Mastering Cylinder Condition

Updated Guidelines for Scavenge Drain Oil Analysis

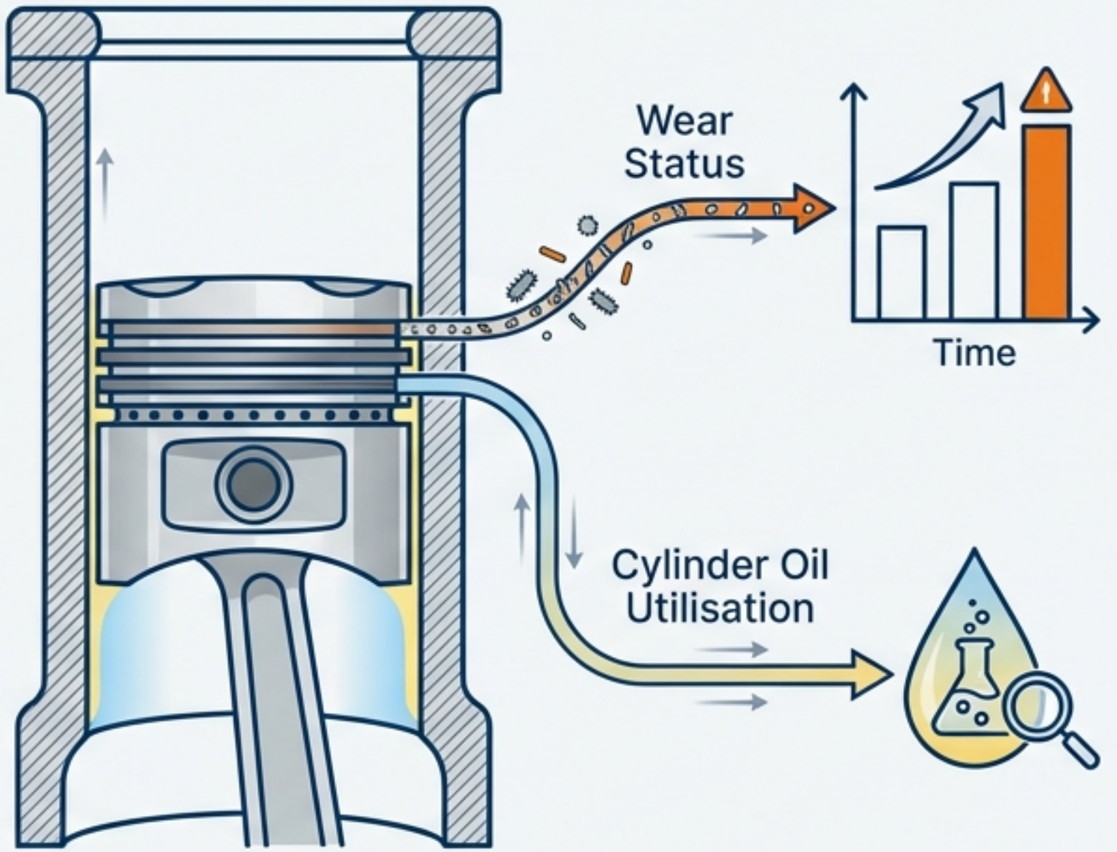
Based on Everllence Service Letter SL2025-776/NHN

Proactive Control Over Engine Health and Performance

Scavenge Drain Oil Analysis (SDA) is a fundamental tool for monitoring the real-time condition of your engine. It provides direct insight into:

* **Wear Status**: Quantifying the wear on piston rings and cylinder liners.
* **Cylinder Oil Utilisation**: Assessing the effectiveness of lubrication and acid neutralization.

This presentation provides a comprehensive guide to the latest SDA guidelines and procedures outlined in SL2025-776, empowering you to make more precise operational decisions.



