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Introduction

Relative to the manufacturing industry at large, the oil industry operates in a high-stakes environment: combustible fluids, high temperatures, toxic vapors, pressurized equipment. And in a world where protecting people, the planet, and operating profits are all equally necessary, those stakes justify world-class efforts to ensure reliability and prevent equipment failure. Given the consequences to employees, the environment, and the nearby communities, “zero” high-consequence loss of primary containment should be every facility’s goal; yet, in reality, this goal is not achieved at the rate many operating companies strive for. Why is this?

Many facilities proudly report “zero overdue inspections” month after month, yet they still experience Tier 1 and Tier 2 loss of primary containment (LOPC) events. Oftentimes, the reported key performance indicators (KPIs) do not match the operational results. I believe this typically boils down to one of two reasons:

Reason #1: the KPIs are poorly crafted “vanity” metrics, unintentionally designed to report positive results up the chain of command

Reason #2: the goals of the underlying KPIs are not effectively translated into action by the individual contributors at the lower levels

Many previous Inspectioneering articles have been written on the topic of KPIs, authored by some of the industry’s brightest minds, that can educate the reader on how to address gaps related to Reason #1. It is important for a site to have a diverse set of metrics in place to help identify where improvement efforts should be focused. A healthy mix of metrics typically consists of leading, lagging, compliance, and effectiveness/efficiency indicators. While the lagging indicators measure results from past actions and decisions, leading indicators provide the management team with areas for potential action that may improve future results. Compliance metrics are an easy way to ensure the basic code requirements are met but must be paired with effectiveness/efficiency indicators to make sure the work processes are delivering the intended results.

However, even with an excellent list of well-crafted metrics, a substantial question remains: how does an integrity program adjust its work processes to achieve better results (as measured by the metrics)? My goal in this article is to deep dive into the Reason #2 and identify a different way of thinking about KPIs that can help drive both ownership and results down to the “boots in the plant” level of today’s modern inspection department hierarchies.

In any continually improving organization, a balance must be struck between routine duty execution and proactive improvement initiatives. However, given the historical scope growth of the average inspector’s responsibilities, there are most often too many

tasks on the inspector’s to-do list to get them all done without significant prioritization and triage, let alone spending any time on the proactive improvements. Furthermore, managers cannot oversee every inspection activity every day, and software alone cannot accurately replace the years of experience held by inspection and engineering professionals when making integrity decisions. Given these restraints, the focus shifts to prioritization and maximizing the effectiveness of daily inspector activities, and the operational success of an integrity program must be owned by the individual contributors (IC) executing the procedures every day. While the ideas in this article won’t improve inherently bad metrics (that’s a different conversation), they can help your team achieve more effective results over a shorter timeframe than the traditional “KPI dashboard and annual review” method so often used in today’s industrial facility.

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What Refineries Can Learn from Google

Let’s take a brief detour and review an alternative type of “reliability” for a moment: one borrowed from the tech industry involving zeros and ones rather than pipes and valves, but nevertheless with just as high stakes given the integration of computer software into banking, healthcare, and even oil and gas operations around the world. I’m talking about software reliability, and there is an excellent case study in the form of Google (the company, not the search engine).

At the time of writing, Google (whose parent company is Alphabet) has roughly 180,000 employees and provides numerous software systems that are utilized globally in 24/7 operations [1]. With such a widely adopted software ecosystem, numerous businesses have built their entire operations platform on top of the Google infrastructure, meaning that reliability and uptime of the software is paramount. How does Google achieve best-in-class reliability? A major part of the answer is a concept called site reliability engineering, or SRE [2]. At its core, SRE attempts to remove the need for manual human intervention (think IT tickets, data administrator

