Unified Theory of Regulatory Compliance: Mathematical Model and CH+ Conversion Logic

Rick Fiene

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Abstract

This document formally defines the mathematical logic model for the Integrated Regulatory Framework (IRF) conversion, mapping empirical quality indicators and compliance metrics into the continuous CH+ scoring system.

1 Introduction

The core of the Unified Theory of Regulatory Compliance relies on a piecewise function that calculates a continuous base score, which is then subjected to categorical veto thresholds representing critical compliance failures. The foundational parameters are defined as follows:

- P: Program Quality Indicators (PQI)
- C: Foundational Compliance / Fiene Coefficient (FC) (Key Indicator Rules)
- N: False Negative / High Risk Rules (F-)
- P_F: False Positive / Low Risk Rules (F+)
- R: Relatively Weighted Contact Hours (RWCH)
- N_c: Number of Children (NC)
- T_o: Time Open (TO)
- T_a: Total Number of Teaching Staff (TA)

2 Mathematical Logic Model for CH^+

The base equation for the continuous quality score (S) prior to categorical vetoes is:

$$S = \left(\sum P - |C| - |N| - |P_F| + R\right) \times 2 \tag{1}$$

Where Relatively Weighted Contact Hours (RWCH) is defined as a 2D Time Element:

$$R = \frac{N_c \times T_o}{T_a} \tag{2}$$

To accurately reflect the macro-level compliance logic ($IRF = C + N + P_F$), the final CH^+ score applies automatic failure conditions regardless of the underlying P score:

$$CH^+ = \begin{cases} 0, & \text{if } |N| \geq 1 \text{ (High Risk Veto)} \\ 0, & \text{if } |P_F| \geq 3 \text{ (F+ Noncompliance)} \\ 0, & \text{if } S \leq 0 \text{ (Systemic Breakdown)} \\ S, & \text{otherwise} \end{cases} \tag{3}$$

3 Regulatory Stratification

Once the final CH^+ integer is computed, the facility is categorized into one of three distinct regulatory statuses:

- **High (Full License):** $70 \leq CH^+ \leq 100$
- **Medium (Provincial License):** $30 \leq CH^+ \leq 69$
- **Low (License Revocation/Questionable):** $0 \leq CH^+ \leq 29$

4 Empirical Conversion Table

Table 1: CH+ Conversion Output Across Sample Sites

Group	**Site**	**PQI**	**FC**	**F-**	**F+**	**RWCH**	**Status**	**CH+**
High	1	40	0	0	0	+10	Pass	100
High	2	40	0	0	0	0	Pass	80
High	3	38	0	0	-1	0	Pass	74
High	4	36	0	0	0	0	Pass	72
Med	5	38	0	0	-2	-10	Pass	52
Med	6	32	0	0	0	-5	Pass	54
Med	7	28	0	0	-2	-3	Pass	46
Med	8	24	0	0	-1	-8	Pass	30
Low	9	35	0	-1	0	0	Fail	0
Low	10	30	0	0	-3	0	Fail	0
Low	11	16	-1	0	-5	-10	Fail	0
Low	12	10	0	0	0	0	Pass	20