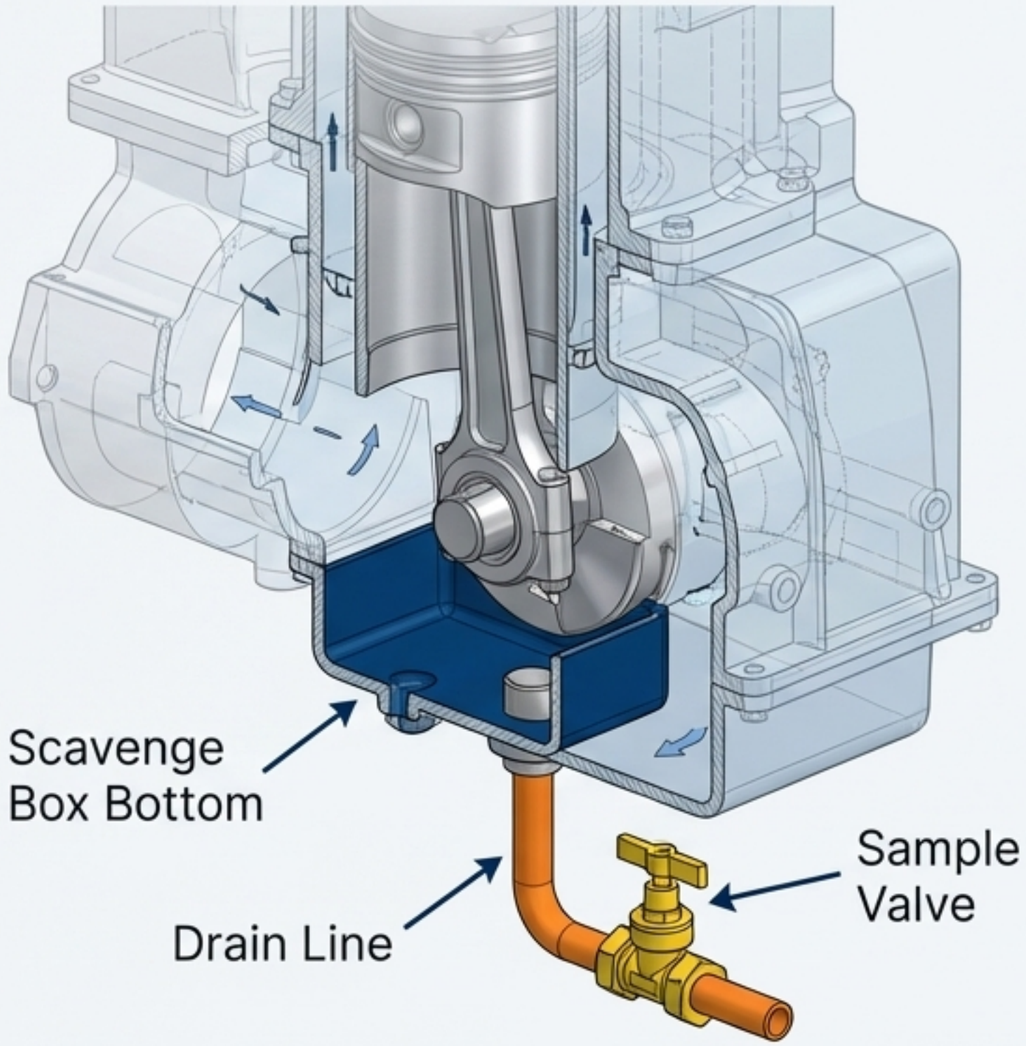
The Foundation of Accurate Analysis is a Perfect Sample

Drain oil samples are small, making them highly sensitive to contamination. The validity of your analysis—whether onboard or in a lab—depends entirely on the quality of the sample collection.

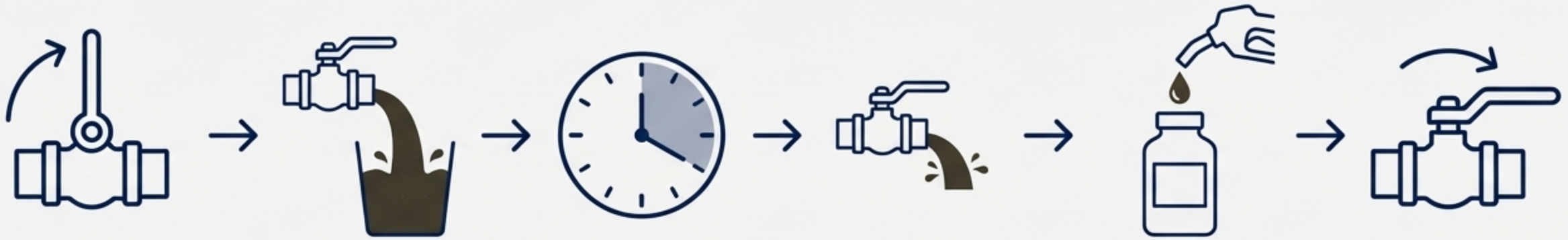
Prerequisites for Success

Clean Environment: Frequently clean the scavenge box bottom to remove deposits that can contaminate the sample.

Clear Path: Ensure the drain line remains open during normal operation.



