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Determining the Appropriate Number of Pipeline Cleaning Runs

A decision framework for routine maintenance and inline inspection readiness

EXECUTIVE CONCLUSION

There is no technically defensible standard number of cleaning pig runs for every pipeline. The appropriate number is determined by the objective, operating constraints, and evidence recovered after each pass.

Executive Overview

Pipeline cleaning should be managed as an evidence-based, progressive process rather than as a predetermined run count. Some pipelines may reach the required condition after only a few runs; others may require multiple pig configurations to gradually remove accumulated deposits while controlling debris volumes and operational risk.

The decision to continue, modify, or conclude a cleaning program should be based on documented run results. This is particularly important before inline inspection (ILI), when remaining debris may affect tool movement, sensor performance, or confidence in the collected data.

Management Implications

- Cleaning scope and cost should be planned as a staged program with decision points, not as an inflexible promise of a fixed number of runs.
- The definition of “clean enough” should be established before the program begins and tied to the operational objective.
- Receiver capacity, debris-handling capability, operating conditions, and run behavior should be treated as program constraints.
- Run records provide the basis for technical decisions and support alignment among Operations, Integrity, Engineering, and service partners.

Recommended Governance Principle

Authorize cleaning in phases. After each run, review the recovered material, pig condition, differential pressure and run behavior, operating conditions, and progress toward the defined objective. The next action may be to repeat the configuration, increase cleaning aggressiveness, change components, perform a verification or gauge run, or conclude the program.

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Why a Standard Run Count Is Not Reliable

Two pipelines of similar size and service can require different cleaning programs. The factors below influence both the number of passes and the configuration selected for each pass.

Decision factor	Why it matters
Pipeline history	Condition, age, previous maintenance, and the time since the last cleaning program.
Service and deposits	Transported product and the type, volume, distribution, and adhesion of debris.
Physical configuration	Diameter, length, bends, restrictions, transitions, fittings, and other features affecting pig passage.
Operating conditions	Available flow, pressure, differential pressure, pig velocity, bypass, and operational limits during the run.
Receiving capability	Receiver volume and the site's ability to safely collect, contain, and manage recovered material.
Cleaning objective	Routine maintenance, restoration of operating performance, contaminant removal, or preparation for ILI.
Run evidence	Debris returns, pig wear or damage, run behavior, and the trend observed across successive passes.

Define "Clean Enough" Before Starting

"Clean" is not a universal condition. A practical completion criterion depends on the intended outcome. Routine maintenance may conclude when debris returns have materially declined and the operating objective has been achieved. An ILI preparation program may require a higher standard because residual material can interfere with the inspection tool or reduce data confidence.

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Control the Variables That Affect Debris Returns

A decrease in recovered debris is meaningful only when the team understands what changed between runs. Pig configuration, pig condition, speed, bypass, flow, and other controllable factors can materially affect the amount of debris recovered.

Run Cleaning Pigs at an Appropriate Speed

Excessive speed can reduce cleaning effectiveness by limiting the time that cups, discs, brushes, blades, and other cleaning components remain in contact with each section of the pipe. Under otherwise equal conditions, the same pig traveling through the same pipeline with an equivalent debris load would generally be expected to remove more debris at 5 mph than at 13 mph.

The effect can be compared to a vehicle hydroplaning when traveling too quickly on a wet road. Similarly, a cleaning pig operating at excessive speed may ride over accumulated debris rather than effectively engaging and removing it.

For many gas-pipeline cleaning applications, 3 to 9 mph is an experience-based operating range that can support effective cleaning. It is not a universal limit: the appropriate speed can change with pig design, diameter, pipeline geometry, product, flow, pressure, debris conditions, and operating constraints. The project team should confirm the target speed for the specific application.

Account for Aggressiveness and Wear

Successive debris volumes should not be compared without considering the cleaning action of each pig. If a less aggressive pig follows a more aggressive pig and returns substantially less debris, the lower return may reflect the change in configuration rather than a cleaner pipeline.

Wear can create the same false signal. If a worn pig follows the same pig when it was new or rebuilt, reduced component contact or sealing may lower the amount of debris recovered. A smaller return alone does not prove that the pipeline has reached the required condition.

Standardize Repeat Runs

Once the program reaches the most aggressive pig style planned for the application, use the same exact pig - in a consistent condition - and run it at the same target speed for comparison passes whenever operating conditions allow. Keep controllable factors as consistent as practicable so that the primary changing variable is the amount of debris available for removal.

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Use Bypass Deliberately

Bypass can be an important part of an effective cleaning strategy. When gas and liquid flow conditions permit, a higher fixed-bypass configuration may improve cleaning efficiency by directing product through the pig's bypass openings. This flow helps suspend loosened debris ahead of the pig and carry it downstream, reducing the amount of material that accumulates directly in front of the pig.

A cleaning pig can hold and push only a finite amount of debris. Once that capacity is exceeded, the pig may begin to run over material or, in rare cases, contribute to a debris plug that can no longer be moved by the available differential pressure. Bypass selection should therefore consider the debris estimate, pipeline operating conditions, receiver capacity, and the pig's ability to maintain stable travel.

Higher fixed bypass can be beneficial when the application supports it, but bypass is not automatically appropriate for every line. Confirm that available flow, pressure, sealing requirements, liquid volumes, and run behavior support the selected configuration.

Use Rare-Earth Magnets for Removal and Trending

Rare-earth magnets are effective for capturing ferrous debris, but their greatest program value is often the evidence they provide about the amount of ferrous material still present. This distinction becomes increasingly important as pipeline diameter and length increase.