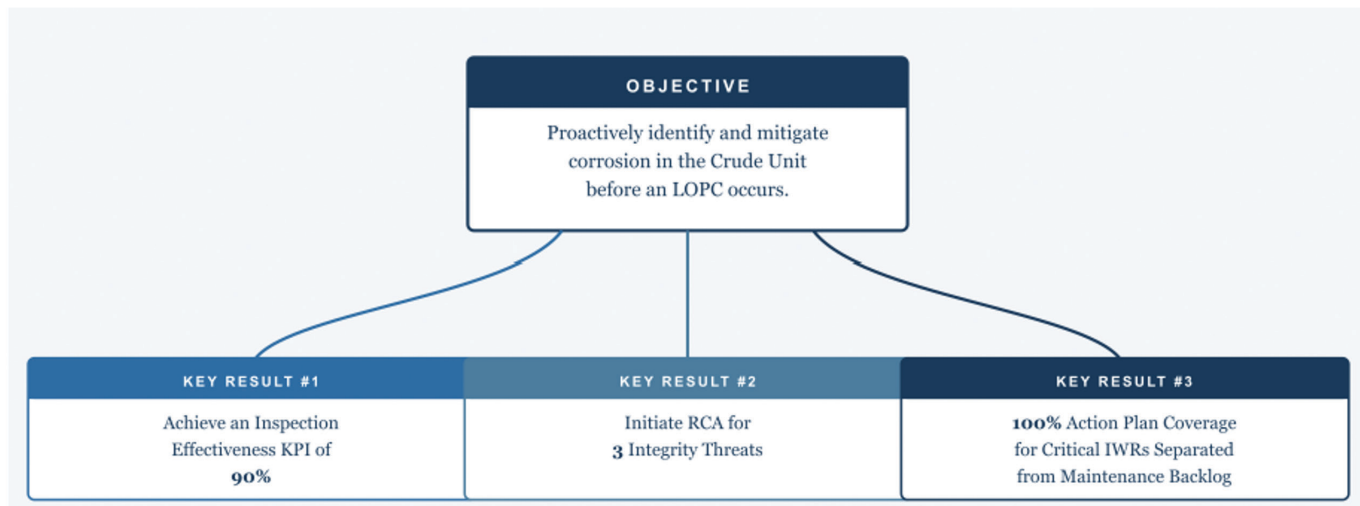


Figure 1. Example OKR for a Unit Inspector.

tasks, manual configuration, etc.) by designing the software to have the reliability built in.

This is no different than how a top-tier refinery integrity department should operate. Rather than relying on individual inspectors to manually schedule each inspection task and review every piece of new thickness data to calculate remaining life, the department should be built on work processes and data analysis that are designed to detect corrosion and integrity threats BEFORE they become an operational problem. It's worth highlighting that the SRE team hasn't removed people from the equation, but rather they ensure that every person focused on SRE has this guiding principle embedded in their daily work. The result can be a force multiplier: fewer reactive firefighting efforts, more proactive reliability improvements, and a team that compounds its effectiveness over time. Inspection departments have the same opportunity, but it requires a goal-setting framework that connects individual daily actions to the broader objective of preventing LOPCs, and surprising that's a concept that Google also uses.

So, what do the people at Google do differently to achieve these results? They utilize objectives and key results (OKRs) to manage the direction and execution of Google's entire workforce. John Doerr, who introduced OKRs to Google in 1999, describes them simply as "a collaborative goal-setting protocol for companies, teams, and individuals." The two components are straightforward:

1. Objective (The "What"): A directional goal or significant milestone that is used to orient the key results towards a common purpose. Think of this like the North Star for a given group of employees working towards a common destination.
2. Key Results (The "How" and "How Much"): These are the measurable metrics that can be used to track specific progress on a task that supports the objective. Typically, there will be 3-5 key results that are all tied to a single objective.

It's critical to point out that OKRs are fundamentally different than the traditional "Annual Performance Goals" that are set by employees and their managers at companies around the globe. OKRs are

typically visible to all employees, reviewed quarterly or monthly to measure progress and adapt to new business priorities, and decoupled from employee performance and compensation.

Developing OKRs Related to Mechanical Integrity

Let's bring it back to the pressure vessel and piping world. Let's look at an example of an OKR that might be utilized by an inspector at an oil refinery, shown in **Figure 1**.

Breaking down the components of the example OKR further:

- **Objective (The "What"):** Proactively identify and mitigate corrosion in the Crude Unit before a loss of primary containment (LOPC) occurs.
- **Key Result #1 (The "How"):** Achieve an "Inspection Effectiveness KPI" of 90%. This is a metric that tracks the ratio of integrity threats found before they leak or require unplanned maintenance to address (i.e., corroding but having a remaining life of 2 to 10 years) against the total number of threats found (including leaks/zero remaining life and requiring unplanned downtime/mitigation to address). The convenience of tracking the result as a ratio is that it works equally well for non-corrosive units in mature inspection programs as it does for units with chronic corrosion problems that are just implementing detailed inspection programs. The ratio normalizes the metric across different situations by reporting the results as a metric of successful saves compared to the number of additional findings that were perhaps missed but should have been caught by a program in advance of becoming an LOPC or immediate integrity threat.
- **Key Result #2 (The "How"):** Identify, document, and initiate root-cause analysis on at least three instances where thickness measurements are found below T-min during routine on-stream monitoring. This has the potential to turn a lagging threat into a highly valuable leading indicator and a learning opportunity. The inspector (hopefully) isn't responsible for causing the corrosion, as they don't control the unit operation,

but they should make the corrosion visible to the organization and ensure that the right disciplines come together to analyze and mitigate the threat before it becomes a larger issue.