The 6-Step Sampling Protocol



1. CLOSE:
CLOSE the drain cutoff ball valve.

2. FLUSH:
FLUSH the sample valve into a sludge container to clear impurities.

3. ACCUMULATE:
ACCUMULATE: Close sample valve, wait 30-300 minutes.

4. PURGE:
PURGE: Briefly open sample valve again into sludge container.

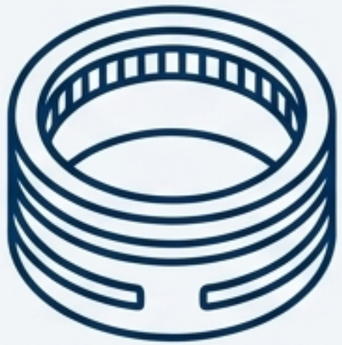
5. DRAW:
DRAW: Collect final sample into a clean, dedicated bottle.

6. RESET:
RESET: Close sample valve, re-open main drain valve.

Avoid Contamination!

- Use only clean, pre-cleaned, or disposable sample bottles.
- Sample directly into the forwarding container for lab analysis.
- Thoroughly clean all onboard test equipment before every use.

Decoding the Data: The Two Key Indicators of Cylinder Condition



Iron (Fe)

Represents: Physical Wear

Answers: “How fast are my cylinder components wearing down?”

Total iron content indicates the combined rate of corrosive and abrasive/adhesive wear.

Residual Base Number (BN)

Represents: Remaining Protective Capacity

Answers: “How much acid-neutralizing potential does my cylinder oil have left?”

Residual BN shows if the cylinder oil is effectively combating sulphuric acid corrosion.

Interpreting Iron Content: The Four Categories of Wear

To accurately assess cylinder condition, wear rates are classified into four distinct levels. Each level requires a different level of attention and action.

NORMAL

Good cylinder condition, adequate lubrication, and low wear.

RAISED

Acceptable wear, uncritical for component service life. Monitor.

ABNORMAL

Increased wear. Acceptable for short periods only. Requires more frequent analysis and potential action. Expected during running-in.

ALERT

A high-wear situation requiring immediate identification and correction to prevent engine damage.

A Critical Step: Normalizing Iron Content to the Reference Feed Rate

To compare your measured iron content against the standard guidelines, you must first correct it to a reference feed rate of 1.0 g/kWh. This ensures you are comparing apples to apples.

$$Fe_{Corrected(1.0)} = Fe_{Actual} \times FR_{Actual}$$

Measured: Iron content (Fe_Actual) is **35 ppm**.

At Feed Rate (FR_Actual): **0.80 g/kWh**.

Calculation: 35 ppm × 0.80 = **28 ppm**.

Conclusion: Your value for comparison against the guideline table is **28 ppm**.

Updated Guideline Values for Total Iron (Fe) Content

Corrected to a reference feed rate of 1.0 g/kWh

Fuel Type	Normal (≤)	Raised	Abnormal (>)	Alert (>)
ULSFO (≤0.1% S)	25	25–40	40	300
VLSFO (0.1–0.5% S)	40	40–80	80	300
HSFO (0.5–3.5% S)	100	100–200	200	800

