- D. Use of metal abrading tools such as pipe wrenches, pliers, and knurled-jaw holding tools shall be rigidly controlled in the CWA/CCZ.
- E. All cabinets, stools, benches, etc., shall be constructed of minimum particle-generating material.
- F. Business machines such as copiers, plotters, facsimile machines, shredders, etc. are prohibited. Limited use of printers may be authorized by the facility manager and the CCE.
- G. Office equipment such as staplers, hole punches, pencils (wooden or mechanical), erasers, paperclips, chalk, etc. is prohibited.
- H. Use ball point pens for writing.
- I. Vacuum cleaners will be "clean room type," equipped with HEPA filters for exhaust air, or the facility vacuum system will be used.

**APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8**

Attachments will be constructed of good quality, non-shedding materials.

1.5 MATERIALS

- A. No tobacco products, food, beverages, or flame producing devices are allowed in the CWA/CCZ.
- B. Only paper products necessary for the current work operation shall be allowed in the CWA/CCZ.
- C. Approved solvents are listed in applicable 'Non-Flight Materials and Equipment' documents (includes approved and restricted materials/equipment).
- D. Oils, grease, or lubricants, other than those approved for specific applications, shall not be permitted in the CWA/CCZ.
- E. Mops will be constructed of non-shedding, synthetic materials.
- F. Wipes will be constructed of cellulose foam or low lint cloths.
- G. Recommended cleaning solutions are Amway LOC®, Clean Room Products HD Detergent®, or 20% isopropyl alcohol in water.
- H. Aerosol spray cans are prohibited.
- I. Consult contractor documents for additional material restrictions in and around flight hardware.

**APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8**

2.0 CWA/CCZ CLEANING RULES

THE FOLLOWING FACILITY ITEMS WILL BE CLEANED AT THE FREQUENCY AND WITH CLEANING METHODS DESCRIBED IN THIS APPENDIX.

2.1 CWA/CCZ FLOORS (INCLUDING ANTEROOMS, AIRLOCKS AND PLATFORM FLOORS)

- A. Floors will be inspected weekly.
- B. Floors will be vacuumed weekly using an installed system with external discharge or HEPA filtered portable system
- C. Dust mops, brooms, or sweeping compounds will not be used in this CWA/CCZ.
- D. Floors will be damp mopped weekly.
- E. Normally only water will be used for damp mopping; where stubborn soils are encountered, other approved cleaning solutions may be used (see paragraph 1.5 of Appendix B).
- F. When cleaning solutions other than water are used, follow with two clear water rinses.
- G. Users who require that facility personnel not work within a defined radius of their flight hardware must maintain that area themselves at the levels defined here.

2.2 CWA/CCZ WALLS AND LEDGES

- A. CWA/CCZ walls will be inspected by the contractor facility manager once monthly and cleaned as required to maintain CWA/CCZ standards. (Normally this requirement is interpreted as "accessible wall areas" from the floor to approximately a 3.7 m (12 ft.) height.)
- B. Where stubborn soils are encountered, the surfaces will be cleaned by wiping with low lint or foam wipes dampened with an approved cleaning solution.

2.3 CWA/CCZ WALLS AND LEDGES ABOVE 3.7 M (12 FT)

CWA/CCZ walls, ledges, exposed beams, plumbing, and other fixtures above 3.7 m (12 ft.) will be inspected as required and cleaned as necessary.

**APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8**

2.4 CWA/CCZ CEILINGS

Ceilings will be vacuumed with an approved vacuum cleaner as required.

2.5 TACKY MATS

Tacky mats will be changed when their effectiveness has diminished.

2.6 CLEANING SCHEDULE

If cleanliness monitoring or inspections establish an increasing trend of contamination within the CWA/CCZ, an accelerated cleaning schedule may be required.

**APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8**

3.0 GSE CLEANING RULES

THE FOLLOWING GSE ITEMS WILL BE INSPECTED AND CLEANED AT THE FREQUENCY AND WITH THE CLEANING METHODS DESCRIBED IN THIS APPENDIX.

