



Proposal Submission
Resiliency Plan:
**Impact of Hydrogen Blending on Saint
Flavien and Pointe du Lac Gas Storage
Facilities**

Prepared for
Intragaz

Prepared by
Keywest Projects Ltd.
April 26, 2022



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1 St Flavien and Pointe du Lac Resiliency Plan

1.1 Resiliency Plan Scope

To help reduce green house gas (GHG) emissions, there is interest in blending hydrogen into the natural gas transmission network throughout Canada. Hydrogen gas is a low or near zero carbon energy source generated from natural gas (with associated carbon capture), or from a clean or renewable electrical energy source through electrolysis. The hydrogen produced from these methods can then be blended into the existing pipeline network to modify the typical natural gas make-up and subsequently reduce the associated GHGs of this energy source.

In anticipation of the hydrogen blending programmes mentioned above, Intragaz has initiated a resiliency Plan to help determine the impact that the increased hydrogen (up to 10% by mole fraction) will have on its Pointe du Lac (PDL) and Saint Flavien (SFL) storage facilities. The addition of hydrogen will potentially affect the performance of the PDL and SFL processing trains that include glycol dehydration, heating, and compression equipment. Furthermore, the hydrogen will affect the capacity of the pipeline network feeding to and from the wellheads along with the reservoirs themselves. Along with facility process performance changes, hydrogen can also present integrity challenges for carbon steel systems via hydrogen induced cracking and embrittlement.

Lastly, due to the make-up of the SFL reservoir there is the potential for hydrogen sulfide (H₂S) formation with the increased hydrogen concentrations in the storage reservoir. As with hydrogen, H₂S can also negatively affect carbon steel piping through the formation of sulphide stress cracking (SSC). Also, the combustion of H₂S in the gas stream by end-users' results in harmful emissions (sulphur dioxide), so the H₂S level within the gas stream is strictly regulated by the transmission companies, including TC Energy and their TQM pipeline system that connect to the SFL and PDL facilities.

1.2 Planned Activities

Keywest has planned the following activities as part of this Resiliency Plan. For a more detailed list of the deliverables included with this Resiliency Plan, please see the attached manhour estimate.

1.2.1 St. Flavien

- Generate a Design Basis Memorandum (DBM) detailing the new process conditions
- Complete a process simulation (Promax) for the facility based on the new design conditions
- Evaluate the performance of the process line-up including piping, instrumentation, compression, dehydration, heating, and utility equipment
- Review secondary effects of the hydrogen addition including possible electrical area classification changes.
- Perform material selection recommendations based on the proposed process conditions
- Investigate technologies and make recommendations to remove H₂S from the gas streams based on various concentration levels. Review equipment and piping integrity for the potential of H₂S.
- Complete preliminary engineering related to the addition of nitrogen to the SFL storage reservoir to replace/displace the existing cushion gas, including the addition of gas chromatograph equipment.
- Assist with the development of programs for the potential of H₂S in the gas and liquid streams. This will include the programs for Operations as well as for Health and Safety.
- Update drawings (Issued for Approval maturity level) for the facility including existing block flow, process flow, and equipment location drawings.
- Prepare a report detailing the findings of the Resiliency Plan.



1.2.2 Pointe Du Lac

- Generate a Design Basis Memorandum (DBM) detailing the new process conditions that will be investigated
- Complete a process simulation (Promax) for the facility based on the new design conditions
- Evaluate the performance of the process line-up including piping, instrumentation, compression, dehydration, heating, and utility equipment
- Review secondary effects of the hydrogen addition including possible electrical area class changes.
- Assist with the development of programs for the potential of H₂S in the gas and liquid streams. This will include the programs for Operations as well as for Health and Safety
- Perform material selection recommendations based on the proposed process conditions
- Update drawings (Issued for Approval maturity level) for the facility including existing block flow, process flow, and equipment location drawings.
- Prepare a report detailing the findings of the Resiliency Plan.

1.3 Estimated hours and Cost

Keywest has provided an estimate for the above scope and planned activities.

For the activities planned at the Pointe du Lac Facility, we have estimated the total hours to be expended to be 1593 hours. At a blended rate of \$145.00/hour this leads to an estimated cost of \$230,950.00

For the activities planned at the St. Flavien Facility, we have estimated the total hours to be expended to be 1729 hours. At a blended rate of \$145.00/hour this leads to an estimated cost of \$250,700.00