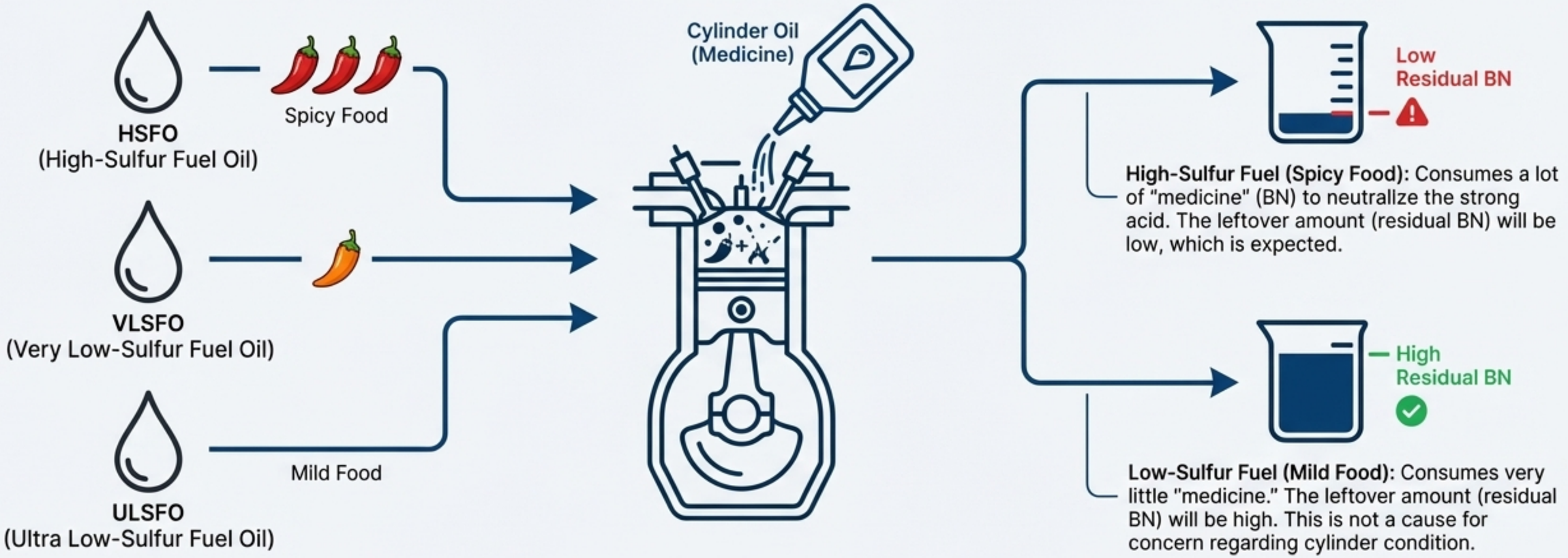
Values in mg/kg (ppm)

Understanding Residual BN: Your Engine's "Stomach Medicine"

INPUT: FOOD

PROCESS: ENGINE

OUTPUT: RESIDUAL BN



High-Sulfur Fuel (Spicy Food): Consumes a lot of "medicine" (BN) to neutrallze the strong acid. The leftover amount (residual BN) will be low, which is expected.

Low-Sulfur Fuel (Mild Food): Consumes very little "medicine." The leftover amount (residual BN) will be high. This is not a cause for concern regarding cylinder condition.

The expected residual BN is directly related to the fuel's sulfur content.

Updated Guideline Values for Residual Base Number (BN)

Cyl Oil	Fuel Sulphur	Normal	Low	Alert
BN 40	≤0.1% S	40–24	23–16	15–0
	0.1–0.5% S	40–20	19–16	15–0
BN 70	≤0.1% S	70–42	41–28	27–0
	0.1–0.5% S	70–35	34–28	27–0
	0.5–3.5% S	70–21	20–14	13–0
BN 100	≤0.1% S	100–60	59–40	39–0
	0.1–0.5% S	100–50	49–40	39–0
	0.5–3.5% S	100–30	29–20	19–0
BN 140	≤0.1% S	140–84	83–56	55–0
	0.1–0.5% S	140–70	69–56	55–0
	0.5–3.5% S	140–42	41–28	27–0

ℹ An unexpected low residual BN can be caused by water in the scavenge air or excessive dilution with system oil.

From Data to Decision: Your Action Plan for Elevated Wear

IF wear is 'Abnormal'
(Successive or repeated abnormal readings)

IMMEDIATE ACTION:
Increase cylinder oil feed rate by **0.1 g/kWh**.

FOLLOW-UP:
Increase frequency of drain oil analysis. Identify and address the root cause (e.g., water, fuel contaminants, insufficient neutralization).

IF wear is 'Alert'
(Any reading in the alert range)

IMMEDIATE ACTION:
Increase cylinder oil feed rate to **1.2 g/kWh or more**.

FOLLOW-UP:
This indicates an ongoing high-wear situation. Identify and correct the cause immediately to prevent component damage.

Onboard vs. Lab Analysis: A Partnership for Performance

Laboratory Analysis

Role: The definitive, comprehensive check. The only accepted documentation of condition.

Measures: Total Fe, residual BN, water content, wear particles, contaminants, PQ index.

Every 1,500 running hours or 3 months, whichever comes first.

Onboard Analysis

Role: A supplementary, high-frequency pulse-check.

Measures: Enables early detection, supports feed rate optimization.

Frequency: See guideline intervals below.

Guideline Intervals for Onboard Analysis [Running Hours]	
BN	100-120 hrs (for VLSFO/HSFO)
Fe	200 hrs (for VLSFO/HSFO)

If iron is abnormal or critical, reduce the interval.

Advanced Diagnostics: Interpreting Other Elements in Your Drain Oil

Look for patterns to identify wear, contamination, or dilution.