- **Key Result #3 (The "How"):** Separate critical inspection work requests (IWRs) from cosmetic or non-critical maintenance (like painting) and verify the closure/action plan for 100% of the IWRs that pose a genuine integrity threat. Critical integrity work orders routinely get lost in maintenance backlogs. A key result such as this one keeps coordination between maintenance and inspection front and center to ensure that the maintenance tasks critical to preventing future LOPC are worked as a priority.

Let's start by breaking down the objective. You'll notice that the example provided is instantly relatable to an inspection department, and the theme of the objective is well within their sphere of influence: "Identify and mitigate corrosion." It doesn't establish an all-or-nothing milestone that is either met or missed, but rather establishes a guiding principle for the inspector to work towards with their specific day-to-day actions. The reason that this ambiguity is acceptable is that the objective is supported by directly measurable key results. Another detail of note is that the objective is general enough that it could resonate with adjacent roles in the organization such as the corrosion engineer or on-stream inspection coordinator, allowing the team to work together towards a common goal.

The objective is supported by three related key results. These key results imply specific actions that the unit inspector will take, with progress easily measured against the target in a quantifiable way. The key results would vary amongst the individual contributors in the group even when the main objective is shared. Most importantly, these key results are directly within the sphere of influence of the unit inspector, driving ownership and action down to the front line. These key results don't expect the unit inspector to convince an operations team to suddenly run less corrosive crude slates overnight, but it does give the unit inspector an opportunity to highlight potential deficiencies in the operational plan by initiating root-cause analyses (RCA) on areas of identified corrosion. A related key result from the integrity manager of the group might be to get funding for implementation of integrity-related gaps identified by these RCAs. By connecting the dots from guiding principles to actionable tasks all in the same OKR framework, it unlocks the true power of an integrity department, but more importantly all the individual contributors, working towards a common goal.

Additional Key Result Examples

Selecting key results that produce the intended outcome can be a challenge, and a poor choice of what to measure can inadvertently drive ineffective, or even counterproductive, behavior in the efforts to achieve it. A few more examples of well-crafted key results related to on-stream inspection programs are below, but keep in mind that every integrity program is different, and key results should be crafted around the specific challenges facing a given program.

Risk-Weighted Overdue Rate

Example KR: Achieve a 50% reduction in the risk-weighted overdue corrosion

monitoring location (CML) count refinery-wide.

Instead of the raw "zero overdue inspections" KPI criticized earlier, a site carrying a large overdue backlog should work towards something actually achievable by reducing the overdue count in a risk-prioritized way. A risk-weighted calculation gives more weight to CMLs on high-risk circuits (based on RBI results or API 570 piping class) than to low-risk services such as stripped sour water or lean amine. That weighting naturally pushes inspectors to work the higher-risk CMLs first to achieve the 50% stretch goal, since a single high-risk CML might be worth as many as ten low-risk CMLs depending on the weighting scheme you choose. A word of caution: the weighting scheme has to be carefully crafted to prevent unintended consequences that may lead to gaming the system!

End-of-Life CMLs Without Action

Example KR: Review and disposition 100% of CMLs in the crude unit that are below T-min or within three years of their calculated retirement date.

This result drives a behavior that is critical to preventing a category of LOPC that is otherwise largely preventable: failure of a component where the measured thickness data already indicated a problem, but action wasn't taken in time. By requiring the inspector to review and document a path forward for every CML at or approaching end of life, you validate that the data you're collecting is actually being acted upon, whether through a temporary repair, a planned turnaround replacement, or a work order to remove the line from service.

Inspection Strategies Optimized for Damage Mechanisms

Example KR: Complete and execute a pilot program to optimize the inspection coverage for at least 25% of the piping circuits in the NHT.

Validating that every inspection location and NDE method is appropriate for the expected damage mechanisms is a proactive way to accomplish two goals: 1) reduce risk by ensuring you collect the inspection data that truly matters, and 2) save money by eliminating inspections that add no value. A key result like this one creates a leading indicator that triggers proactive review and revision of existing inspection plans, rather than waiting for a piping failure investigation to reveal CMLs that were placed without regard for the relevant damage mechanisms. Twenty-five percent may seem like a low bar, but in reality, the first pilot of any initiative is difficult to start and simply making some progress will be beneficial to identify potential benefits.