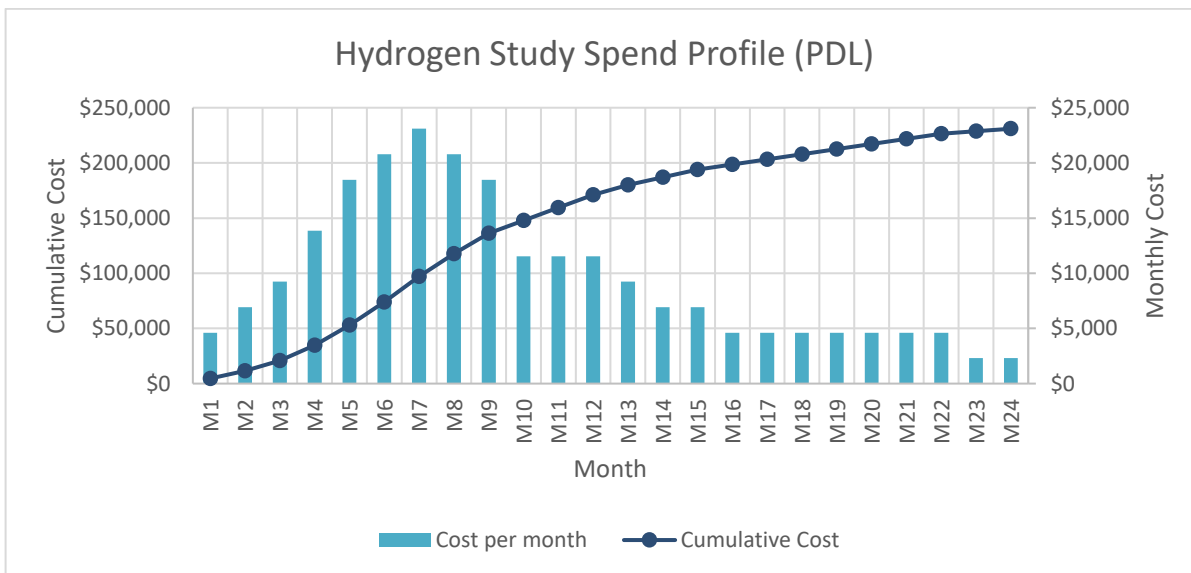
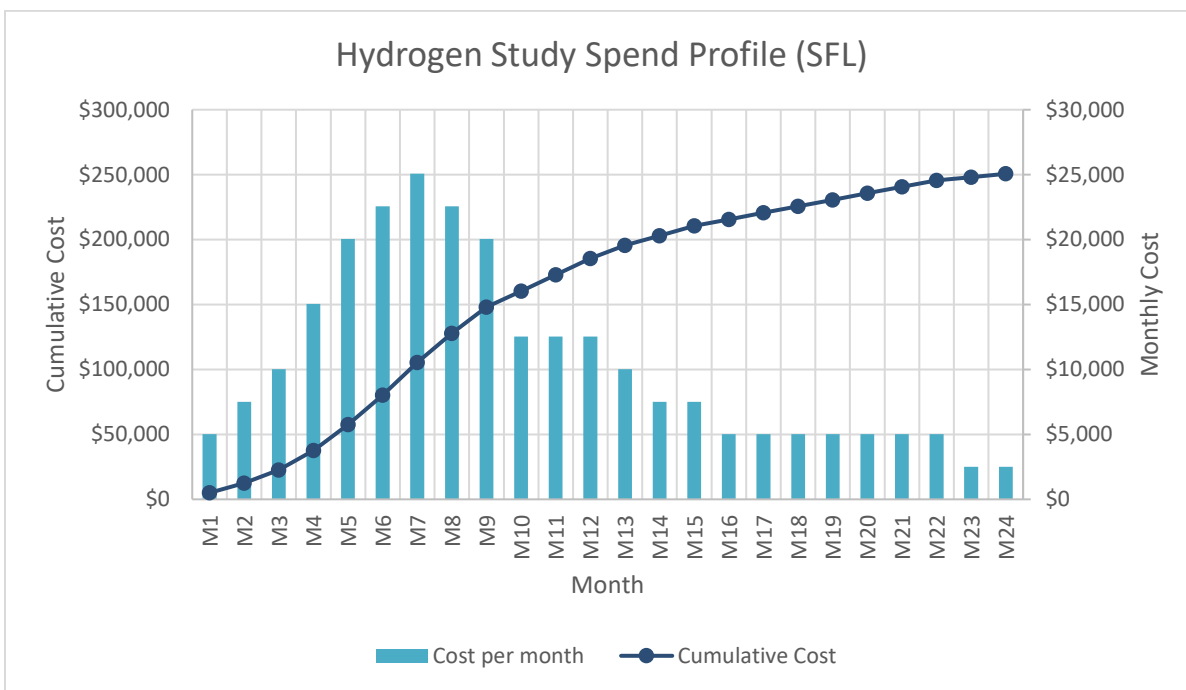
The total estimate hours for both facilities is 3322 hours for a total estimated cost of \$481,650.00. The total value does not include any cost escalation over the life of the project.

1.4 Schedule

The Resiliency Plan is expected to commence in the first quarter of 2023 and will extend through 2025 or earlier as required. However, the schedule is not firm and the starting date will be adjusted based on Intragaz project priorities.

1.5 Spending Profile

The charts indicate the anticipated engineering spending profiles for SFL and PDL facilities. This is based on a two year project duration.



2 The Keywest Advantage

2.1 Competitive Advantage

Operating as a multi-discipline EPCM private employee-owned Albertan company, Keywest offers extensive project experience and proven results. We have completed a host of projects related to resource play development in both Alberta and Northeast British Columbia. Keywest takes pride in maintaining partnerships with our clients. We guard these relationships with the utmost importance, aligning our project team goals with our client goals.

Our difference and advantage:

- Standardization and Repeatable Template Design.
- Reduced Cycle Time.
- Reduced Cost.
- Reduced Startup & Operational issues.
- Closely working with vendors to stay up to date with technical and commercial trends.
- Conveniently located in Bankers Hall downtown Calgary.
- We are a full- service, mid-sized EPCM. We pride ourselves on being nimble flexible, responsive and relationship driven.
- Using a staged/gate approach to minimize client exposure and risk.
- Ensuring that the right deliverables and their maturity are paired with the right phase of the project.
- Investigating options, ideas, and innovative technologies upfront (study/pre-FEED/FEED) to maximize cost savings and reduce the schedule.
- Using our experience to make reasonable/accurate assumptions to keep the project moving forward.
- Understanding “fit for purpose” designs that offer robust cost-effective solutions.
- Local: All of our staff and contractors are local to the Calgary area and contribute to our community.

By working with different clients, in a variety of areas of Western Canada, Keywest has gained significant experience in numerous gas plant projects and can help provide insight into issues/problems that some clients are encountering, that other clients may have resolved.

While working with our clients to ensure projects are executed timely and efficiently, Keywest also establishes a good working relationship with the Client’s Field and Operations Groups. This relationship has led to continual improvement and reduced downtime.

2.2 The Keywest Team

Keywest has extensive experience with the design and construction of gas plant, compression, and pipeline projects but also a variety of upstream and midstream facilities. We operate as a multidisciplinary team, ensuring that no detail is overlooked in each project. Utilizing proven project execution procedures, we complete our projects on schedule and within the budget, while achieving the client’s deliverables and goals. The diverse background of the Keywest team provides excellent opportunity to add value to the project. We are all located in Calgary and surrounding area, contributing to our community and economy.

We were built on the idea and the determination to bring back the traditional values that the Oil and Gas Industry began to overlook, building and maintaining true partnerships. Our key values represent who we are and how we are going to do it. Alignment with our partners is at the core of how we believe we can execute innovative and successful projects.

2.3 Our Vision

Our vision is to be a global leader in Oil and Gas EPCM innovation and services by establishing and growing successful partnerships with our clients, team members and all stakeholders.



2.4 Our Key Values

- **Safety.** Always first.
- **Innovation.** Executing advanced practices, thinking outside the box.
- **Collaboration.** Passionately empowering our collective brilliance.
- **Integrity.** Honest and Ethical communication practices.
- **Sustainability.** Environmentally sound for the next generation.
- **Community.** Together making a difference.

We believe in living and promoting sustainability. We consider environmental protection to be an important and integral part of conducting business. While doing our work, we consider the appropriate protection of humans, animals, plant life, air, water, and soil. (Keywest Environmental Policy, 2019).

With a collaborative approach we believe that our innovative practices set standards to not only engineering quality but for our communities. Why this is important is because it show us the dedication and commitment of our great team!