Substance	Symbol	Possible Origin
Chromium	Cr	Wear to piston ring grooves / piston rings
Molybdenum	Mo	Wear to piston skirt or cermet coating
Copper	Cu	Running-in wear; Stuffing box wear
Aluminium / Silicon	Al / Si	Cat fines in residual fuels
Sodium	Na	Seawater contamination
Lead / Tin	Pb / Sn	System oil dilution / Bearing wear
Calcium / Zinc	Ca / Zn	Lube oil additive package

Advanced Optimization: The Sweep Test for High-Sulphur Fuel

Purpose

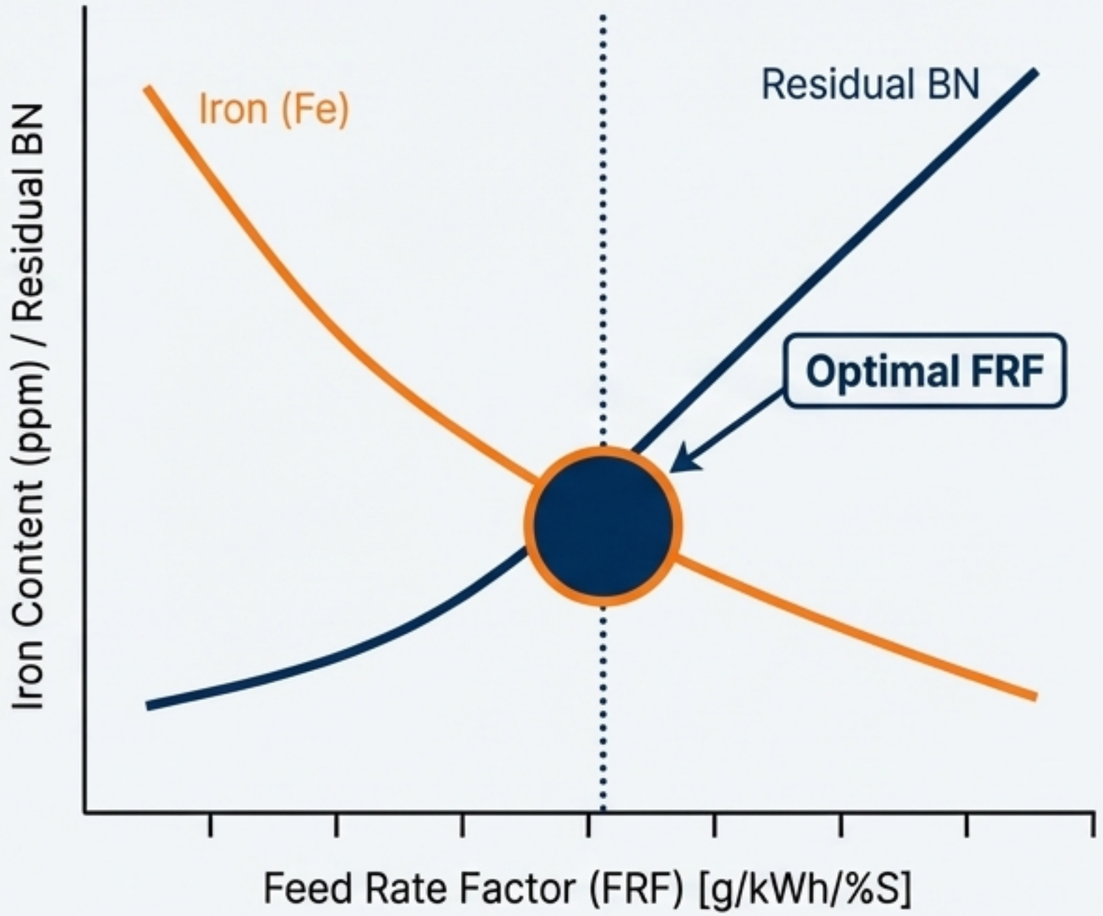
To establish the engine's specific corrosiveness and determine the optimal Feed Rate Factor (FRF) before reducing the feed rate.