3.1 PLATFORM STRUCTURES

- A. Fixed and moveable platforms or work stands and associated beams and structures will be inspected once weekly for surface cleanliness.
- B. This equipment will be cleaned a minimum of once monthly.
- C. When stubborn soils are encountered, surfaces will be wiped clean using low lint or foam wipes moistened with an approved cleaning solution (see paragraph 1.5 of Appendix B).

3.2 ELECTRICAL PANELS AND CONSOLES

- A. Electrical and electronic panels and consoles will be inspected bi-monthly by the contractor facility manager for surface cleanliness to level VC.
- B. This equipment will be cleaned a minimum of once monthly or as required to maintain CWA/CCZ standards.

3.3 SERVICER UNITS

- A. Fluid and gaseous servicer units and pneumatic panels will be inspected bi-monthly for surface cleanliness to level VC.
- B. This equipment will be cleaned a minimum of once monthly or as required to maintain CWA/CCZ standards.
- C. When stubborn soils are encountered, this equipment will be wiped clean using low lint or foam wipes moistened with water or an approved cleaning solution.

3.4 CRANES, HOISTS, FORKLIFTS, TUGS, ETC.

- A. Cranes and hoists with associated rails and structures and large CWA/CCZ airlock or bay doors will be inspected annually for surface cleanliness to level VC.
- B. Excess lubricants and greases will be removed from this equipment.
- C. This equipment will be cleaned as required to maintain CWA/CCZ standards.

**APPENDIX B - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVELS 3 & 4/CCZ CLASSES 7.7 & 8**

- D. When stubborn soils are encountered and with the concurrence of cognizant engineering, this equipment will be wiped clean using low lint or foam wipes moistened with detergent solution or an approved cleaning solvent.

3.5 CLEANING SCHEDULE

If contamination monitoring establishes an increasing trend of contamination within the CWA/CCZ, an accelerated inspection and cleaning schedule may be required.

APPENDIX C - OPERATIONS AND MAINTENANCE RULES FOR CWA LEVEL 5/CCZ CLASS 8.5

1.0 CWA/CCZ OPERATIONAL RULES

THE FOLLOWING ARE THE OPERATIONAL RULES FOR CLEAN WORK AREAS/ISO CLASS CLEAN ZONES AT KSC, CCAFS, AND VAFB:

1.1 PERSONNEL ATTIRE

Cleanroom smocks and caps/hoods are optional.

1.2 CWA/CCZ ENTRY

Tacky mats shall be used prior to entering the CWA/CCZ.

1.3 CWA/CCZ OPERATIONS

- A. Particle generating operations such as platform installation or adjustments, sanding, drilling, welding, and painting will use controls to prevent the spread of contamination. Consult Appendix 'E' for contamination control guidelines.
- B. CWA/CCZ users will be responsible for assistance in maintaining clean room conditions.
- C. No unnecessary operations will be performed within the CWA/CCZ.

1.4 TOOLS, FIXTURES AND EQUIPMENT

- A. Tools shall be stored in steel trays, molded plastic holders, or other non-particle-generating surfaces. They shall not be stored in wooden, cloth, or felt-lined containers.
- B. Tools used shall be corrosion resistant and be constructed of minimum particulate-generating materials.
- C. Tools shall be cleaned to VC prior to entry into the CWA/CCZ and periodically thereafter to maintain VC status.
- D. All cabinets, stools, benches, etc., shall be constructed of minimum particle-generating material.
- E. Use of metal abrading tools such as pipe wrenches, pliers, and knurled-jaw holding tools shall be minimized in the CWA/CCZ.
- F. Business machines, such as copiers, printers, plotters, facsimile machines, shredders, etc., are prohibited unless authorized by the contractor facility manager.
- G. Office equipment such as staplers, hole punches, pencils (wooden or mechanical), erasers, paperclips, chalk, etc., are prohibited.

**APPENDIX C - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVEL 5/CCZ CLASS 8.5**

- H. Use ball point pens for writing.
- I. Vacuum cleaners will be "clean room type," equipped with HEPA filters for exhaust air, or the facility vacuum system will be used. Attachments will be constructed of good quality, non-shedding materials.

