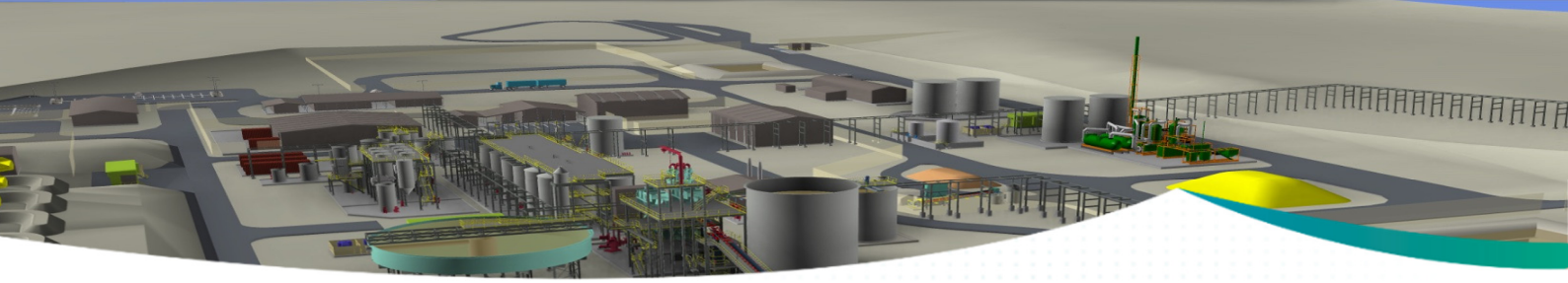




# ASX Announcement

**6 September 2021**

## Mulga Rock Project

### Positive Results from Metallurgical Optimisation Testwork

### Highlights

- **Preliminary ion-exchange testwork indicates improved uranium recoveries, reduced operating costs through reagent savings and lower capital cost resulting from higher uranium loadings**
- **Uranium uptake on the new resin is three times that of the resin tested in the Definitive Feasibility Study**
- **Physical and chemical characteristics of the new resin suited to Resin-In-Pulp process and conducive to reduced resin consumption rates**
- **Further testwork will quantify potential capital and operating cost savings and increased recoveries**

Vimy Resources Limited (**ASX:VMY, OTCQB:VMRSF**) is pleased to announce preliminary testwork results on an alternative ion exchange resin for its Mulga Rock Project plant uranium circuit.

The Mulga Rock Definitive Feasibility Study ("**2018 DFS**" - ASX 30 January 2018) and the 2020 DFS Refresh ("**2020 DFS**" - ASX 26 August 2020) confirmed robust financials and a simple, low-cost uranium mining and recovery process, positioning Vimy as Australia's largest, near-term uranium producer.

Following the 2020 DFS Refresh, Vimy has embarked on a number of optimisation studies, including evaluating and improving our mining and metallurgical processes at Mulga Rock.

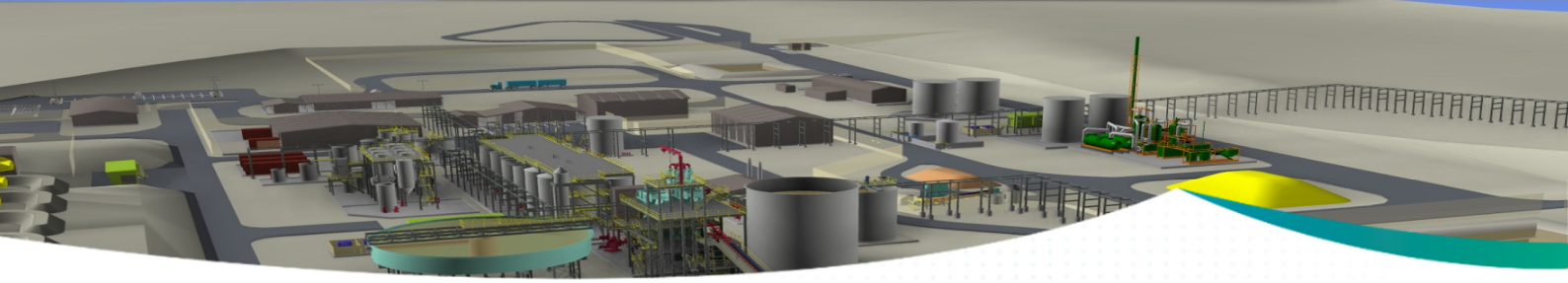
Interim CEO Steven Michael said, *"Our uranium extraction technique is based around ion exchange (**IX**) resin technology, and so getting the right resin for the job is extremely important. This testwork suggests that this new resin could shave in the order of A$1/lb $U_3O_8$ off already low operating costs.*