Giving Back to the Community

In 2021, despite being a tough and challenging year with the Pandemic, we are pleased to share our staff raised \$26,825 and Keywest Projects matching that amount having raised a total of nearly \$48,000 for the 2021 United Way campaign. The participation rate by our staff was 71% having more than surpassed expectations. This was higher than our initial goal with 37% more per person raised for the 2021 campaign, all due to the generosity of the people at Keywest Projects who share the vision of giving back to the community.

Keywest has been a nominee and recipient of the following United Way awards:

- 2015, we were awarded the *“Quantum Leap Award”*
- 2016, we were nominated for *“Employees Making a Difference in the Community”* and awarded *“Leading the Way Award”*.
- 2018, we were nominated *“Quantum Leap Award”*.



2019 United Way Parade

The Keywest Team is located in the Calgary area and are dedicated and committed to giving back to our great community.

3 Keywest Health and Safety



COMMITMENT TO SAFETY

“SAFETY IS NO ACCIDENT”

Safety is at the core of our values and culture and an integral part of our company

We are committed to continuing our accident-free workplace through continual improvement and providing effective administration, education and training

Keywest’s safety program includes a comprehensive set of policies, procedures and guidelines for performing work safely

We continually maintain our **COR (Certificate of Recognition)**. In April 2021 we participated in an external audit of our **Health and Safety Management System** and achieved a score of **99%**.

We are committed to the health and safety of our employees. We believe that the Well-being of our company and our relationship with our clients, is dependent on the health and safety of our workforce. We are committed to continuing our accident-free workplace through effective administration, education, and training.

In pursuit of this goal, we are committed to the following activities:

1. Compliance with ISNetworld, ComplyWorks and Avetta
2. Maintaining our Safety Certificate of Recognition
3. Tracking our Safety Statistics

4 Keywest Project Experience

4.1 Relevant Experience

“To our clients, quality is our product; within Keywest, quality is our people.”

Keywest Projects has become an industry leader in various oil and gas project in Western Canada. We have extensive and current experience in both brownfield and greenfield projects. We are very proud of our industry leading metrics for both on time delivery (Pre-Feed to startup and production) and on budget total installed costs.

We have extensive and current relevant experience in gas plants projects. We are very proud of our industry leading metrics for both on time delivery (Pre-Feed to startup and production) and on budget total installed costs. In most cases even returning the full contingency of the estimated TIC.

This past October, we completed the detailed engineering phase of a of a large gas plant project. Phase 1 of this project was commissioned in January 2021. Keywest Projects is familiar with Intragaz’s two reservoirs located in Quebec and we look forward to potentially providing our services for upcoming underground natural gas storage projects.



4.1.1 Full In-House EPCM

Keywest is a full service EPCM that offers a consistent and committed level of service by having the following expertise in house:

- Electrical Engineering, Instrumentation, Automation and Controls Team
- Mechanical Engineering
- Procurement, Expediting, and Logistics
- Document Controls
- Project Controls
- Regulatory
- Project Management
- Civil/ Structural Engineer
- Project/ Mechanical Engineering
- Process Engineering
- Drafting & 3D Design
- HOCM (Home Office Construction Management Team)
- Stress Analysis and Materials Control
- Hydraulic/Pipeline Engineering
- QA/QC Inspection Services

4.1.2 Full Life-Cycle Engineering

Keywest has always been a firm believer of Full Life-Cycle Engineering. Support does not end once the drawings are handed off, contracts let, and equipment procured. It does not end when the construction is complete or even after the facility is started up. Keywest provides hands on, onsite support throughout the full startup and commissioning phase through to project handover and beyond. We believe in providing responsive on-site troubleshooting support for running facilities, weather they are a Keywest designed process or any other system.

This philosophy comes from Keywest history of supporting Brownfield and MOC type projects. To be successful at this type of project and deliver consistent value to the client, a level on hands on knowledge of how systems in existing facilities interact with each other. Not only will this ensure the right questions get asked at the kickoff of the Brownfield or New Project, but it also delivers new additions and changes that integrate with existing equipment and enhance the overall performance of the plant.

Further, being involved in how a design addition or change works in the field and how it effects other systems is a critical feedback step in learning and improving on all future designs. Keywest strives for continuous improvement, which can only be achieved with good feedback and a system that takes that knowledge and incorporates it into the design process.

While hands on involvement is not always required by the client or the project, Keywest is always ready to provide the knowledgeable “boots on the ground” when the scope and benefits dictate.



4.1.3 Gas Plant Experience

Keywest Projects has extensive experience with Gas Plants, our Sour Gas/Deep Cut gas plant experience highlighted in yellow below:

GAS PLANT	DESCRIPTION	YEAR	PRE-FEED (MMscfd)	FEED (MMscfd)	DETAILED (MMscfd)	ON STREAM (MMscfd)	Compression Horsepower (HP)
1	Refrigeration Plant NE BC	2011	50				2,320
2	Refrigeration Plant NE BC	2011	50	50			5,640
3	Sour Deep Cut/Acid Gas Injection/SRU AB	2011	600				37,000
4	Refrigeration Plant NE BC	2012	50	50	50	50	5,120
5	Refrigeration Plant NE BC	2013	100				4,600
6	Refrigeration Plant NE BC	2013	100	100			4,650
7	Refrigeration Plant NE BC	2013	100	100	100	100	11,770
8	Sour Refrigeration/Incineration Plant NW AB	2014	50				6,250
9	Sour Refrigeration/Incineration Plant NW AB	2014	25	25			3,125
10	Sour Refrigeration/Incineration Plant NE BC	2014	100				6,000
11	Refrigeration Plant NE BC	2014	100	100	100	100	21,705
12	Refrigeration Plant NE BC	2014	100	100	100	100	2,480
13	Deep Cut Plant AB	2015	100				4,960
14	Sour Refrigeration/Incineration Plant NE BC	2015	200				12,448
15	Sour Refrigeration/Incineration Plant NE BC	2015	200	200	200		11,510
16	Deep Cut Plant AB	2015	110	110	110	110	5,500
17	Refrigeration Plant NE BC	2015	100	100	100	100	18,642
18	Refrigeration/Debutanizer Plant NE BC	2016	100	100	100		4,400
19	Sour Refrigeration/Incineration Plant NE BC	2017	110	110			8,700
20	Cond Stab Refrigeration Plant NW AB	2017	100	100			11,356
21	Sour Refrigeration AG Comp Plant NE BC	2017	100				25,840
22	Refrigeration Plant AB	2017	130	130			9,220
23	Deep Cut and Fractionation Plant NW BC	2017	120				8,380
24	Sour Refrigeration/Incineration Plant NE BC	2018	350	350			4,800
25	Deep Cut Plant AB	2018	120	120	120	120	8,600
26	Refrigeration/Debutanizer Plant NE BC	2019	200	200	200	200	26,000
27	Sour Refrigeration/Incineration Plant, Power	2020	185	185	185	185	14,650
28	Sour Refrigeration/Incineration Plant, Power	2021	185	185	185		9,650
TOTAL MMscfd			3,835	2,415	1,550	1,065	295,316
TOTAL Bcfd			3.8	2.4	1.6	1.1	