1.5 MATERIALS

- A. No tobacco products, food, beverages, or flame producing devices are allowed in the CWA/CCZ.
- B. Approved solvents are listed in applicable 'Non-Flight Materials and Equipment' documents (includes approved and restricted materials/equipment).
- C. Oils, grease, or lubricants, other than those approved for specific applications, shall not be permitted in the CWA/CCZ. Containers must be kept covered when not in use.
- D. Only paper products necessary for the current work operation shall be allowed in the CWA/CCZ.
- E. Mops will be constructed of quality materials and maintained in good condition.
- F. Wipes will be constructed of cellulose foam or lint free cloths.
- G. Recommended cleaning solutions are Amway LOC®, Clean Room Products HD Detergent®, or 20% isopropyl alcohol in water.
- H. Aerosol spray cans are prohibited.
- I. Consult contractor documents for additional material restrictions in and around flight hardware.

**APPENDIX C - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVEL 5/CCZ CLASS 8.5**

2.0 CWA/CCZ CLEANING RULES

THE FOLLOWING FACILITY ITEMS WILL BE CLEANED AT THE FREQUENCY AND WITH CLEANING METHODS DESCRIBED IN THIS APPENDIX.

2.1 CWA/CCZ FLOORS (INCLUDING ANTEROOMS, AIRLOCKS AND PLATFORM FLOORS)

- A. Floors will be inspected monthly.
- B. Floors will be vacuumed weekly using an installed system with external exhaust or a HEPA filtered portable unit.
- C. Floors will be damp mopped weekly.
- D. Normally only water will be used for damp mopping; where stubborn soils are encountered, other cleaning solutions may be used (see paragraph 1.5 of Appendix C).
- E. When cleaning solutions other than water are used, follow with two clear water rinses.
- F. Users who require that facility personnel not work within a defined radius of their flight hardware must maintain that area themselves at the levels defined here.

2.2 CWA/CCZ WALLS AND LEDGES

- A. CWA/CCZ walls will be inspected by the contractor facility manager every 3 months and cleaned as required to maintain CWA/CCZ standards. (Normally this requirement is interpreted as "accessible wall areas" from the floor to approximately a 3.7 m (12 ft.) height.)
- B. Where stubborn soils are encountered, the surfaces will be cleaned by wiping with low lint or foam wipes dampened with an approved cleaning solution.

2.3 CWA/CCZ WALLS AND LEDGES ABOVE 3.7 M (12 FT.)

CWA/CCZ walls, ledges, exposed beams, plumbing, and other fixtures above 3.7 m (12 ft.) will be inspected r as required and cleaned as necessary.

2.4 CWA/CCZ CEILINGS

Ceilings will be vacuumed with an approved vacuum cleaner as required.

2.5 TACKY MATS

**APPENDIX C - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVEL 5/CCZ CLASS 8.5**

Tacky mats will be changed when their effectiveness has diminished.

2.6 CLEANING SCHEDULE

If cleanliness monitoring or inspections establish an increasing trend of contamination within the CWA/CCZ, an accelerated cleaning schedule may be required.

**APPENDIX C - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVEL 5/CCZ CLASS 8.5**

3.0 GSE CLEANING RULES

THE FOLLOWING GSE ITEMS WILL BE INSPECTED AND CLEANED AT THE FREQUENCY AND WITH THE CLEANING METHODS DESCRIBED IN THIS APPENDIX.

3.1 PLATFORM STRUCTURES

- A. Fixed and moveable platforms or work stands and associated beams and structures will be inspected by operations engineering once weekly for surface cleanliness to level VC.
- B. This equipment will be cleaned as required to maintain CWA/CCZ standards.
- C. When stubborn soils are encountered, surfaces will be wiped clean using low lint or foam wipes moistened with an approved cleaning solution.

3.2 ELECTRICAL PANELS AND CONSOLES

- A. Electrical and electronic panels and consoles will be inspected bi-monthly by the contractor facility manager for surface cleanliness to level VC.
- B. This equipment will be cleaned a minimum of once monthly or as required to maintain CWA/CCZ standards.

3.3 SERVICER UNITS

- A. Fluid and gaseous servicer units and pneumatic panels will be inspected bi-monthly for surface cleanliness to level VC.
- B. This equipment will be cleaned a minimum of once monthly or as required to maintain CWA/CCZ standards.
- C. When stubborn soils are encountered, this equipment will be wiped clean using low lint or foam wipes moistened with water or an approved cleaning solution.