When to Perform

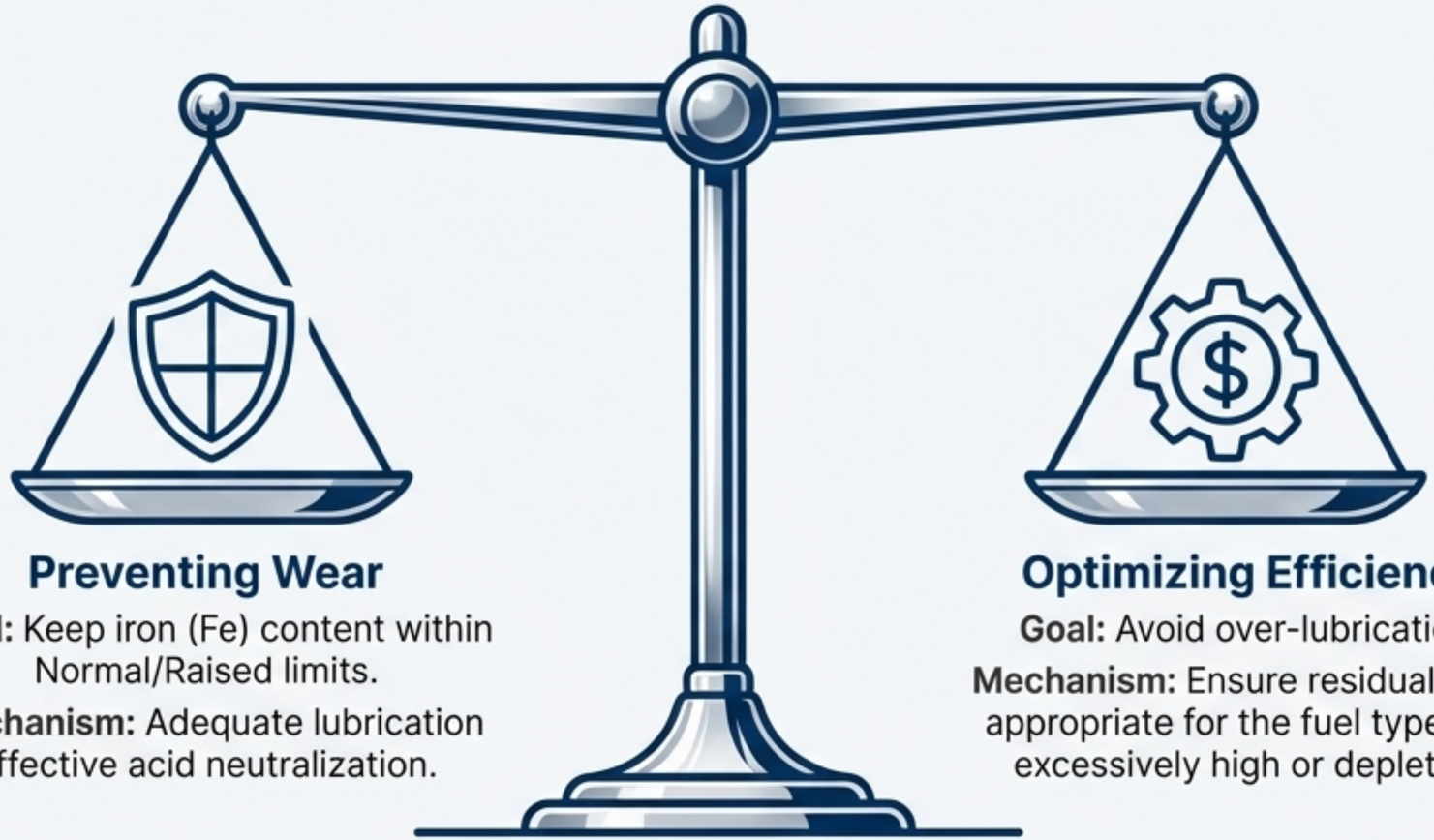
- After running-in is complete.
- If engine specification is altered or operating conditions change significantly.

Core Procedure

1. Operate on fuel with **>2.8% Sulphur**.
2. Maintain stable engine load **(>50% MCR)**.
3. Collect drain oil samples at a series of **feed rates** (e.g., 1.4, 1.2, 1.0, 0.8 g/kWh), holding each rate for 24 hours.
4. Plot residual BN and Iron content against the **Feed Rate Factor** to identify the ideal balance.



The Goal: A Balanced Cylinder Condition



Preventing Wear

Goal: Keep iron (Fe) content within Normal/Raised limits.

Mechanism: Adequate lubrication and effective acid neutralization.

Optimizing Efficiency

Goal: Avoid over-lubrication.

Mechanism: Ensure residual BN is appropriate for the fuel type, not excessively high or depleted.

The updated guidelines in SL2025-776 provide the precise data needed to achieve this balance. Mastering Scavenge Drain Oil Analysis is mastering direct control over your engine's long-term health and operational costs.