4.1.4 NEBC & NWAB Gas Plant Performance Summary (Last 8 Years)

		FROM PREVIOUS CLASS III ESTIMATE		FROM PREVIOUS CLASS IV ESTIMATE	
ESTIMATE CLASS	TIC MM\$	Δ MM\$	Δ %	Δ MM\$	Δ%
WITH CONTINGENCY					
Class IV	843.2				
Class III (AFE)	851.5			+8.3	+1.0%
Final Actual Cost	778.0	-73.6	-8.6%	-65.3	-7.7%
WITHOUT CONTINGENCY					
Class IV	744.4				
Class III (AFE)	781.9			+37.4	+5.0%
Final Actual Cost	778.0	-3.9	-0.5%	+33.5	+4.5%

4.1.5 Previous Sour Gas Experience

Keywest has recent and relevant experience with Sour Gas/Deep Cut Gas Plant design. Our most recent experience involved the design, construction, and start-up of a 230MMscfd Alder Flats Deep Cut Gas Plant built for Bellatrix Exploration, completed in 2018. The plant is now owned/operated by a JV between Keyera and Sparta Delta Corp. This plant involved two trains of Turbo Expander deep cut plant recovering 99.5% of the C3 and ranging from 18.5% to 57% of the C2 component. Keywest completed this plant in two separate Phases of construction, and costs were under budget and the project was completed on schedule. Specifically, the Phase II project was completed and started up in 2018, 8% under budget.

In addition, Keywest has completed:

- Pre-FEED design on a full Deep Cut ethane extraction plant, 600MMScfd (3 x 200MMscfd trains) for Daylight Energy (now Sinopec)
- Pre-FEED design on a 100MMscfd Propane Plus Deep Cut Plant for Jupiter Resources (now Tourmaline)
- Pre-FEED design on a 120MMscfd Propane Plus Deep Cut plant for AltaGas

(a) Town North – 370 MMscfd Sour Gas Plant

Pre-FEED; FEED; Detailed Engineering; Full Engineering & Procurement (EP), Full Home Office Construction Management (HOCM); Commissioning & Start-up Phase I (185MMscfd Train) complete, Phase II (185MMscfd Train) in Detailed Eng.

Major equipment included:

- Inlet separation (3 Separators)
- Amine train, Sour Gas Incineration
- 2 x Refrigeration trains
- Sales compression (electric drive)
- 3 x 50% Gas Turbines (Solar T-130)
- Waste Heat Recovery Unit (WHRU)
- Deethanizer trains
- 1 x Debutanizer train
- 2 x Condensate Stabilizer trains
- Liquid's storage/handling
- LACT connection for C3+/C5+
- All associated utilities and Delta-V DCS Control System

This development is Keywest's largest facility in Northeast BC. The project stands apart from our experience in that it is our first project utilizing a full power island for power generation. All compression is electrified, and Solar T-130 units were purchased to generate the power required. A Waste Heat Recovery Unit (WHRU) captures the heat from turbine exhaust gas and provides the full plant heat medium duty required. Phase I (the initial 185MMScfd Train) was completed on time and within the Class III Estimate budget (including contingency) in January 2021. Phase II is in detailed engineering and is on schedule to be started up in 2022. Phase II will add an additional 185MMscfd of Capacity and a spare T-130 unit.

4.1.6 Pipeline Experience

(a) Dawson Creek

LACT Installs & PL Study; detailed engineering deliverables; Full “EP”

Design, licensing, and procurement for two sales product pipelines carrying C3+ and C5+ products with flow ranges of approximately 74,000 bbl/d and 32,000 bbl/d respectively. The C3+ pipeline is approximately 25km of 10” steel material while the C5+ pipeline is approximately 15km of 8” steel material, both shall be licensed to 9930 kPag MOP.

Pipeline design deliverables included P&ID’s, wall thickness calculations, pig barrel designs and isometrics, pressure test designs and calculations, crossing designs and calculations for highway 97 crossings, alignment sheets, BCOGC and BC Ministry of Transportation applications, buoyancy control design, stress analysis, ROW configuration drawings, pipeline hydraulics, material procurement and bid, evaluation, and award of pipeline construction.

These pipelines were intended for use as sales pipelines from a liquid extraction facility and were licensed as HVP pipelines. C3+ and C5+ sales specification product flows from various LACT skids to the mid-stream companies mainlines.

(b) Wapiti Sour Gas Trunk Line

Full “EP”

Design, licensing and procurement for a 14.7km 8” steel sour natural gas trunk line, this pipeline is licensed to 4960 kPag MOP and 10% sour.

Pipeline design deliverables included:

- P&ID’s,
- wall thickness calculations,
- pipeline hydraulics,
- material procurement and bid,
- evaluation and award of pipeline construction.

(c) Pembina 13-02 to 15-15 Oil Sales Line

Full “EP”

Design and installation of a 6” sales oil pipeline complete with pigging equipment to replace current 4” flexpipe pipeline due to capacity constraints. For smart pigging capabilities, s-bend risers on the ~8km pipeline were installed.

(d) Ponoka 16-02 to 08-24

P/L Study

Engineering, regulatory and procurement planning for the proposed construction of a new 12” fiberglass pipeline to transport high CO₂ content oil effluent from various wells and satellite to an existing battery. The pipeline is approximately 14km long with a 10km twinned section. The ditch will also contain various other Flexsteel pipelines consisting of 6”, 4” and 3” sizes.



(e) Ponoka 08-06 to 08-24

P/L Study

Engineering, regulatory and procurement planning for the proposed construction of a new 6" pipeline to transport high CO₂ content oil effluent from various wells and satellite to an existing battery. The pipeline is approximately 8km long.

(f) Killam 9-9 Oil Battery

Detailed Engineering & Procurement

Installation of a 300HP water injection pump to increase the batteries capacity to process water and inject more water to increase production rates.