3.4 CRANES, HOISTS, FORKLIFTS, TUGS, ETC.

- A. Cranes and hoists with associated rails and structures and large CWA/CCZ airlock or bay doors will be inspected annually and cleaned to level VC as required.
- B. Excess lubricants and greases will be removed from this equipment.
- C. This equipment will be cleaned as required to maintain CWA/CCZ standards.

**APPENDIX C - OPERATIONS AND MAINTENANCE RULES FOR
CWA LEVEL 5/CCZ CLASS 8.5**

- D. When stubborn soils are encountered, this equipment will be wiped clean using foam wipes moistened with detergent or an approved cleaning solvent.

3.5 CLEANING SCHEDULE

If contamination monitoring establishes an increasing trend of contamination within the CWA/CCZ, an accelerated inspection and cleaning schedule may be required.

**APPENDIX D - MINIMUM CLEAN WORK AREA/ISO CLASS CLEAN ZONE
GARMENT REQUIREMENTS (8)**

AREAS	SMOCKS	CLEAN ROOM COVERALLS	HOOD OR SHOWER CAP	LINT FREE GLOVES (1)	BOOTIES OVER SOFT SHOES	COVER FACIAL HAIR
SSPF - High Bay - Intermediate Bay - Airlock - Hardware Inspection Area	----- Acceptable business attire -----					
Off Line Labs	As required by user with clean room garments required when working on or within 3 feet of flight hardware					
Directly on or over Flight Hardware (2)		Yes	Yes	Yes	Yes (3)	Yes
Within Three Feet of Flight Hardware Access Stand Adjacent to Flight Hardware (2)	Yes (4)		Yes	Yes	(5)	Yes
Kitting Flight Hardware Logistics Areas				Yes		
MPPF High Bay (6)	Yes		Yes	Yes	(7)	Yes
PHSF High Bay (6)	Yes		Yes	Yes	(7)	Yes

- When handling flight hardware.
- Flight crew members entering or working over/on flight hardware are required, as a minimum dress standard, to wear clean flight/jump suits, shower caps, and clean rubber soled athletic shoes. The shoes will be donned on an upper level of the test stand and booties may be substituted for the athletic shoes at the crew member's discretion.
- Booties over stockings are the only footwear allowed on pallets and other flight hardware identified by mission processing teams.
- Coveralls may be worn in place of smocks.
- The determination for the wearing of shoe covers within 3 feet of flight hardware and on access stands may be made at the discretion of the Mission Processing Team. This determination can vary from control area to control area, as long as the controlled area is not occupied by more than one Mission Processing Team.
- Unless otherwise specified by the Contractor Facility Manager, Program Requirements Document, or Safety Requirements.
- Optional
- Safety considerations may dictate additional requirements

APPENDIX E - Guidelines For Contamination Control During Contamination Generating Operations In Payload Facility Clean Work Areas/ISO Class Clean Zones

