Vaudreuil 2022 - Phase I

2020 Canadian Consulting Engineering Awards

HATCH

Integrated project team at Vaudreuil site celebrates project completion.

Rio Tinto (RT) wanted to find the optimum alternative to avoid closing the Vaudreuil Alumina Refinery in 2022. Constrained by the bauxite residue disposal capacity, RT engaged Hatch to provide EPCM services for expanding or opening a new bauxite residue disposal area with at least 70% solids content, while maintaining operations at the facility.

The sustained effort of the integrated team delivered an injury-free project, one month ahead of schedule, and below the estimated cost.

Project highlights

Complexity

Vaudreuil Works, in Saguenay, Québec, is an alumina plant 100% owned by Rio Tinto (RT). The refinery is the largest centre of inorganic chemistry in Canada, converting bauxite, shipped from overseas, into alumina. Vaudreuil uses the "Bayer Process" and stores the discarded bauxite residue in a residue disposal area (RDA).

The objectives of the project were to achieve filtered residue with a solids content of more than 70% on schedule, within estimated costs, and with no injuries.

Vaudreuil project under construction.

The bauxite RDA is limited and this constraint was a significant obstacle to extending the life of the Vaudreuil plant beyond 2022. RT wanted to investigate an optimum alternative to closing the refinery with the best NPV/CAPEX trade-off.

Hatch was contracted to provide full engineering, procurement, and construction management (EPCM) services up to Pre-Operational Verifications (POV), from Pre-Feasibility Study (PFS) to final delivery. Commissioning was completed by RT. Hatch was responsible for construction, safety, contract administration, and POV activities on site, working as an integrated team with RT's functional managers and commissioning personnel.

Since the residue disposal area capacity was a constraint to the expansion of the operational life of the plant, the project scope entailed expanding or opening a new disposal area for bauxite residue with at least 70% solids content. The phase 1 project scope included transporting the residue (via pipelines) to a residue filtration facility, and the residue disposal to existing RDA sites by conveyor.

The priority was an engineering project that would ensure the plant's viability. The objectives were to achieve filtered residue with a solids content of more than 70% on schedule, within estimated costs, and with no injuries. RT identified the following priorities:

Schedule

Timelines are critical for any project; they were especially critical at Vaudreuil because the entire plant's operations depended on them. Any delay in project implementation or future operational issues would impact the alumina refinery's production due to its limited storage capacity for residue. In June 2019, the client asked Hatch to accelerate delivery of the first filtered residue, to assist operations.

Budget

In spring 2016, Hatch was awarded the mandate to complete the PFS with a commercial incentive to reduce the estimated Total Installed Cost (TIC) of $250M by 20%. The objective of cost reduction for the project was communicated from the initial phase, where conventional cost reduction exercises were expanded to also include separate schedule and indirect cost reductions.

Health and safety

"Zero harm" was a key priority for the project team. This message was consistently communicated through a specific prevention program aimed at collaboration between all personnel.

Meeting client's needs

RT's goals for the project were to reduce the project's cost while achieving the baseline schedule, reducing operational risks, and achieving zero harm. The project team implemented key performance indicators (KPIs), as listed below, that provided a measurable means of quantifying value to RT.

Health and safety (HSE)

The objective of "zero harm" was a key priority and this message was continuously communicated to the team. A customized HSE mobile application was developed to simplify health and safety declarations, while matching RT's management systems. Another initiative, the "Stop and Seek" program, encouraged employees to stop and ask for assistance when confronted with potential hazards. The result: no recordable or lost time injuries for approximately 550,000 hours worked.

Schedule

In June 2019, RT asked Hatch to accelerate delivery of the first filtered residue. Following workshops, a detailed execution plan was presented to and approved by RT. The result: the first red mud was filtered on October 24, 2019—four weeks ahead of the baseline deterministic schedule.

Project costs

The objective of cost reduction was communicated from the initial phase, where conventional cost reduction exercises were expanded to include separate schedule and indirect reductions. A strong change management program was adopted and embraced by the team throughout the project. The final cost of the project totalled $176.1M—12% under the approved budget of $200.5M and 30% under the $250M estimate from RT at the end of the first phase of the PFS. This result was a huge achievement for the integrated team.

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Environmental benefits

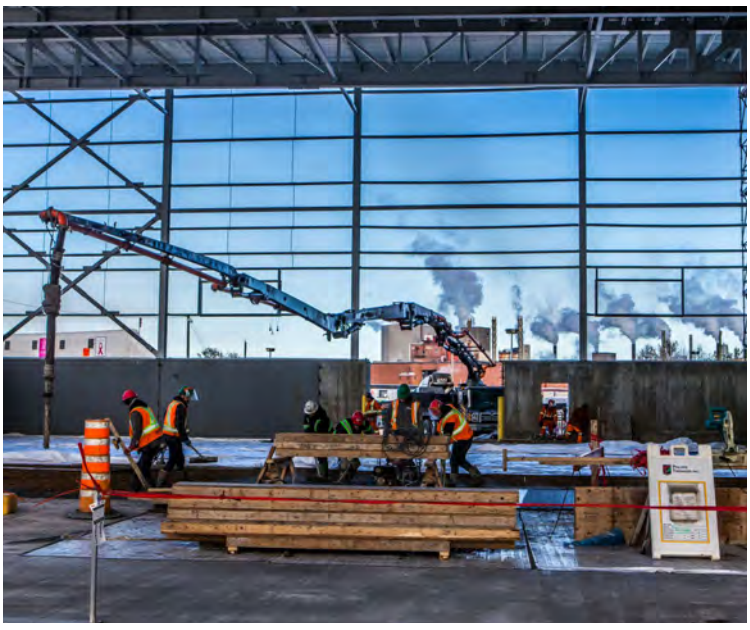
Through its environmental initiatives, Vaudreuil will become a global benchmark in the alumina industry for the management of bauxite residue.

