FIRE DAMAGE ASSESSMENT FOR THE REFINING & PROCESS INDUSTRIES

LIMITING RECONSTRUCTION COSTS, REDUCING PLANT DOWNTIME

Without a carefully structured damage assessment, plant owners run the risk of escalating restoration costs and prolonging plant downtime.

Once the fire has been extinguished and personnel cared for, attention quickly shifts toward getting the damaged plant up and running, as Business Interruption losses accumulate minute by minute. Steve Norrington, Chartered Loss Adjuster and Engineer, Integra Technical Services suggests "a key challenge following every major industrial fire is to develop an orderly and efficient system for the assessment, ensuring that it is sufficiently comprehensive but at the same time quick."

THREE LEVEL FITNESS FOR SERVICE EVALUATION

A common methodology that has proven itself time and again is the American Petroleum Institute's Recommended Practice for Fitness for Service, which is often referred to as API RP 579. It is widely recognised as the best way to achieve a cost effective restoration that reduces plant downtime. Steve explains "Section 11 (Assessment of Fire Damage) is tailor-made for the task and far more user friendly than the alternatives, such as British Standard BS7910."

An important feature of the standard is the three-level system of evaluation shown in Figure 1, which enables 'run, repair or replace' decisions to be made at the earliest stage in the damage assessment. According to Steve "this offers a significant benefit when it comes to procurement of long lead time items that will ultimately determine the critical path of the project and the duration of the outage."

EVALUATION SCOPE

1. A conservative screening, considering only metallurgy and temperature exposure
2. Metallurgy and temperature exposure plus inspections
3. A detailed evaluation using stress analysis and materials testing

Figure 1. Three level fitness for service evaluation

The Level 1 evaluation considers Heat Exposure Zones (HEZ's) as shown in Figure 2, determined from field observations of 'tell-tale indicators' of the temperatures experienced. Knowledge of the degradation associated with the fire damaged equipment and the circumstances of the fire event will also be taken into account, including fuel and ignition source, wind direction, time at raised temperature and cooling rate.

HEZ	Temperature & Description Example	"Tell-Tale" Indicators
I	Ambient, no fire exposure	Clean
II	≤66°C, smoke & water exposure	Soot deposits
III	66°C - 204°C, light heat exposure	Vinyl paint coating blisters
IV	204°C - 427°C, moderate heat exposure	Steel develops blue temper colour
V	427°C - 732°C, heavy heat exposure	Aluminium melts
VI	≥732°C, severe heat exposure	Structural steel deforms

Figure 2 Level 1 Heat Evaluation Zone Assessment

FIVE KEY TIPS

1. Assemble a qualified and experienced team of specialists, covering all the relevant engineering disciplines.
2. Conduct the damage assessment closely in conjunction with or supplementary to the local or refinery team.
3. Ensure regular communications with plant management, with daily meetings as a minimum.
4. Carefully document all survey findings, compiling a complete photographic record.
5. Identify at the earliest stage the items likely to have the longest lead times and potentially forming the critical path.

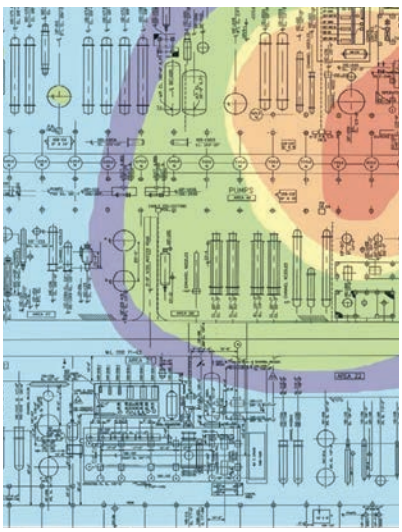

Figure 3. Example HEZ colour coded map (produced by Failure Analysis & Prevention)

A colour coded map of the various HEZ's at each floor level (figure 3), often with significant variations by elevation, provides a detailed three dimensional picture of the heat exposure from the fire event and enables the bulk of the repair work to be immediately scoped.

Steve emphasises that "whilst the HEZ is based on the maximum exposure temperature reached during the fire, the actual metal temperature of any individual item of equipment could be less than this due to shielding provided by insulation or cooling effect from internal liquid within vessels or exchangers."

"I have seen many examples where the majority of the fire damaged shell and tube heat exchangers are confirmed safe for reuse following Level 2 analysis, in spite of their heavily scorched appearance and classification within HEZ V (heavy heat exposure)."

COMMUNICATION

The management of this process will normally fall to a cross functional team that includes engineering specialists and the Loss Adjuster that has been appointed to manage the insurance claim. Communication is an essential and parallel part of the process and will involve the team providing verbal and written short reports that permit work planning, organisation and procurement.

Steve concludes "a methodical approach to major fires undoubtedly helps avoid over-estimating the remedial measures that, ultimately, increase the cost of refurbishment and prolongs the outage period."