Nexen's Balzac Abandonment & Reclamation – Program Update and Lessons Learned



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Presentation Agenda

Field and Plant History

Formation of the Abandonment and Reclamation Team

Project Updates:

Plant Abatement Project Plant Demolition Planning Sulphur Basepad Removal Well Site Demolition and Abandonment

Lessons Learned







Balzac Field History

- The first discovery wells were drilled in 1956, a total of 125 (includes 5 D&A wells) wells were drilled & produced
- The Balzac Gas Plant was built in 1961 and expanded in 1967, processing over 3 Tcf of gas over its long & successful life
- Field covers ~400 square kilometers, running ~35 km north to south and ~20 km east to west
- Rapid urbanization has resulted in third-party utilities (power, cable, telephone, gas, water, sewer, rail ways) present throughout the field





Gas Plant site prior to 1960



Is this where you would build a gas plant?

CENTRE DE REPRODUCTION PNA - ENERGIE, MINES ET RESSOURCES - GOUV. DU CANADA - DROITS RESERVES



Balzac Plant History

- 1961 Plant startup Petrogas Processing (28 owners) Jefferson Lake Petrochemicals
- 1965 Liquefied Petroleum Gas (LPG) unit added
- 1967 Additional Gas Treating and Sulphur Recovery added
- 1974 Inlet Compression (250 mmscfd raw gas capacity) added
- 1975 Sulphreen Unit added to meet regulatory requirements
- 2001 2002 Addition of Balzac Power Plant
- 2003 2004 Slating to Prilling of solid sulphur.
- 2009 South Sulphur Plant Mothballing, Unsuccessful Parkway Drilling
- 2010 Decision to close gas plant, 1 Year for planning
- 2011 Plant Closure, Shutdown and Decommissioning Begin



Balzac Plant History

Balzac Gas Plant (1961)

Balzac Gas Plant (2011)





Abandonment and Reclamation Team

- Team dedicated to the execution of the Balzac Abandonment and Reclamation project
 - Multi-disciplined team comprised of environmental professionals, engineers, project managers and various consulting specialists
 - Formed prior to the shutdown of the Balzac Gas plant and has continued to grow as the scope of the entire program has developed





Program Scope

Gas Plant (~420 acres)

- Asbestos abatement
- Structural demolition
- Site assessment and remediation
- Ongoing power station operations
- Adjacent development and infrastructure crossing Nexen property
- End land use and closure decisions

~60 Inactive wells

- Well abandonment (30 45 days of rig time)
- Surface facility demolition
- Pipeline suspension and abandonment (~200 km)
- Site remediation and reclamation
- Access road remediation and reclamation
- Ongoing production (diversion) and development (Viking) opportunities

Benchmarking scope & performance is difficult as there are very few analogous fields & plants with the same proximity to urban residential & commercial developments.



Balzac Timeline and Workstreams





Project Updates

- Plant Abatement
- Plant Demolition Planning
- Sulphur Basepad Removal
- Field Demolition and Well Abandonment





Abatement





Abatement – Project Scope

- Removal of all exterior asbestos and non-asbestos insulation within the plant
- High percentage of work from man-lifts and scaffold builds
- Transport and Disposal of material to a Nexen approved landfill location
- Industrial hygiene monitoring for all asbestos activities that are occurring on site





Abatement - Project Progress

- All major towers (excluding LPG area) have been completed to date
- Major containments have been completed in sulphur area (converter beds, large diameter pipe, etc.)
- Work is ongoing in two large buildings (treater / boiler house)
- Significant progress made in pipe racks and other process piping





Abatement – Containments





Abatement – Manlift Work





Abatement – Industrial Hygiene Monitoring

- All industrial hygiene monitoring on Balzac site performed through a 3rd party consultant
 - Responsibilities of consultant includes ensuring compliance with work procedures, completing air monitoring, and supporting Nexen in determining responses to high readings
- Nexen has had detailed discussions with Occupational Health & Safety in regards to abatement techniques
- Continuously evaluate air results to ensure consistent performance





Abatement – Owner Considerations

- How much control do you want? Prime vs. Not Prime
- Are you willing to consider non typical work-procedures?
- Are your responders ready to handle an incident in a high risk enclosure?
- Understand the limitations of your own HSE manual and be very specific in how you want the work performed
- Educate your management early, the work force and activities is not-typical for industrial sites at this scale
- Contract must match your plan, philosophy and performance metrics