The volume that body-mounted magnets can hold is small relative to the internal surface area and total potential debris volume of a large or long pipeline. Ferrous particles captured by body-mounted magnets are typically carried, flung, or allowed to fall onto the magnets.

For that reason, magnet returns should be trended across comparable runs. The amount, type, distribution, and attachment of ferrous debris should be documented along with pig condition, speed, bypass, and other run variables before concluding that the ferrous debris load has reached an acceptable level.

DECISION RULE

Do not stop because a planned run count has been reached—and do not continue simply because additional runs were budgeted. Stop when documented evidence shows that the defined objective and readiness criteria have been met.

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Progressive Cleaning: A Stage-Gate Framework

A progressive program begins with an appropriate, generally less aggressive configuration and increases cleaning action only when the evidence supports it. This approach helps manage debris loads and avoids removing more material than the receiving facilities can safely handle in a single pass.

1. Establish the Baseline

Purpose: Remove loose material and obtain the first reliable indication of internal conditions.
Evaluate: Type and volume of debris, pig condition, speed, bypass, differential pressure, run behavior, and receiver loading.
Decision: Repeat the configuration, modify the next pig, or escalate cleaning action.

2. Increase Cleaning Action as Needed

Purpose: Address deposits that remain after the initial pass.
Evaluate: Whether heavier or adherent deposits remain, whether debris volumes can be safely managed, and whether speed and bypass support the cleaning objective.
Decision: Select cups, discs, brushes, scraper components, blades, or another application-specific configuration.

3. Target Remaining Contaminants

Purpose: Apply components suited to the material still present.
Evaluate: Contaminant characteristics and the trend in recovered material.
Decision: Use brushes for residual pipe-wall material; use magnets when ferrous debris is present; select other methods for non-ferrous deposits.

4. Standardize Comparison Runs

Purpose: Create a defensible trend once the planned cleaning aggressiveness has been reached.
Evaluate: Whether the same pig, component condition, target speed, bypass, and other controllable factors can be maintained.
Decision: Repeat under comparable conditions or document why a variable had to change before interpreting the debris trend.

5. Verify Readiness

Purpose: Confirm that the defined cleaning objective has been achieved.
Evaluate: Minimal or acceptable returns, stable run behavior, pig condition, and any project-specific acceptance criteria.
Decision: Conclude cleaning, perform an additional verification pass, or adjust the program.

6. Proceed to ILI When Applicable

Purpose: Launch the inspection tool with greater confidence in passage and sensor performance.
Evaluate: Completion of cleaning criteria and any required gauge run or clearance confirmation.
Decision: Authorize ILI or address remaining readiness concerns before launch.

IMPORTANT LIMITATION

This sequence is a framework, not a universal prescription. Not every pipeline requires every stage, and the order, number of runs, and pig configuration should be adjusted to the application.

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Post-Run Review: Minimum Decision Record

A consistent post-run review allows management and technical teams to understand why the program is continuing, changing, or concluding. At a minimum, document the following:

- Type, approximate volume, and condition of recovered material
- Whether debris returns are increasing, stable, or decreasing
- Identity of the exact pig used and whether it was new, rebuilt, previously run, or visibly worn
- Configuration and condition of cups, discs, brushes, magnets, blades, or other components
- Pig speed or run time, target and actual bypass, differential pressure, and any abnormal run behavior
- Pipeline operating conditions during the pass
- Receiver loading and debris-handling constraints
- For magnet-equipped pigs, the amount, type, distribution, and attachment of captured ferrous debris
- Any controllable factor that changed from the previous pass and how that change affects interpretation
- Progress against the stated cleaning or ILI-readiness objective
- Recommended next action and the technical basis for that recommendation

Recommended Program Controls

Set the objective. Document what the program is intended to accomplish and how completion will be judged.

Use decision gates. Review results after each pass before authorizing the next configuration.

Control escalation. Increase aggressiveness deliberately, considering debris volume, receiver capacity, and operating limits.

Standardize comparison runs. When evaluating a debris trend, hold the pig, component condition, target speed, bypass, and other controllable factors constant whenever practicable.

Maintain traceability. Preserve run data, photographs, debris observations, component condition, and configuration changes as the technical record.

Coordinate stakeholders. Align Operations, Integrity, Engineering, field personnel, and the cleaning provider before material changes to the program.

How Enduro Supports the Decision

Enduro's Pipeline Cleaning Division can review the pipeline application, cleaning objective, operating conditions, recovered debris, pig condition, and prior run results. Based on that information, the team can help evaluate the next appropriate configuration and support a progressive cleaning plan tailored to the pipeline.

RECOMMENDED NEXT STEP

Conduct an application review with Enduro before establishing the initial cleaning sequence - and again when run evidence indicates that speed, bypass, configuration, or cleaning action should change.

Contact:

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Continue the Conversation with Enduro

Enduro invites pipeline operators and integrity teams to schedule an onsite class and facility tour at our Tulsa headquarters. These sessions provide an opportunity to learn more about the full process—from evaluating an application and designing the appropriate solution to manufacturing, assembly, and final quality inspection.

Classes and tours can be tailored to your team's experience level and operational interests, including pipeline cleaning, pig selection, inline inspection, tracking equipment, and other pipeline integrity topics. Participants can meet directly with Enduro's technical team, ask application-specific questions, and better understand how our products and services are developed.

To schedule an onsite class or facility tour, contact the Enduro team.

Technical note: This brief provides a general decision framework. Pig selection, run sequencing, speed, bypass, and readiness criteria should be confirmed for the specific pipeline, operating conditions, facilities, and project objectives.