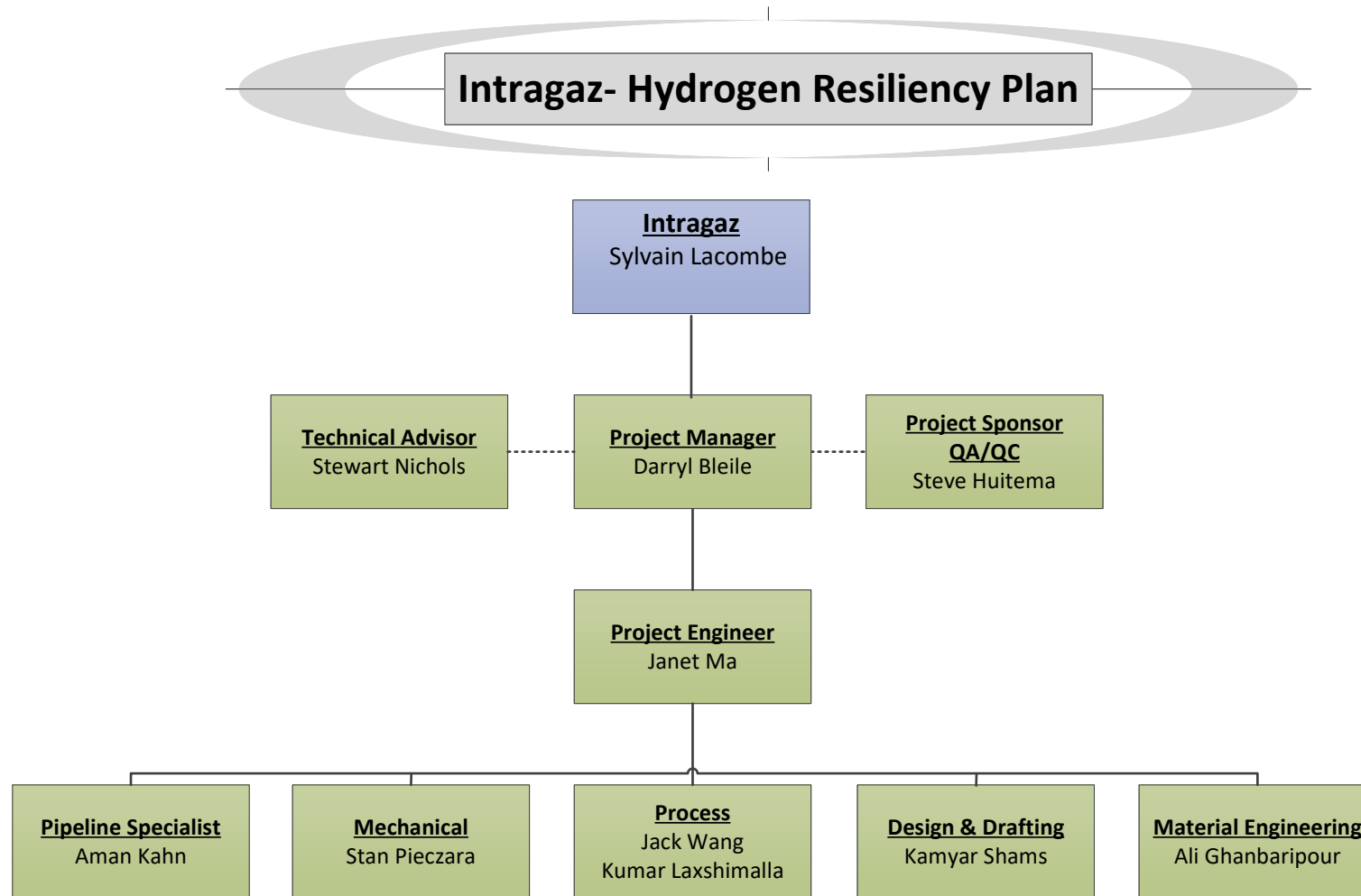
(g) Retlaw 01-32 Battery Modifications

Oil Battery Expansion

Installation of a second water disposal pump to expand the water pumping capabilities
250HP electric reciprocating plunger pump
Max flow for pump 965m³/d

5 Project Organizational Chart and CVs





Résumé of Ali Ghanbaripour

Sr. Material/ Corrosion Engineer

Career Summary

Senior Material / Corrosion Engineer

Senior material and corrosion engineer with specialized expertise in material selection, corrosion studies, cathodic protection system design, protective coating and lining systems and welding procedure review. Extensive knowledge of corrosion issues on metallic and non metallic materials. Over 19 years of experience in challenging positions including management, field operation, inspection, design and installation in oil, gas, and petrochemical industries.

Experience Highlights

- Mechanical Engineering Coordinator, and Senior Corrosion Specialist
- Lead Metallurgist, responsible for the preparation of MSD for PAD and CPF
- Project Manager, also in charge of material specialist
- Material and Corrosion Chief Engineer (from year 2000 to 2008)
- Deputy of Mechanical and Piping Engineering Department (from year 2001 to 2006)
- Head of Mechanical and Piping Engineering Department (from 2006 to 2008)

Related Experience

May 2013-
Present

Senior Material / Corrosion Engineer

Keywest Projects Ltd.

Calgary, AB

- Corrosion study and calculation
 - Corrosion root cause analysis of existing plants
 - Preparing material selection diagram and report
- Presenting advantage of corrosion study to existing clients and Business Development

Education

MS of Material Selection and Corrosion Engineering

Shahid Bahonar University of Technology (1998)

BS of Process Design Sharif University of technology (1994)