Plant Demolition





Plant Demolition – Project Scope

- Removal of all surface facilities (towers, buildings, vessels and equipment)
- Transport and Disposal of waste materials
 to a Nexen approved landfill location
- Segregation and recovery of scrap metals
- **Out of Scope**: Underground tanks and piping, incinerator stacks, facilities that will be used for future remedial efforts
 - Scope of below ground work is difficult to define
 - Removing the buildings and equipment will enhance ability to assess underlying contamination





Plant Demolition – Site Preparation

- Plant decommissioning
 - Cleaning of process piping
 - Isolation of electrical sources
 - Updating plant drawings
- Hazmat Removal
 - Removal of accessible asbestos
 - Removal of accessible hazardous wastes (PCB, Chemicals, Mercury, etc)
- Sale of reusable equipment & inventory
 - To date ~2.5\$ Million Recovered
 - Nexen has a dedicated Salvage Coordinator that looks at all Canadian assets





Plant Demolition – Understanding Volumes and Weights

- Assess the plant site to understand material volumes
 - Either internal or 3rd party estimate
 - Assessment should be done of all major vessels, process equipment and buildings
 - Estimate volumes of steel, concrete, etc. to be demolished / processed / recovered
- Break down by process area
 - Each area of the plant process will have its own inherent issues, it is good to understand what portion of this metal may not be recoverable
 - Examples: Sulphur plant piping plugged with Sulphur, LPG unit with norm contamination



Plant Demolition – Understanding Your Contamination

- Recovery is dependent on contamination that may be present in equipment / metal
 - PCB's in transformers have increased disposal costs
 - NORM's in piping and equipment may require costly disposal at a remote landfill
 - Piping that is solid with sulphur will not be accepted by a scrap dealer and will be costly to dispose of
- Techniques for dismantling / demolition may be affected by contamination
 - Residual Sour Gases (H2S)
 - Flammable Materials (Methane, Sulphur, Etc.)



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Plant Demolition – Controlling the Work

- Nexen has decided that we would like to retain prime onsite during demolition
 - Balzac Power Station is still operational and in proximity of critical work areas
 - Surface water management and other operational activities will still be coordinated by Nexen
 - Anticipating significant amount of survey work, excavation work, etc. to be occurring on other areas of the plant site





Sulphur Basepad Removal





Sulphur Basepad Removal – Project Scope

- Maximise recovery of sulphur that is present in the sulphur basepad
 - Focus on reuse of materials and limiting volumes that are sent to landfill
 - Analyze different methods of sulphur recovery
- Estimated ~25,000 30,000 tonnes of spec sulphur (>99.7%)
- Estimated ~50,000 100,000 tonnes of off-spec sulphur (<99.7%)

Note: Basepads at Balzac were formed by pouring molten sulphur onto bare ground. Therefore depths of material varies greatly throughout the basepad





Sulphur Basepad Removal – Economics

- Current sulphur market has netted a positive sale price for material in Balzac
 - ~13,000 tonnes sold at positive price at plant gate in separate sales
 - Costs for excavation additional
- Costs to dispose of sulphur through a landfill are currently high
 - Need to understand break even of on-site services and sale vs.
 expected cost of disposal services





Sulphur Basepad Removal – Bagged Sulphur

- Nexen is investigating selling off-spec sulphur in the international market
 - Cost analysis will be completed against landfilling of material vs. sulphur bagging operation
 - Low volume, high cost work
 - Cost looks comparable to landfill but discount seems minimal
 - Considerations around risk of transport and acceptance of spec





Sulphur Basepad Removal – Considerations

- Critical front end planning in an urban environment:
 - Dust mitigation
 - Fire control
 - Emergency Response
 - Monitoring of hazardous gases
- Consider how the sulphur surface is contoured to ensure minimal collection of acidic water
- Understand ownership transfers for material that has been sold into the market





Well Site Demolition and Abandonment





Well Site Demolition and Abandonment – Job Scope



- Wellsite demolition program was initiated prior to the abandonment of well
- Most wellsites included a small amount of asbestos abatement, structual demolition and salvage of materials, recovery of glycol and cleanup of debris on site
- Significant reduction in costs from past "oneof" programs due to larger volume of work



Well Site Demolition and Abandonment – Job Scope



- Many of the Balzac wells are in proximity to urban development; which adds operational complexity and requires stakeholder engagement to ensure operational success.
- Abandonment priority considers proximity to residential and industrial development, in addition to wellbore integrity, access constraints, surface rental issues, etc.
- The execution plan includes initiating work in 2012 and then carrying directly into 2013 as a continual program.