OPERATION	LIMITATIONS / RESTRICTIONS	CONTAMINATION CONTROL PROCEDURES
MINOR SANDING	TOTAL AREA LESS THAN 16 SQUARE INCHES. HAND SANDING ONLY.	WET SAND WHEN POSSIBLE. VACUUM PARTICULATE MATTER AS IT IS GENERATED. CLEAN SURROUNDING AREA DURING AND AFTER OPERATION. MINIMIZE PERSONNEL IN IMMEDIATE AREA.
**MAJOR SANDING	TOTAL AREA GREATER THAN 16 SQUARE INCHES OR POWER SANDING.	IN ADDITION TO MEASURES FOR MINOR SANDING, PROTECTIVE TENT REQUIRED AROUND OPERATION. POWER SANDING STRONGLY DISCOURAGED.
MINOR GRINDING	TOTAL AREA LESS THAN 16 SQUARE INCHES. HAND FILING / GRINDING ONLY.	VACUUM PARTICULATE MATTER AS IT IS GENERATED. CLEAN SURROUNDING AREA DURING AND AFTER OPERATION. MINIMIZE PERSONNEL IN IMMEDIATE AREA.
**MAJOR GRINDING	TOTAL AREA GREATER THAN 16 SQUARE INCHES OR POWER GRINDING. POWER GRINDING REQUIRES BURN PERMIT.	IN ADDITION TO MEASURES FOR MINOR GRINDING, PROTECTIVE TENT REQUIRED AROUND OPERATION. POWER GRINDING STRONGLY DISCOURAGED.
MINOR SAWING	SAW LINE LESS THAN 8 INCHES. HAND SAWING ONLY.	VACUUM PARTICULATE MATTER AS IT IS GENERATED. CLEAN SURROUNDING AREA DURING AND AFTER OPERATION. MINIMIZE PERSONNEL IN IMMEDIATE AREA.
**MAJOR SAWING	SAW LINE GREATER THAN 8 INCHES OR POWER SAWING.	IN ADDITION TO MEASURES FOR MINOR SAWING, PROTECTIVE TENT REQUIRED AROUND OPERATION. POWER SAWING STRONGLY DISCOURAGED.
**DRILLING	LOW SPEED ONLY. MINIMIZE USE OF CUTTING OILS.	VACUUM PARTICULATE MATTER AS IT IS GENERATED. CLEAN SURROUNDING AREA DURING AND AFTER OPERATION. MINIMIZE PERSONNEL IN IMMEDIATE AREA.
MINOR PAINT REMOVING - MECHANICAL -	TOTAL AREA LESS THAN 16 SQUARE INCHES. HAND SANDING ONLY.	USE MINOR SANDING PROCEDURE.
**MINOR PAINT REMOVING - CHEMICAL -	TOTAL AREA LESS THAN 4 SQUARE INCHES. CHEMICAL STRIPPER MUST BE APPROVED BY CONTRACTOR M&P ENGINEERING.	PREPARE STRIPPER OUTSIDE OF CWA/CCZ. MINIMIZE AMOUNT OF STRIPPER BROUGHT INTO CWA/CCZ - 2 FL OZ MAXIMUM. UTILIZE PORTABLE HEPA FILTERED EXHAUST UNIT TO CAPTURE SOLVENT FUMES WHILE PAINTING.

APPENDIX E - Guidelines For Contamination Control During Contamination Generating Operations In Payload Facility Clean Work Areas/ISO Class Clean Zones

OPERATION	LIMITATIONS / RESTRICTIONS	CONTAMINATION CONTROL PROCEDURES
MAJOR PAINT REMOVING	TOTAL AREA GREATER THAN 16 SQUARE INCHES. GENERALLY NOT ALLOWED IN CWA/CCZ.	
TOUCH-UP PAINTING	TOTAL AREA LESS THAN 16 SQUARE INCHES. BRUSH PAINTING ONLY - NO SPRAY PAINTING.	MIX / STIR PAINT OUTSIDE OF CWA/CCZ. MINIMIZE AMOUNT OF PAINT BROUGHT INTO CWA/CCZ - 2 FL OZ MAXIMUM. UTILIZE PORTABLE HEPA FILTERED EXHAUST TO CAPTURE PAINT FUMES WHILE PAINTING.
**MAJOR PAINTING	TOTAL AREA GREATER THAN 16 SQUARE INCHES. BRUSH PAINTING ONLY - NO SPRAY PAINTING.	MIX / STIR PAINT OUTSIDE OF CWA/CCZ. MINIMIZE AMOUNT OF PAINT BROUGHT INTO CWA/CCZ - 4 FL OZ (PER CONTAINER) MAXIMUM. PROTECTIVE TENT MUST ENCLOSE OPERATION. FUMES INSIDE TENT MUST BE EXHAUSTED OUTSIDE OF CWA/CCZ. MAJOR PAINTING STRONGLY DISCOURAGED.
**SOLDERING	BURN PERMIT REQUIRED. LIMITED TO MINOR REPAIR / ASSEMBLY WORK.	UTILIZE PORTABLE HEPA FILTERED EXHAUST UNIT OR FACILITY VACUUM SYSTEM TO CAPTURE SOLDER SMOKE. EXTENSIVE SOLDERING WILL REQUIRE A PROTECTIVE TENT TO ENCLOSE AND EXHAUST THE SMOKE.
**WELDING, CUTTING, BRAZING	GENERALLY NOT ALLOWED IN CWA/CCZ.	

