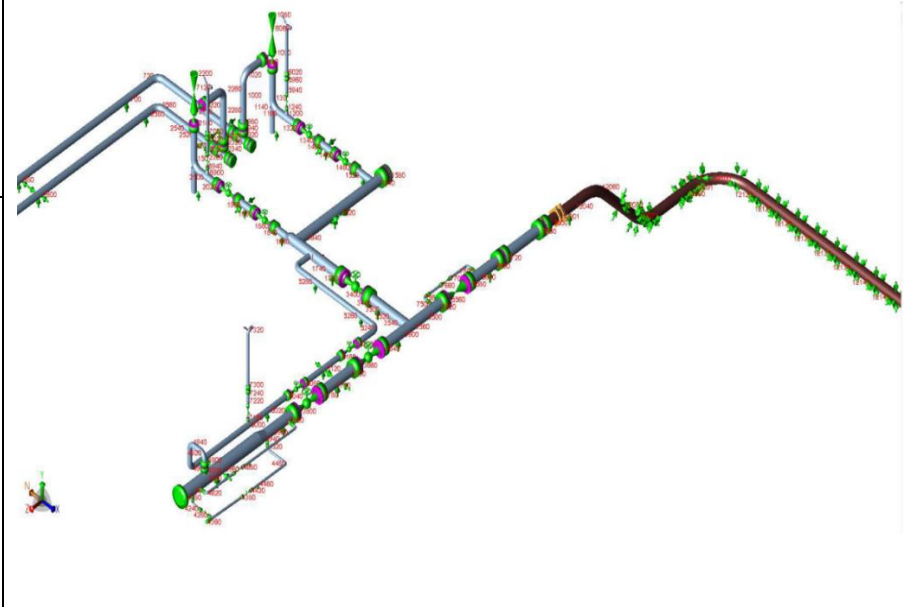


Case Study

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| Study Area: | HUGS Piping Stress Analysis | |
| Job: | Execution of static and dynamic piping stress analysis, including vibration, fatigue, and integrity assessments for wellhead piping and flowline systems. | |
| Date: | 2024-2025 |  |
| Location: | Australian Client | |
| Project Overview: | <p>The Heytesbury Underground Gas Storage (HUGS) Project is an expansion of the Gas Storage Facility in Australia, involving the development of a new well site and associated wellhead piping, flowlines, and an underground pipeline system.</p> <p>Comprehensive piping stress analysis and vibration assessments were performed to ensure structural integrity, fatigue resistance, and compliance with applicable codes and industry guidelines under static and dynamic operating conditions.</p> | |
| Scope of Work: | <p>The scope of work included detailed stress analysis and specialized assessments for wellhead piping and flowlines associated with multiple wells. Key activities comprised:</p> <ul style="list-style-type: none"> • Static piping stress analysis • Flow Induced Vibration (FIV) assessment • Acoustic Induced Vibration (AIV) screening • Slug flow analysis • Buried piping analysis • Dynamic modal analysis • Flange leakage checks • Local stress assessment for welded pipe attachments | |
| Engineering Approach & Methodology: | <p>Stress analysis was performed in accordance with relevant international codes and industry guidelines. For stress-critical piping systems:</p> <ul style="list-style-type: none"> • FIV checks were carried out in line with the Energy Institute (EI) Guidelines for the avoidance of Vibration-induced Fatigue Failure in process piping. • Piping natural frequencies were controlled through layout optimization and support/bracing requirements, including checks for small-bore connections to | |

Case Study



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| | <p>minimize fatigue risk.</p> <ul style="list-style-type: none"> • Dynamic modal analysis was performed to identify critical vibration modes. • Flange leakage checks were conducted to ensure joint integrity under operating and displacement loads. • For direct-welded pipe attachments such as dummy supports, M.W. Kellogg's Local Stress Method was applied to assess localized stresses. • Buried piping was modelled with sufficient length to simulate virtual anchors, allowing accurate evaluation of buried pipe expansion effects on above-ground piping systems. |
| <p>Key Challenges:</p> | <ul style="list-style-type: none"> • Tight project schedule, requiring accelerated execution • Parallel development of piping drawings and stress analysis, leading to frequent design updates • Ongoing HAZOP and design reviews, resulting in multiple revisions to piping layouts and operating conditions <p>These factors necessitated repeated updates and reassessments of stress models throughout the project lifecycle.</p> |
| <p>Execution & Coordination: Images:</p> | <p>Despite the challenges, Elixir adopted a flexible and collaborative working approach. The stress analysis team worked closely with the client's engineering team, promptly incorporating design changes and HAZOP actions into the stress models. Efficient change management and proactive communication ensured consistency between detailed engineering and stress analysis deliverables without impacting project milestones.</p> |
| <p>Key Deliverables:</p> | <ul style="list-style-type: none"> • Piping stress analysis reports • FIV and AIV assessment documentation • Dynamic modal analysis results • Flange leakage checks reports • Local stress assessment calculations |
| <p>Results & Value Delivered:</p> | <ul style="list-style-type: none"> • Successful completion of stress analysis for all systems within the project schedule • Improved vibration control and reduced fatigue risk for stress-critical lines • Enhanced mechanical integrity of wellhead and flowline piping systems • Compliance with EI guidelines and industry-recognized stress assessment methodologies • Effective support to detailed engineering and HAZOP activities |
| <p>Conclusion:</p> | <p>The successful delivery of the HUGS Project highlights strong capability in executing complex piping stress analysis and vibration assessments for gas storage and wellhead facilities. The project demonstrates the ability to manage dynamic design environments while maintaining technical rigour, schedule compliance, and high-quality engineering outcomes.</p> |