APPLIED COMPUTING

CASE STUDY

Physics-grounded AI, verified by the engineers who run the plant

Indorama Ventures · Port Neches, Texas

PO/MTBE



INDORAMA VENTURES

indovinya
YOUR NEEDS, OUR CHEMISTRY

ORBITAL

Applied Computing built Orbital for Indorama Ventures (IVL) against more than 4 years of the F5 unit's own DCS and laboratory history. IVL's process and production engineers verified and signed off the model's understanding of the plant, section by section. Having proven Orbital's capabilities, the 2 companies are now working towards live deployment on F5, based on a shared belief that several million dollars in benefits can be realised.

THE UNIT

A world-scale unit, not a contained corner

Indorama Ventures Limited's F5 PO/MTBE unit is one of the most complex units within its Port Neches Operations (PNO) plant: six tightly coupled process sections across two production chains, more than 15,000 tags and instruments, and decades of operating knowledge spread across documents, historians and long-tenured engineers. IVL put Orbital on this complex unit to stress test its full capability.

THE SYSTEM

Intelligence built for one plant

Orbital is not a general model pointed at industrial data. It is trained on a single plant's own history and constrained by the physics that governs the process, firewalled to answer only from that unit's data and learned physics. It runs as three layers.

LAYER 1 **Physics-grounded foundation**	Learns how the unit behaves: the relationships between conditions and outcomes that are constrained by process physics, not correlations that happened to appear in the data.
LAYER 2 **Prediction**	A continuous estimate of 16 quality parameters across the PO, TBHP and MTBE streams, pairing an estimate from DCS data with continuous calibration to the most recent lab result. It flags when the plant drifts off-normal or an analyser diverges from the calibrated prediction, and localises the cause to a process section.
LAYER 3 **Access**	Puts it in an engineer's hands. Plain-language questions, answered from the unit's own data and documentation and nothing else, with the reasoning shown.

> "When product goes off-spec on a unit this size, the cause can be a few pounds of material somewhere in three hundred feet of tower. That's a needle in a haystack, and it's exactly the kind of problem where this will be very impactful."



Donald Berg
PROCESS ENGINEER · F5 PO/MTBE UNIT

GUARDRAILS

Advisory by design

Orbital recommends. People decide. The boundary between the two is fixed in the design, not left to policy.

- Never writes setpoints, never trips equipment. Alarms and safety-instrumented systems stay untouched.
- States its confidence, and says it doesn't know at the edge of its competence.
- Operators retain full control of the unit at all times.
- An engineer implements any change themselves.

VERIFICATION

What it takes to earn an engineer's trust

IVL set the bar and held it. Rather than close model testing at the 4-week mark, IVL's leadership extended it against two criteria of their own choosing: demonstrate foundational understanding of all 6 process sections, prompt by prompt, and prove the model improves when given accurate documentation. Each section was tested on four questions covering what it does, what equipment sits in it, what each piece of equipment does, and which control levers operators have.

Five IVL users were onboarded, with Applied Computing on site at Port Neches for hands-on onboarding and workflow shadowing. Most of the gaps that surfaced traced to source documents that had fallen out of date, which is true of any plant with decades of operating history. IVL's engineers were close enough to the unit to spot every one of them. Two rounds of tuning followed, every gap was logged and owned, and resolution turned engineer feedback and corrected documentation into verified fixes within days.

On held-out test data measured against lab sample results, the typical error sat inside the agreed accuracy tolerance on every one of the 16 targets. Tolerances were set per parameter, at roughly 10 per cent of the specification limit for impurities and a tighter band for purity.

PROCESS SECTIONS VERIFIED AND SIGNED OFF

6 of 6

- MTBE
- PEROX
- EPOX
- TBA
- Feed Prep
- PO Purification

Four years of plant records hold more than any one person can carry. By the final sessions Orbital was surfacing equipment the unit's own engineers hadn't known was there.

> "Before, answering a question was time consuming. It meant pulling data and calculations together from several different systems. Now it comes back from one place, and it understands what I'm actually asking."



Alex Cook
PRODUCTION ENGINEER · F5 PO/MTBE UNIT

NEXT PHASE

From verified intelligence to operating value

This phase answered the only question that mattered first: does the model actually know the plant? 6 sections and 16 parameters later, the answer came from IVL's own engineers.

F5 now has something it didn't have before: a model of itself, built from its own history and verified by the people who run it.

"In manufacturing, credibility comes from the people closest to the process. Our engineers pushed this system, looking for gaps and testing its limits. Instead of finding reasons not to use it, they found reasons to expand it. The PO/MTBE pilot demonstrated that AI can do more than answer questions; it can preserve knowledge, accelerate problem solving, and augment decision making at every level of the organisation. That is why we are expanding our partnership with Applied Computing."



Mark Holden

CHIEF MANUFACTURING AND TECHNOLOGY OFFICER, CPET, INDORAMA VENTURES.

"The future of manufacturing won't be defined simply by having more data or better technology. It will be defined by how quickly we turn insight into action and action into learning. Our partnership with Applied Computing at Port Neches in the PO/MTBE unit is an opportunity to prove that capability where it matters most, in the operation."



Chad Anderson

CHIEF MANUFACTURING AND TECHNOLOGY OFFICER, INDOVINYA, INDORAMA VENTURES.



Energy's Foundation Model

https://www.appliedcomputing.com/