**Operations requiring pre-approval by other affected parties. Contact Operations Engineering, Facility Management contractor, Processing Management contractor or contractor CCE/M&P Engineering to arrange for approval.

Contact Operations Engineering, Facility Management contractor, Processing Management contractor, or contractor CCE/M&P Engineering prior to performing any potential contamination generating operation.

The procedures within this guide are to be considered minimum requirements. More stringent requirements may be imposed by Facility Management contractor, Processing Management contractor, contractor CCE/M&P Engineering, and/or other affected parties.

APPENDIX F - DEFINITIONS

- a. Airborne Particles - Particulate matter suspended in the ambient atmosphere.
- b. Class Clean Zone (CCZ) - An area that uses engineering controls, personnel controls, housekeeping procedures, and restraints on contamination-generating operations to maintain a high level of cleanliness.
- c. Clean Work Area (CWA) - See Class Clean Zone.
- d. Contaminant - Any unwanted matter that could be detrimental to the required operation, reliability, or performance of a part, component, subsystem, or system.
- e. Controlled Work Area - An area with a visual barrier surrounding flight hardware, payloads, test stands, and/or work platforms. This area is typically defined using a rope, fence, or chain, with instructional signs and/or rules posted at the entrance.
- f. Fiber - A particle whose length-to-width ratio is in excess of 10 to 1. (minimum length 100 microns)
- g. Generally Clean (GC) - Freedom from manufacturing residue, dirt, oil, grease, processing debris, or other extraneous contamination. This level can be achieved by washing, wiping, blowing, vacuuming, brushing, or rinsing. This level shall not be designated for hardware that is sensitive to contamination.
- h. High Efficiency Particle Air (HEPA) Filter - a filter with minimum efficiency of 99.97 percent for particles 0.3 micron and larger determined by an airborne particulate probe test at airflows of 100 percent of the rated flow capacity of the filter.
- i. Localized Control Area (LCA) - An area that has definite boundaries and which has the contamination control requirements of a CWA/CCZ or a good housekeeping area. An LCA can be a temporary or a permanent area for the processing of flight hardware (e.g. a clean tent or designated portion of a flight hardware processing area).
- j. Micrometer/Micron - A unit of measurement equal to one-millionth of a meter or approximately 0.00003937 inch (e.g., 25 microns are approximately 0.001 inch).

APPENDIX F - DEFINITIONS

- k. Molecular Deposition - Matter (usually film) without definite dimension deposited on critical surfaces.
- l. Non-Processing - Periods in which flight hardware and/or critical payload Ground Support Equipment (GSE) is not present (or expected to arrive within three weeks) at a facility. During non-processing periods, the facility environmental requirements may be relaxed and energy conservation measures should be in effect.
- m. Non-Volatile Residue (NVR) - Soluble (or suspended) material and insoluble particulate matter remaining after controlled evaporation of a filtered volatile liquid, usually measured in milligrams. Filtration is normally through a nominal 0.2-micrometer membrane filter prior to evaporation.
- n. Particle - Matter with observable length, width, and thickness usually measured in microns. This definition includes fibers.
- o. Particle Counters - Automatic electronic devices designed to separate, size, and count individual airborne particles.
- p. Particulate Matter - The general term applied to matter with observable length, width, and thickness (as contrasted to non-particulate film matter without definite dimension).
- q. Processing - Activities associated with flight hardware and/or critical payload ground support equipment. Processing periods include facility environmental certification in preparation of flight hardware arrival, presence of flight hardware, and dwell time during missions. Payload facility environmental requirements are fully applicable during these activities.
- r. Visibly Clean (VC) - The absence of all particulate and non-particulate matter visible to the normal unaided (except corrected vision) eye using specified lighting (illuminance and angle) and viewing distance. Particulate is identified as matter of miniature size with observable length, width, and thickness. Non-particulate is film matter without definite dimension. Reference Table 1-1 for Visibly Clean (VC) as applied to Payloads and applicable GSE/tools.