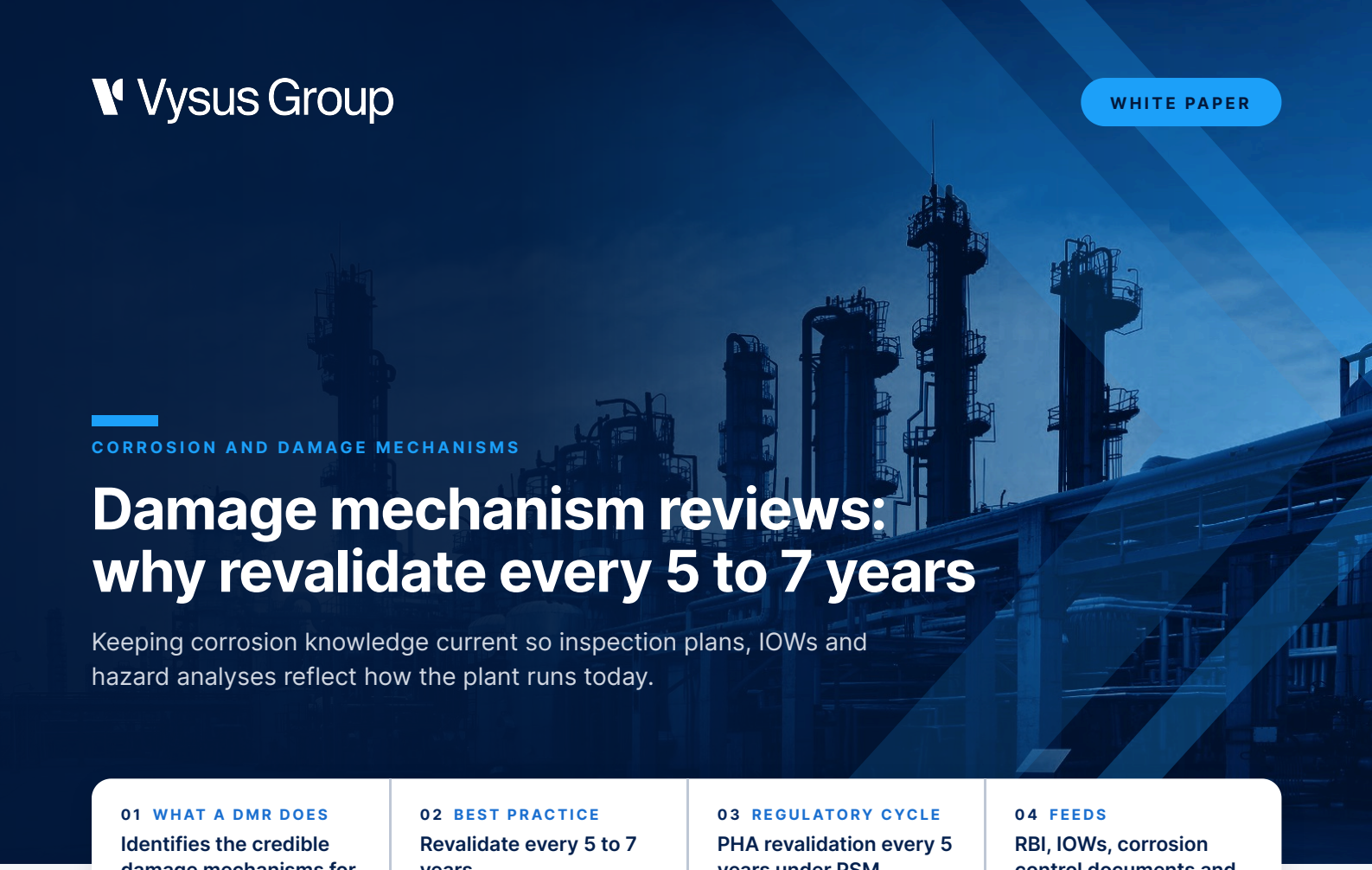
Vysus Group

WHITE PAPER



CORROSION AND DAMAGE MECHANISMS

Damage mechanism reviews: why revalidate every 5 to 7 years

Keeping corrosion knowledge current so inspection plans, IOWs and hazard analyses reflect how the plant runs today.

01 WHAT A DMR DOES	02 BEST PRACTICE	03 REGULATORY CYCLE	04 FEEDS
Identifies the credible damage mechanisms for each circuit and item	Revalidate every 5 to 7 years	PHA revalidation every 5 years under PSM	RBI, IOWs, corrosion control documents and the PHA

EXECUTIVE SUMMARY

Why damage mechanism reviews need a fixed review cycle

A damage mechanism review (DMR) is the corrosion foundation under an integrity program. It identifies which mechanisms are credible for each piece of equipment and piping circuit, and everything downstream depends on it: RBI, inspection plans, integrity operating windows (IOWs) and the process hazard analysis (PHA).

Plants rarely run the same way for long. Feedstocks change, throughputs rise, upsets happen and coatings and insulation age. A DMR that was right five years ago can now be missing the mechanism that causes the next failure.

A revalidation every 5 to 7 years, ideally timed to feed the PHA cycle, compares predicted damage with what inspection actually found and resets the program on current conditions.