Implementing OKRs Successfully

To make the concept of OKRs succeed in a mechanical integrity program, three major OKR concepts seem to be beneficial:

1. **Keep OKRs Transparent and Collaborative:** OKRs shouldn't be handed down in secret from the supervisor to each direct report. Rather, transparency across the integrity department ensures that peer results are well understood by the team and collaborative opportunities are captured appropriately. If two inspectors are both focused on legacy data cleanup in their area, those can be worked parallel path to prevent duplicate efforts. In this example, IDMS queries run for one unit could certainly be

utilized for the other unit and save both inspectors some time. Collaboration is critical in identification and development of the key results also. A worthy target is to strive for >50% of key results being developed by the front-line integrity staff rather than handed down from above. While the integrity manager would likely be crafting the objective (based on overall business goals), the front-line inspectors are oftentimes most knowledgeable about day-to-day business workflows (and the related inefficiencies) and are therefore some of the most qualified to help identify the key results that will truly move the needle towards achieving the objective.

2. Make OKRs Aggressive and Aspirational: OKRs should not be easy to attain. Easy goals create a "check-the-box" mentality used to report positive results to upper management. Stretch goals force a mindset shift and help to highlight when resources are diverted to focus on other competing priorities. Instead of a goal to simply "develop turnaround inspection scope worklist before the deadline," an aspirational goal pushes an inspector to specifically target high-value tasks, like developing detailed turnaround inspection drawings for towers and drums at least 6 months ahead of the turnaround deadline to allow for peer review.

3. Divorce Metrics from Compensation to Avoid Unintended Consequences: Traditional performance goals are often tied to compensation, which encourages well-intentioned people to take the path of least resistance to ensure their compensation is protected. For example, if you mandate a 20% reduction in CMLs to save costs and tie it to a bonus, inspectors may deactivate critical CMLs in an already under-inspected unit just to hit the target, significantly increasing risk. OKRs should be mostly divorced from compensation to encourage honest reporting and allow for department priorities to change as the performance/business year advances. It's unrealistic to expect an integrity department to rework (or operate outside of) the existing performance management program for an entire facility; however, it's reasonable to implement the concepts of OKRs as a standalone integrity department initiative in a way that the end results help each employee achieve outstanding levels in the existing performance management system as well.

Sustainability

Once implemented, the importance of routine review of established OKRs is paramount. OKRs are designed to be reviewed quarterly or even monthly, not annually like many traditional performance management KPIs. Annual reviews often amount to autopsies of improvement efforts that never got the regular focus they deserved. Monthly reviews allow for dynamic conversations between individual contributors and their supervisors (or peer groups) about why an effort is stalled. It allows for triage when progress is limited and celebration for quick wins. If an inspector is behind on achieving a given result, the department can quickly pivot and assign additional resources, acquire new tools, or remove other roadblocks to achieve the stretch goals that will affect the bottom line and prevent high-consequence LOPCs. Each IC should

own their OKR review cycle and come prepared to recap progress during their monthly one-on-one with their manager.

Conclusions

Traditionally, common industry practice has been for inspection teams to set lofty but general KPIs at the start of each year, which are loosely tracked but otherwise reflected upon at year-end to measure the overall success of the inspection program at large. While this practice may appease the executive and leadership levels at the typical refinery, the reality is that more detailed and nuanced OKRs can be used to drive specific actions at the individual contributor level and allow an integrity department to achieve better results.

The OKR system allows individual contributors to take more ownership in identifying and executing the actions that are most likely to move the needle on improving performance within the inspection work processes. OKRs also give front-line managers a starting point, whether it be one target improvement area or one measurable goal, to tweak the existing performance management framework in a way that unlocks their team's true expertise and full potential. Finally, OKRs provide plant leadership visibility into the objectives being worked in the integrity space to ensure they align with facility risk management priorities and operational commitments.

By supplementing the traditional annual KPI system with detailed, integrity-specific OKRs, an integrity team can achieve the long-stated goal of preventing significant LOPCs and running reliably to produce the energy and resources our world needs to keep on spinning, a fact that today's tech companies of the world (like Google) are likely grateful for. ■

For more information on this subject or the author, please email us at inquiries@inspectioneering.com.

REFERENCES

1. Unify, How many people work at Google? Headcount and employee trends, Retrieved July 2026, <https://www.unifygtm.com/insights-headcount/google>.
2. Beyer, B., Jones, C., Petoff, J., & Murphy, N. R. (Eds.), Site reliability engineering: How google runs production systems, O'Reilly Media, <https://sre.google/sre-book/>.



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