Lessons Learned





#1) The Human Element is of the utmost importance

- More than just the facility staff are affected
- Emotional ties run deep
- Resistance to change impacts safety & performance

#2) Benefits of planning in advance

- The greatest potential to influence the outcome is at the start
- Campaign efficiencies cannot be realized without planning
- Planning assists in ensuring high level of stakeholder engagement, making execution smooth & efficient



Balzac Model Plane Airport



#3) Benefits of a sustained dialogue & joint problem solving with regulators can not be understated

- Projects of this nature have unique challenges & opportunities that require co-operation to develop creative & effective solutions
- Understanding the intent of the regulations is important It takes time & effort to build and maintain trust
- There are many regulators to include in the dialogue (ERCB, ESRD, municipalities, Infrastructure, etc).



#4) Leveraging partner & industry experience

- Accessing a larger knowledge base creates value for all participants (e.g. asbestos learning, well abandonment efficiency)
- There is no information hoarding or competitive advantage in the A&R realm

#5) Costs of base-line compliance

- These carrying costs may not be well understood initially, further incentive to proceed with timely abandonment & reclamation
- Estimated base-line compliance as a "lock & walk" scenario, the minimum resources necessary to remain in compliance



#6) There are disincentives associated with non-landfill remediation

- Landfilling severs future land use & development conflict risk
- Landfilling remains the low cost "remedial technology"

#7) The value of internal education

- A&R is a non-core activity so the enterprise lacks the models & frame of reference to quickly & efficiently make A&R related decisions
- Many of the lessons learned can be applied at the front of the life cycle to create value from the beginning





#8) Understand your contractual commitments before you shut down your business

- This includes utility contracts, lease & rental agreements, operating agreements, etc.
- If possible, match contract termination to the expected closure window

#9) Common language ("definitions") is important

- "Decommissioning means different things to different people"
- Some terms have different meanings under different regulations
- A common language helps achieve and maintain team & stakeholder alignment





#10) Complexity & value of a proper Shut-Down, Decommissioning & Salvage project

- A shut-down program requires more planning than a turn-around
- Retaining staff can be beneficial (knowledge) and detrimental (old habits), change management is critical

#11) Accelerated house-keeping practices and rationalization of bone-yards as a large facility or field nears the end of its life has value

- Leverages a larger work-force to get labor intensive work completed
- Reduces post-shut-down site maintenance costs & security concerns
- Can have positive impacts on site logistics, traffic management, etc.



#12) Limited value of salvage

- The costs of preservation & recovery may exceed the sale price
- The market for used goods is limited and time sensitive

#13) Inventory should be managed "just in time" as a large facility or field nears the end of its life

 Unused inventory may be worth 20% or less of purchase price, not including the costs of holding, maintaining and selling it





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#14) Joint infrastructure

- Tying plants & facilities together may save capital and operating costs, but it creates additional expenses and operational & regulatory complexities at the time of shut-down
- Integrated facilities decreases the options for the facilities
- Consider the "end of life" when making investment decisions



#15) Off-spec sulphur & the value of waste minimization

- There is value to be realized from non-traditional markets
- Different operating practices (e.g. liners, small volume static remelter) may have reduced or eliminated this exposure





Lessons Learned - Field

#16) Impacts to A&R efficiency resulting from land development pressures

- Erodes ability to select optimal timing & technologies
- Restricted site access & working hours

#17) The value of regional soil & groundwater background data can not be understated

- Expedites closure of contaminated & reclaimed sites
- Cost savings realized by not chasing "false positives"



Lessons Learned - Field

#18) Proper well suspensions create savings opportunities at the time of abandonment

- Verification of site conditions & wellhead/equipment configurations
- Opportunity to log known or suspect wells
- Placement of bridge plugs & barriers in appropriate locations





"The process of shutting down a sour gas plant & field is complex, but achievable with the proper investment of people, time, and resources, including dialogue & coordination between ourselves, partners, regulators & community stakeholders."