KEY FIGURES

US$2.5T
estimated global annual cost of corrosion (NACE IMPACT study, 2016)

15–35%
of that cost avoidable with proven corrosion control practices, per the same study

5 yrs
the PSM cycle for revalidating the PHA that a DMR feeds

Talk to our team

Americas@vysusgroup.com
vysusgroup.com

WHAT A DMR IS

The corrosion basis for the integrity program

A DMR brings process, corrosion, materials and inspection specialists together to work through each system and circuit. Drawing on API RP 571, the team identifies the damage mechanisms that are credible given materials, process conditions and operating history, groups equipment into corrosion loops, and sets the expected damage rates and locations.

Its outputs drive the rest of the integrity program. RBI uses them to calculate probability of failure. Inspection plans use them to choose methods and locations. IOWs (API RP 584) and corrosion control documents (API RP 970) turn them into operating limits and responsibilities. The PHA relies on them to judge whether equipment can contain the process.

REGULATORY DRIVERS

Where the five-year cycle comes from

OSHA PSM, 29 CFR 1910.119

PHA revalidation

The process hazard analysis must be updated and revalidated at least every five years. A credible PHA needs current equipment integrity information, which is what the DMR supplies.

CALIFORNIA REFINERY PSM

DMR required

Title 8 CCR §5189.1 makes damage mechanism reviews a requirement for refineries and ties their review to the five-year PHA cycle. Washington State has adopted a similar refinery rule.

API 510, 570 AND 653

RBI reviews

RBI assessments must be reviewed when events could significantly affect damage rates or mechanisms, and at least every 10 years. A DMR revalidation is the cleanest way to show that test has been applied.

Outside these rules, a periodic DMR is good practice wherever RBI, IOWs or corrosion control documents are in use. Many owner-users schedule it to land just ahead of the PHA so that hazard reviewers work from current integrity data.

FOR THE BUDGET CONVERSATION

Questions your approver will ask

Nothing has failed. Why spend on this now?

Many corrosion failures follow a process or operating change that was never assessed against the damage mechanisms. Revalidation identifies those changes before they result in a leak.

Can we combine it with other work?

Yes. Running the DMR revalidation alongside an RBI revalidation, or just ahead of the PHA, shares data gathering and team time across all three.

What do we get back?

An inspection program aimed at current mechanisms, updated IOWs and corrosion control documents, and a PHA built on current integrity data.

WHY 5 TO 7 YEARS

Six reasons to revalidate on a fixed cycle

1 **Degradation accumulates**
Over five or more years equipment accumulates wall loss, fatigue and cracking. Revalidation makes sure mechanisms such as corrosion under insulation (CUI), wet H_2S cracking and erosion are quantified before they cause a failure.

2 **Process chemistry changes**
New crude slates or chemical feedstocks with more sulfur, acids or impurities, higher flow velocities and shifted temperatures or pressures can turn a low-risk item into a likely failure point.

3 **Operating window excursions**
Start-ups, shutdowns and upsets push equipment outside its IOWs. Repeated excursions can start mechanisms the original review ruled out. Revalidation looks back at how the plant really ran.

4 **Alignment with the PHA**
The PHA cycle is five years under PSM. Timing the DMR to land before it means hazard reviewers assess current integrity risk, not the picture from the last cycle.

5 **Inspection data tests the predictions**
Years of UT, radiography and internal inspection show whether predicted rates held. Where corrosion ran faster than predicted, inspection plans and condition monitoring locations (CMLs) need updating.

6 **Original reasoning gets lost**
The specialists who built the original review move on. A revalidation records why each mechanism was included or ruled out, so the next team does not start from scratch.

THE COST OF AN OUT-OF-DATE DMR

What budget approvers should weigh

Misdirected inspection
Inspection methods and locations chosen for yesterday's mechanisms can miss today's. Inspection budget is spent, but active damage can go undetected.

Unplanned outages
A mechanism the program does not know about shows up as a leak or failure, often at short notice and high cost.

A weaker PHA
Hazard reviewers rely on integrity data to judge safeguards. Out-of-date damage assumptions weaken the PHA and the recommendations that come from it.

Compliance gaps
Where DMRs are required, a lapsed review is a finding. Elsewhere, it undermines the case that RBI has been reviewed after significant changes.

WHAT A VYSUS DMR REVALIDATION INCLUDES

Scope of a DMR revalidation

- **Review of process, feedstock and operating history since the last DMR, including IOW excursions**
- **Comparison of predicted and measured corrosion rates by loop and circuit**
- **Updated mechanism assignments, corrosion loops and CML recommendations**
- **Outputs ready to load into RBI and to support the next PHA**

Outputs are delivered in the major integrity software platforms on the market, including the one your team already uses.

GETTING STARTED

A practical route to revalidation

01

Gather the history

Process, feedstock, IOW and inspection records.

02

Test the predictions

Compare predicted and measured damage by loop.

03

Update the review

Mechanisms, loops, CMLs and IOW limits.

04

Feed the program

Outputs into RBI, CCDs and the PHA.

WHY VYSUS GROUP

About Vysus Group

200+
consultants across our global team

270+
customers served every year

4.9/5
customer satisfaction score

Our Americas team works from Calgary, Houston and Trinidad, and draws on specialists across the wider group for corrosion, materials and process safety.

Is your DMR due for revalidation? Let's talk.
Email **Americas@vysusgroup.com** or visit **vysusgroup.com**

Calgary
Houston
Trinidad

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