Résumé of Aman Khan P. Eng., M. Eng

Career Summary	Pipeline Engineer Specialist More than 22 years of engineering design, project management, construction, commissioning, startup experience on Oil & Gas pipeline and facilities, Cryogenic/Carbon Dioxide/Hydrogen Plants, Crude oil/Sour Gas/Oxygen pipelines and facilities. Pipeline conceptual and detailed design. Well versed with codes and standards. Report writings, design reviews, stress model reviews by using AutoPIPE, crossing design, and route selection.
Experience Highlights	<ul style="list-style-type: none">• A comprehensive mechanical engineering design and analysis experience involving line sizing, equipment sizing, wall thickness (for internal and external pressure), component design, support span, flange leak, hydrotest, pneumatic test, fracture arrest, depth of cover, upheaval buckling, HDD, road crossings calculations and buoyancy control analysis• Hands on experience on all applicable CSA, ASME, API, NACE codes and standards. Practical knowledge of Canada & USA regulations• Development of P&IDs, Isometrics, Alignment sheets, plot plans, HAZOPs, 3-D Model reviews, detail design, welding procedure reviews, NDE requirements, preparing estimates, planning and procurement. Practical experience on fabrication of Tanks, installation of Turbo and Reciprocating Compressors and pumps• Development of P&IDs, Isometrics, Alignment sheets, plot plans, HAZOPs, 3-D Model reviews, detail design, welding procedure reviews, NDE requirements, preparing estimates, planning and procurement. Practical experience on fabrication of Tanks, installation of Turbo and Reciprocating Compressors and pumps• Extensive experience in construction of Gas Plants, Cryogenic Plants, Pipeline and Facilities. Commissioning and pre-commissioning activities like punch listing, pressure testing, cleaning and blowing, and pressurizing• Hands on experience of pipeline design in rugged terrain, good understanding of Geotechnical engineering concepts, materials, and stress VS strain-based designs for various geohazards.• Route selection, class location determination, water body crossing design, familiar with geotechnical aspects of pipeline design.
Related Experience April 2019- Present	Pipeline Engineer Specialist <i>Keywest Projects Ltd.</i> <i>Calgary, AB</i> <ul style="list-style-type: none">• Pipe and pipeline stress analysis• Pipeline hydraulic studies• Prepare and/or review pipeline design and materials specifications• Consulting for pipeline design deliverables including:<ul style="list-style-type: none">• Wall thickness calculations• Routing study• Alignment sheets• Crossing method selection and design & details• HDD and auger bore design• Buoyancy study• Pressure test plan• Cathodic protection study• ROW configuration drawings• Technical review of pipeline related project documents and drawings• Provide final review and P. Eng. stamp on various pipeline deliverables and drawings• Pipeline project cost estimating including risk factors• Provide pipeline engineering input to project scoping documents such as DBMs and technical reports during Pre-FEED, FEED, Detailed Engineering• Review and provide design input to Keywest's Piping Specifications• Troubleshooting of pipeline installations• Field engineering design services• Construction Information Packages
Education	Bachelor of Science Mechanical Engineer University of Engineering & Technology, Pakistan, 1995 M. Eng. Pipeline Engineering , University of Calgary, Canada - 2009



Résumé of Darryl Bleile, P.Eng. Manager of Projects/ Project Advisor

Career Summary

Manager of Projects/ Project Advisor

Darryl has 23 years of Project Engineering experience in the oil and gas industry. His work has included detailed design of facilities, including P&ID and Shutdown Key development, process design, project management and project coordination.

Experience Highlights

- Gas Processing and Treating
- Pipelines, Compression & Metering
- SAGD and Heavy Oil Projects
- Steam Systems
- Well Sites, Flow Lines & Satellites

Related Experience

Jan 2019 –
Present

Manager of Projects/Project Advisor

Keywest Projects Ltd.

Calgary, AB

- Work closely with Director of Projects, as well as Discipline Leads to ensure continuous communication and collaboration of project requirements
- Technical coordination with various engineering disciplines at Keywest, holding project review meetings, updating status of engineering deliverables
- Applicable administrative duties including estimating, resource planning, project coordination, progress reporting and other associated activities relating to your clients and projects
- Either completing or coordinating the completion of project deliverables such as engineered drawing development, checking and sign-off; equipment sizing, specifications and datasheets; project cost management; quality control and checking
- Approve, manage and balance the project triangle: Scope, Cost and Schedule
 - Scope: review and approve the project Design Basis Memorandum (DBM), build project requirements, and manage project constraints. Involved in the major decision-making process to help mold and define project scope
 - Cost: review and approve the initial project cost estimate, AACE classification, cost tolerances and contingency
 - Schedule: Create clear and attainable project milestones. Ensure project deliverables are completed in a timely manner per the project schedule. Ongoing development of systems to standardize the efficient completion of project deliverables
 - Balance Scope, Cost and Schedule. Identify, approve and manage changes throughout the life of the project
 - Communication: Ensure key decisions are documented and that changes to the project triangle are communicated to the internal team and the client
- Review and approve the Project Execution Plan (PEP) and ensure the PEP is followed throughout the duration of the project
 - Ensure the Management of Change (MOC) process is followed on the project
 - Ensure smooth execution and initiate project reviews throughout the life of the project
 - Stakeholder management and communication. Channel information between the client, field, and project staff
 - Review and approve the RASCI chart. Final sign off project deliverables per the project RASCI chart
- Issue project specific engineering instructions as required

Education

B. Sc., Mechanical Engineering (with Distinction), University of Calgary 1997



Résumé of Jack Wang

Senior Process Engineer

Career Summary

Senior Process Engineer

Senior Process Engineer with over 25 years of extensive international experience in thermal heavy oil processes, hydrocarbon treating, gas compression, gas dehydration, gas sweetening, oil refinery and ethylene production processes. Specializes in process plant simulations/test runs/start-ups, process designs, BFD, PFD, and P&ID development. Extensive experience with heavy oil plant design, oil treating, gas processing, and water treatment and steam generation technologies.

Experience Highlights

Brownfield and Greenfield Projects:

- Sweet and Sour Gas Plants, Shallow and Deep Cut
- Compression Stations
- Gathering Systems
- Oil Pipelines
- Gas Pipelines
- Oil Batteries
- Water treatment
- Well Pads

Special Projects:

- Oil Refineries
- SAGD projects

Related Experience

Senior Process Engineer

Keywest Projects Ltd.
Calgary, AB

- Lead Process Engineer
- Progress Energy Town North Sour Gas Plant – Feed, 350 MMSCFD sour gas capacity
- Progress Energy Town North Sour Gas Plant – Phase 1 Detail, 185 MMSCFD sour gas capacity
- Amine sour gas treating, refrigeration, gas separation and compression etc.
- Process design and development, modeling, evaluation, optimization.
- Progress Energy: Altares Refrigeration Plant Phase 2
- Detail Design
- Refrigeration, gas separation and compression, 100 MMSCFD

Education

Masters of Science

Organic Chemistry, Wuhan University 1989

Bachelor of Science

Organic Chemistry, Wuhan University 1986

Applied Bachelor's Degree

Petroleum Engineering Technology, SAIT, Calgary, AB 2002



Résumé of Janet Ma

Senior Project Engineer/ Project Manager

Career Summary

Senior Project Engineer/Project Manager

Experienced in project engineering, project management, and mechanical design for well sites, pipelines, gathering systems, and facility projects within a consulting / EPCM environment for both conventional and SAGD projects. Experienced in quantitative and qualitative risk assessment and integrity management for pipeline systems

Experience Highlights

- Lead multi-discipline project teams on MOC projects related to SAGD facilities and off-site well pads, including turnaround, and operational / maintenance support.
- Performed stress analysis on critical lines, steam lines, and high temperature piping. Determine support type / location and piping layout to handle stress associated with high temperature thermal expansion.
- Prepared mechanical drawings including plot plans, GA, ISO for piping systems including steam piping. Prepared piping specification for steam lines for design use.

