# PIT Case File 001: The Mystery of the Dryland Crop

## Educator Correlative Guide: Applied Chemistry and Engineering

This guide connects the concepts in PIT Case File 001 to common state-level Next Generation Science Standards (NGSS) and technology curriculum objectives. Use this series to illustrate how core science principles lead directly to high-tech, regional career paths.

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### Essential Definitions for Educators

**1. NGSS Standards (e.g., ESS3-1)** The codes refer to the Next Generation Science Standards. Using these codes helps educators quickly align the story with their curriculum requirements.

- **e.g., ESS3-1 (Earth and Space Science):** This specific standard focuses on the critical relationship between **changes in climate and natural hazards** (like the drought in the story) and how they **affect human activity** (like farming and regional economics).

**2. TRL (Technology Readiness Level)**

- **Definition:** TRL is a scale used by industry and funding agencies to measure a project's maturity, from TRL 1 (basic research) to TRL 9 (market-ready product). This shows students the practical journey from a college lab to a real factory.

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### Part I: Scientific Standards and Concepts (The 'What')

**1. Drought and NDVI Maps (e.g., ESS3-1)**

- **Correlative Science Standard/Topic:** Earth and Space Science (ESS3-1): Human activity and natural hazards.
- **Specific Lesson Tie-in:** Remote Sensing: Using the **Normalized Difference Vegetation Index (NDVI)** to measure plant health and moisture stress in precision agriculture. Directly relates to Chapter 1.

**2. Polyols and OH Value**

- **Correlative Science Standard/Topic:** Chemistry (HS-PS1-2): Properties of organic compounds.

- **Specific Lesson Tie-in:** Organic Chemistry/Polymerization: Explaining the role of the **hydroxyl (OH) functional group** as the necessary "reactive site" for building polyurethane foams.

**3. Waxes and Crystalline Sediment**

- **Correlative Science Standard/Topic:** Chemistry (HS-PS1-3): Phase change and intermolecular forces.
- **Specific Lesson Tie-in:** Solubility and Purification: Illustrating how **intermolecular attraction** (not chemical bonds) causes waxes to phase separate (crystallize) from the polyol when cooled.

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## Part II: Engineering and Applied Technology (The 'How')

**1. The Computational Crack (Chapter 2)**

- **Correlative Engineering/Tech Standard:** Engineering Design (ETS1-2): Optimization and iterative design process.
- **Specific Career Connection:** Computational Modeling: Leo's use of **Finite Element Analysis (FEA)** to solve a real-time thermal instability. Teaches that engineers solve problems with data, not just tools.

**2. The Exotherm Fix (Chapter 3)**

- **Correlative Engineering/Tech Standard:** Plastics Technology/Process Control: Materials processing variables.
- **Specific Career Connection:** Materials Processing Engineering: Demonstrating how adjusting process parameters (temperature, flow rate) is critical to a material's final physical structure and performance.

**3. Compression Test (Chapter 3)**

- **Correlative Engineering/Tech Standard:** Engineering Design (ETS1-3): Analyzing data to determine performance.
- **Specific Career Connection:** Quality Control and Material Testing: The necessity of comparing the Lesquerella polyol against the **petroleum standard** to prove viability and superiority.

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## Part III: Career and Economic Relevance (The 'Why')

- **The Hero: Leo from Hays, Kansas** (Materials Processing Technology student), demonstrates the direct pipeline from a local community to a high-tech solution.

- **The Discussion Question:** "PIT and the **MAG team** successfully proved the science. Why did they then need the **PECG Director** and the **HDT** to secure the project? What role does finance play in making science *real*?"