Throughout the project, the team delivered the following environmental initiatives:

- Designing and delivering a project in compliance with the environmental permitting obtained from the Ministry of the Environment and the Fight against Climate Change (MELCC) including conservation and protection of wetland environments, and noise reduction initiatives throughout construction and for the new facility
- Investing in compensatory measures by cleaning, developing, and enhancing the Saint-Damien rangeland wetland carried out in accordance with the MELCC
- Providing a dedicated Hatch environmental resource onsite during the civil works activities to ensure wetlands protection, and compliance with soil and material management requirements.
- Promoting the project partnering vision with local contractors; sharing one goal to deliver a successful project with no harm

The completed project will have positive and lasting impacts for the environment, including:

- Significant reduction of area required for bauxite residue storage with dry-stacking technology (reduced geographic footprint)
- Significant reduction in the risk of dust emissions to neighbouring properties
- Significant reduction in residue processing time; 17 minutes versus 3 years
- Easier and faster progressive rehabilitation of sites
- Significant possibilities for future residue valorisation projects



Innovation

Bauxite residue dewatering

The Vaudreuil project entailed expanding or opening a new bauxite residue disposal area with at least 70% solids content. It centered on technological decisions that were reviewed extensively during the conceptual, prefeasibility, and feasibility studies. Various bench tests, plant visits, and intensive research resulted in the selection of industrial filtration as the new bauxite residue dewatering technique.

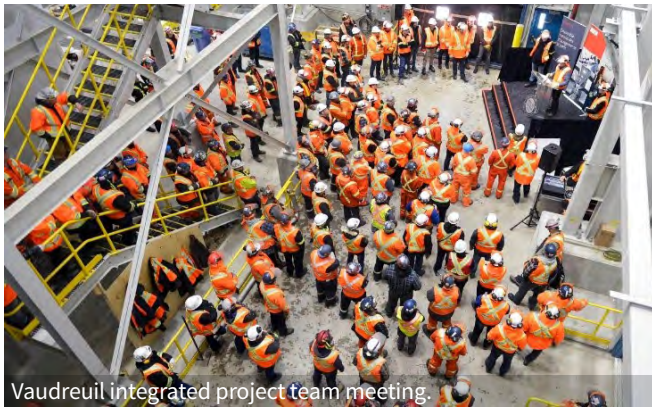
Filtration consists of applying a mechanical pressure to dewater bauxite residue so it can be stored more easily. This technique has the advantage of allowing dry stacking, which reduces the site's footprint. Also, the residue dewatering operation lasts approximately 17 minutes, rather than the 3 years required for the previous storage process. It is the most environmentally-friendly technology in the alumina industry to date.

With dry stacking technology, the Vaudreuil plant is a world leader in the filtration industry for bauxite residue and similar materials. Early filtration results at Vaudreuil showed a solids content of just over 73% compared to the minimum theoretical target set at 70%.

Interactive project dashboards

To ensure execution efficiency and meet client expectations, the team deployed custom digital solutions for the project, including interactive project dashboards for HSE, engineering, procurement, and construction progress. The result was increased data visibility that improved trending while reducing processing effort.

To support these dashboards, a customized HSE mobile application was developed to provide more efficient safety reporting. This tool replaced the paper forms, thereby eliminating data entry time and making data available instantly.



Vaudreuil integrated project team meeting.

Social and economic benefits

The Vaudreuil refinery is very important to the Jonquière, Saguenay-Lac-St-Jean region of Québec, and, since 2015, the integrated project team has taken the perspectives of all stakeholders into account. To ensure that the concerns of all parties in the region were considered, RT hosted recurrent discussions with the community to share project objectives, progress, and community initiatives.

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Vaudreuil employs one thousand people in the region, making it critical to the community's economic sustainability. Launched in February 2018, the phase 1 project has generated $120M in economic benefits for local companies that have supported the project's procurement, engineering, and construction efforts. With the extension of the life of the facility beyond 2022—approximately 18 additional years—the refinery will not only continue to support jobs in the region, but it will open the door for other projects and the potential valorization of its residue.

As part of Vaudreuil's community engagement, the Stop & Seek HSE program was linked to a charitable initiative. The program was implemented to encourage workers to stop work and ask for help when faced with potential safety hazards. Participants were rewarded with a symbolic medal and, for each medal, a donation was made to a local charity. As a result, the program gave $32,450 to the community.

Additionally, RT and Hatch prioritized the wellbeing of onsite personnel. Management teams were jointly certified in Workplace Mental Health Leadership by Queen's University and promoted physical and mental health onsite through organized fitness activities and the availability of healthier food options.

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HATCH