Related Experience

Senior Project Engineer/Project Manager

Keywest Projects Ltd.
Calgary, AB

- Analyze past project data to predict performance on future projects as well as determine areas for improvement
 - Manage scope, cost and schedule control
 - Either completing or coordinating the completion of project deliverables such as DBM's; cost estimates; schedules; engineered drawing development, checking and sign-off; equipment and material requests for quotes, evaluation and award; contract preparation including scope of work (EWP), bid preparation; quality control and checking
 - Maintain overall responsibility for project multi-discipline drawings:
 - P&IDs
 - Plot Plans
 - Shutdown Keys
 - Line Designation Tables (LDTs) or Line Lists
 - Control Narratives
 - Preparation of mechanical equipment and/or package MRQs, TBEs and make recommendations to the client. Review other discipline or junior engineers' TBEs to ensure accuracy and consistency with the project.
 - Technical coordination: work with engineering discipline leads to ensure continuous communication and collaboration of project requirements, chairing project review meetings, providing path forward guidance, updating status of engineering deliverables.
 - Ongoing communications, maintaining contact with external sources such as equipment vendors and clientele of Keywest.
 - Mentorship of junior project engineering staff and act as an Advisor, providing guidance towards completion of project duties
 - Assist with environmental, regulatory applications and submissions Stay informed of the latest directives and requirements.
 - Participate in HAZOP (Hazards and Operability Study) and PHAs (Process Hazards Analysis) and represent the Keywest project team t HAZOPs and PHAs
 - Review/squad check vendor drawings
 - Maintain and grow a working knowledge of the applicable design codes and standards including CSA Z662, ASME B31.3, etc.
- Assist with overall project execution and delivery.

Education

Bachelor of Science, University of Calgary, Faculty of Engineering, 1998

Master of Engineering, University of Calgary, Schulich School of Engineering, 2010



Résumé of Kamyar Shams

Manager, Drafting and Piping Design

Career Summary

Manager, Piping Design and Drafting

Over 23 years of experience in 3D Modeling Piping Design from Upstream to Complex Petrochemical Plants. Project Piping Lead with Mechanical Engineering background who has done extensive Piping Design and Process Drafting as well as AutoCAD/AutoPLANT support and Material/Spec generation.

Related Experience

Manager, Piping Design and Drafting

Keywest Projects Ltd.
Calgary, AB

Petronas - Town North Gas Refrigeration Plant - Ph.1 - 175 MMSCFD (in Construction) and Ph.2 - 175 MMSCFD (in Detail Design)

- Overlooked Piping Design and Modeling activities to ensure high quality end product through constructability, operability and maintainability
- Checked isometrics
- Responsible for Spec updates and modifications

Petronas - Town 72-A Gas Refrigeration Plant - 200 MMSCFD

- As Piping point of contact, reviewed all piping related RFI's from the site and corresponded in the shortest possible time to expedite construction
- Checked isometrics and GA's
- Responsible for Spec updates and modifications

Bellatrix - Alder Flats Deep Cut Gas Plant - Ph.2 - 117 MMSCFD

- Overlooked Piping Design and Modeling activities to ensure high quality end product through constructability, operability and maintainability
- Checked isometrics and GA's
- Responsible for Spec updates and modifications

Progress - Altares Gas Compression Plant - Ph.2 - 50 MMSCFD

- Checked Piping Design and Modeling activities to ensure high quality end product through constructability, operability and maintainability
- Checked isometrics and GA's

Bellatrix Gas Compression Plants (one at Pembina, 3 at Ferrier)

- Designed Plot Plan
- Checked isometrics and GA's
- Attended several Model reviews with the client to ensure their expectations are met
- Responsible for Spec updates and modifications

Encana Wellpads Expansion

- Checked, modified and improved well pads Piping Design to optimize Piping department man-hour spent on several pads resulting in 30% reduction of piping design time

TAQA Kaybob Gas Compression Plant

- Modified and designed Plot Plan, modeled the piping and checked the isometrics
- General tasks include:
 - Troubleshooting AutoCAD and AutoPLANT for the piping design team
 - To update AutoPLANT Specs and ensure they match Keywest Projects Specs
- Checked isometrics and GA's
- Responsible for Spec updates and modifications

Education

B.Sc. in Mechanical Engineering, Major in Heat and Fluids

K.N.T. University of Technology – Tehran, Iran (1997)



Résumé of Kumar Laxshimalla, P.Eng. Process Engineering Manager

Career Summary

Process Engineering Manager

Chemical Engineer with 42 years of process design and engineering experience in gas production, gas processing, heavy oil (SAGD and CSS), offshore platform production facilities, and refinery industry. Responsible for the process engineering execution of various projects right from the conceptual studies, feasibility studies, basic design, detailed design, construction and commissioning/start up phases. Projects include upstream Surface Facilities Oil and Gas production, Sour Gas Treatment, NGL fractionation, LNG and LPG facilities, Heavy Oil processing, water treatment, Cogeneration, and Utilities. Experienced in process simplification, design to capacity, energy optimization, waste minimization, risk management, value engineering, cost reduction initiatives, lessons learned modularization and constructability and also participated in HAZID, HAZOP, RAM and QRA workshops on a number of oil and gas projects.

Experience Highlights

- Executing Natural Gas dehydration projects Ethane and LPG recovery from natural gas using turbo expander cryogenic processes, refrigeration and oil absorption projects
- NGL fractionation facilities and storage projects, Stabilization of condensate projects, LPG and condensate treatment projects
- Executing Heavy Oil Production and Processing projects - CSS and SAGD
- Sour gas sweetening for gas plant and refinery off gas projects
- Acid gas injection projects
- Coal power generation, CFB boilers and Cogeneration projects

Related Experience

Process Engineering Manager

Keywest Projects Ltd.

Calgary, AB

Bellatrix Alderflats Deep Cut Gas Plants for Ph1 and Ph 2

- Lead Process Engineer for FEED and Detailed design of Turbo Expander plants for recovering Ethane plus or Propane plus liquid products. Filed gas condensate is also stabilized to recover CAPP spec C5+ product.

