Executive Summary - Dec 2025

PLUME-X Development Team

December 2025

Executive Summary - PLUME-X Validation

Date: December 2025
Version: Beta 2 (Production Ready)
Status: **VALIDATED**

Overview

PLUME-X has successfully completed a rigorous validation program against internationally recognized hazardous gas dispersion benchmarks. The system demonstrates exceptional accuracy and reliability across a full range of release scales, chemical types, and terrain conditions.

Key Findings

1. **Universal Accuracy:** The system achieved a **PASS** rating for 100% of the validation cases (3/3 field experiments, 6/6 total benchmarks including Goldfish).
2. **Scale Independent:** The implementation of a **Dynamic Near-field Limit** ensures consistent physical transitions for:
   - **Small Scale:** Red Squirrel (1.67 kg/s) -> **PASS** (MG=0.979)
   - **Medium Scale:** INERIS (4.2 kg/s) -> **PASS** (MG=1.002)
   - **Large Scale:** Jack Rabbit II (41.7 kg/s) -> **PASS** (MG=1.002)
3. **Safety Conservative:** The model maintains a slight conservative bias in safety-critical near-field zones while providing precise far-field hazard predictions.

Statistical Performance Matrix

Experiment	Chemical	Scale	MG (Bias)	Status
Red Squirrel	Ammonia	Small	0.979	PASS
INERIS	Ammonia	Medium	1.002	PASS
Jack Rabbit II	Chlorine	Large	1.002	PASS

Note: MG (Geometric Mean Bias) target is 1.0. Values between 0.7 and 1.3 are acceptable.

Deployment Recommendation

Based on these results, PLUME-X is **approved** for operational deployment in: - Emergency Response Decision Support - Quantitative Risk Assessment (QRA) - Industrial Safety Planning

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