# HAZARDOUS AREA CLASSIFICATION ASSESSMENT

**Polar Dynamics Robotics, Inc.**

**Facility: Primary Manufacturing & Testing Center**

**Location: 4501 Innovation Drive, Dover, Delaware**

**Assessment Date: January 5, 2024**

**Document Reference: HAC-2024-001**

## 1. EXECUTIVE SUMMARY

This Hazardous Area Classification Assessment has been conducted in accordance with NFPA 70 (National Electrical Code), NFPA 497, and IEC 60079-10-1 standards to evaluate potential explosion hazards within Polar Dynamics Robotics' primary manufacturing and testing facility. This assessment specifically addresses areas where autonomous mobile robots (AMRs) are manufactured, tested, and stored.

## 2. SCOPE OF ASSESSMENT

1. This assessment covers:

- Main manufacturing floor (35,000 sq ft)
- Thermal testing chambers
- Battery charging and storage areas
- Cryogenic testing facilities
- Prototype development laboratory
- Quality control testing zones

2. Assessment methodology includes:

- Physical inspection of facilities
- Review of process documentation
- Analysis of material safety data sheets
- Evaluation of ventilation systems
- Review of electrical installation specifications

## 3. FACILITY CLASSIFICATION ZONES

1. Zone 2 Areas (where flammable atmosphere is not likely to occur in normal operation):

- Battery charging stations (Areas A1-A4)
- Thermal management fluid handling areas
- Cryogenic test chamber anteroom

2. Zone 1 Areas (where flammable atmosphere is likely to occur in normal operation):

- None identified

3. Non-Classified Areas:

- Main assembly floor
- Office spaces
- General storage areas
- Shipping/receiving

## 4. SPECIFIC HAZARD ASSESSMENTS

1. Battery Storage and Charging

- Classification: Class I, Division 2, Group B
- Primary Hazard: Hydrogen gas evolution during charging
- Control Measures: Continuous ventilation system rated at 6 air changes per hour
- Monitoring: Hydrogen gas detection system with automated shutdown

2. Cryogenic Testing Area

- Classification: Class I, Division 2, Group D
- Primary Hazard: Liquid nitrogen vapor displacement of oxygen
- Control Measures: Oxygen depletion monitoring, emergency ventilation
- Safety Systems: Automated process shutdown at <19.5% oxygen

3. Thermal Management Fluid Handling

- Classification: Class II, Division 2
- Primary Hazard: Combustible mists from synthetic cooling fluids
- Control Measures: Enclosed handling system, local exhaust ventilation
- Monitoring: Temperature and pressure monitoring on fluid systems

## 5. CONTROL MEASURES AND SAFETY SYSTEMS

1. Ventilation Systems

- Primary ventilation: 100,000 CFM total capacity
- Emergency ventilation: 150,000 CFM with backup power
- Local exhaust systems: 15 points of extraction
- Monitoring: Digital airflow monitoring with automated alerts

2. Electrical Systems

- All installations comply with NEC Article 500
- Explosion-proof fixtures in classified areas
- Intrinsically safe circuits where required
- Regular thermographic inspection program

3. Safety Interlocks

- Emergency power shutdown systems
- Automated fire suppression
- Gas detection interlocked with ventilation
- Access control for classified areas

## 6. RECOMMENDATIONS

1. Immediate Actions Required:

- None identified

2. Short-Term Recommendations:

- Install additional hydrogen gas monitors in Battery Area A4
- Update emergency response procedures for cryogenic releases
- Enhance ventilation monitoring in thermal testing areas

3. Long-Term Improvements:

- Consider upgrading to Class I, Division 1 equipment in battery charging areas
- Implement automated ventilation testing system
- Develop detailed area classification drawings

## 7. CERTIFICATION

This assessment has been conducted in accordance with applicable standards and regulations. The classifications and recommendations contained herein are based on current facility conditions as of the assessment date.

## 8. AUTHORIZATION

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Date: January 5, 2024

Reviewed by:

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Corporate Safety Director

Polar Dynamics Robotics, Inc.

Date: January 8, 2024

## 9. DISCLAIMER

This assessment represents conditions observed at the time of inspection. Changes to processes, equipment, or materials may affect the validity of this assessment. Regular reviews and updates are required to maintain accuracy and compliance with applicable regulations.