Kanata Beaton River Gas Plant

- Lead Process Engineer for the Pre Feed design of sour gas plant. Gas plant includes inlet pipelines, separation, amine gas treating, propane refrigeration, dales gas compression, C3+ liquid recovery, LPG recovery and C5+ recovery.

Progress Energy Gas Plants

Process Manager for establishing the design basis and DBM. Supporting and providing guidance to process engineers for project execution of various propane refrigeration gas plant projects to recover C3+ liquids and C5+ liquids. These include

- **Caribou South**
- **Lily – Sweet Gas**
- **Altares – Sweet Gas**
- **Julienne – Sour Gas**
- **Town North – Sour Gas**
- **Town Gundy – Sweet Gas**

Upstream Projects

Process manager supporting and mentoring process engineers for various Oil battery projects, Gas compressor station projects and Pipelines

Education

Bachelor of Chemical Engineering (1978)

Master of Business Administration (1984)



Résumé of Stan Pieczara

Senior Mechanical Engineer

Career Summary

Senior Mechanical Engineer

Stan is a Senior Mechanical Engineering specialist with 26 years' experience. Analytical, dependable professional specializing in well tie-ins and production facilities, water and CO2 injection for enhanced oil recovery, water treatment, SAGD, oil sands, modular design, gas processing facilities and offshore packages. Stan is familiar with ASME, API, ANSI, NACE and CSA standards, Proficient in Caesar II, NozzlePRO, SAP

Experience Highlights

- Experienced in analyzing existing operations and implementing effective systems, strategies and processes to improve organizational performance and safety
- Extensive experience in mechanical engineering design with a solid background in project engineering.
- Extensive experience in piping, line pipe, tank and vessel design, as well as material engineering, selection and purchase of materials, mechanical specifications, stress analysis and ABSA registrations including piping, fittings and OPPSD scenarios

Related Experience

Senior Mechanical Engineer

Keywest Projects Ltd.

Calgary, AB

- Review vendor designs, submissions, drawings and mechanical details/calculations for compliance with RFQ documents and Client/Project requirements
- Direct activities to ensure that fabrication, installation and operational commissioning meet recognized codes and standards and customer requirements
- Evaluate the desired goal of a system and assist in the design or selection of the appropriate equipment to achieve the project design objectives
- Work with other disciplines while providing effective mechanical engineering services
- Develop solutions to complex mechanical engineering problems related to oil and gas industry
- Identify and document discipline scope changes and provide feedback to project managers
- Provide mechanical discipline input for supporting project deliverables such as DBM, cost estimate, man-hour estimate and resource plan for mechanical discipline, delivery schedule, engineered drawings, equipment datasheets, quality control and checking
- Develop and define project specifications for equipment selection, quotation and purchase
- Material selection and implementation in design
- Coordinate / oversee sizing and selection of rotating and static equipment
- Coordinate / oversee stress analysis and confirmation of code compliance for critical service lines
- Review technical documents and drawings for compliance with safety, quality, regulatory and technical standards as directed by project engineering
- Prepare and coordinate specialty items on various projects
- Ensure design conformance with specifications
- Authenticate deliverables as per client and technical jurisdiction requirements

Education

Bachelor of Science, Mechanical Engineering, University of Calgary, May 2001



Résumé of Steve Huitema

Director, Engineering

**Career
Summary**

Director, Engineering

As a professional engineer registered in Alberta, British Columbia, Saskatchewan and Manitoba, Steve has a variety of 31 years' experience specializing in the oil and gas industry.

**Experience
Highlights**

- Extensive experience in Petro-Chemical Industry refineries, gas plants, Sulphur plants, oil batteries, gas gathering and compression
- Experience with facility pipeline, project engineering and project management
- Proven leadership skills as a Team Leader, Manager, General Manager and Director
- Demonstrates strong skills in the ability to lead a diverse group of individuals and maintain client relationships

**Related
Experience**

Director, Engineering

Keywest Projects Ltd.

Calgary, AB

- Oversees the Engineering department and acts as the prime client contact, including:
 - Determine and manage client and project expectations
 - Reviews and designs schedules, man-hour budgets/ project budgets
 - Working side by side with Executive leadership to manage decision making, workforce planning and resource allocation
 - Provides input to project team for supporting deliverables including DBM, Cost estimate, engineered drawings, equipment datasheets and quality control
 - Participates in studies, project definition and technical bid preparation for projects

Education

BSc. Mechanical Engineering

University of Calgary (1990)

Journeyman Finishing Carpenter

SAIT (1986)



Résumé of Stewart Nichols, P. Eng. Vice President, Engineering/ Senior Process Engineer

Career Summary

Vice President, Engineering / Senior Process Engineer

A results oriented, highly motivated project leader with a proven track record in project planning and execution; manufacturing operations; engineering design; team leadership; customer interface rolls, product line management and technical application of principles and practices. A firm understanding of how bottom-line driven objectives and goals can be achieved to contribute directly to the value of an organization.

- Compression equipment application sizing and packaging
- Steel design and fabrication experience
- Pressure vessels, heat exchangers, and process equipment design and manufacturing experience
- Project Management and Process Engineering experience in high tech manufacturing
- Process equipment design, pricing and execution

Consulting – process design, optimization, feed studies and Project Management

Related Experience

Vice President, Engineering/ Senior Process Engineer

Keywest Projects Ltd.

Calgary, AB

- Vice President and co-founder
- Complete business plan for full engineering, procurement and construction management (EPCM) service provider
- Related experience with:
 - Inlet Separation, Filtration and treating.
 - Compressor packages, Sales, Process and Refrigeration
 - Oil Batteries, Blending packages
 - Gas Sweetening, Dehydration and liquids removal.
 - Shallow and Cryogenic (Turbo Expander) Refrigeration Gas Plants
 - Liquids Stabilization and Fractionation
 - High and Low Vapor Pressure Storage systems
 - LACT units and Liquids pumping / distribution
 - Lift Gas Systems
 - CO2 Liquefaction and Compression
 - General Engineering Support Projects
 - Ammonia Water Refrigeration

Education

Mechanical Engineering Degree

University of Calgary (1992)

ENCH 609 Natural Gas Processing Technology

University of Calgary (2008)

Process Modeling using Aspen HYSYS

AspenTECH (2005)

ENCH 607 Natural Gas Processing Principles

University of Calgary (2004)

Fundamentals of Project Management

University of Calgary (1998)

Northern Telecom Cellular Systems

Northern Telecom Learning Institute (1997)

Micro C I / C II courses

SAIT (Southern Alberta Institute of Technology) (1993 – 1994)

Additional

H2S Alive • CPR • Management by Responsibility • Improved Welding Design