*Furthermore, resin technology and efficiency are improving all the time, which may lead to further gains throughout the Project's life.*

*This testwork opens the door to further capital and operating savings, without changes to the Mulga Rock Process flowsheet."*

Following the metallurgical pilot plant testwork that underpinned the 2018 DFS, Vimy identified a high-capacity strong base anionic resin (Lewatit® TP107, manufactured by Lanxess) as having the capacity to be very effective for uranium recovery from saline sulphuric acid leach liquors.

The Australian Nuclear Science and Technology Organisation (**ANSTO**), through its Minerals Business Unit, has since developed and patented a novel two-stage elution for the Lewatit® TP107 resin, demonstrated at a pilot scale on a different uranium project.





Early in 2021, Vimy engaged the services of ANSTO to test the chemical, mechanical and physical properties of the Lewatit® TP107 resin and investigate its suitability for the Mulga Rock process flow sheet.

The Lewatit® TP107 resin is a strongly basic, macroporous anionic exchange polyacrylic resin (see photograph below) initially developed to support drinking water and groundwater treatment applications. It was designed to offer very high metal takeup, fast kinetics, and good physical and chemical stability, which reduces replacement rates and costs.

The testwork by ANSTO, and reported here, aimed to test the suitability of the Lewatit® TP107 resin to the recovery of uranium in the Mulga Rock process plant. The testwork concentrated on the physical and chemical properties to determine whether the new resin could improve uranium recovery and reduce costs.

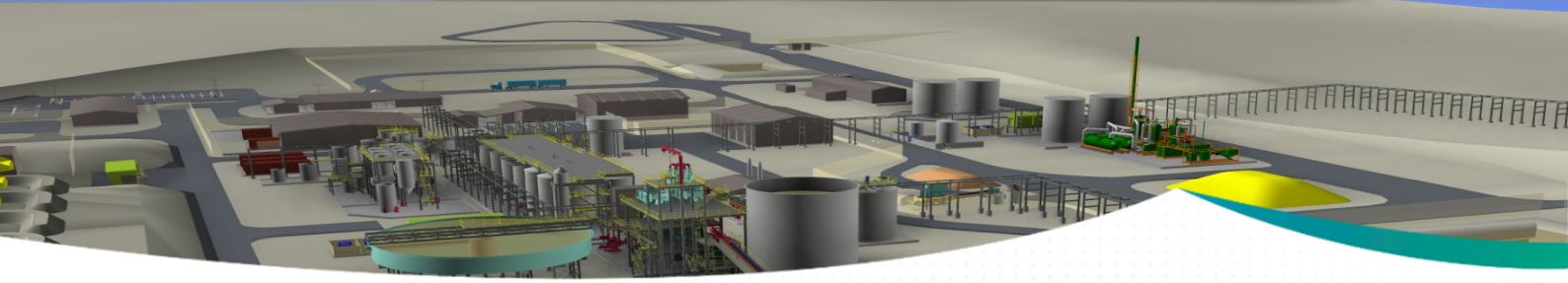
Key outcomes of the testwork showed the following:

- Preliminary sizing and mechanical testwork indicate that the Lewatit® TP107 resin is equally as suitable to the Resin-In-Pulp (**RIP**) process as the resin tested in the 2018 DFS;
- Uranium loading tests showed a step-change in loading efficiency with an increase of approximately three times in uranium loading;
- Successful elution (stripping) of the loaded resin using ANSTO's two-stage patented process:
    - Steep elution profile, indicating increased extraction of uranium in the leach due to reduced preg-robbing;
    - Very low residual loading on the resin following elution;
    - High eluate uranium concentration, which might support eliminating the nanofiltration plant from the process flowsheet in a continuous elution configuration; and
    - The deportment of impurities was very low.

## Next steps

The results justify moving to the next phase of testwork, which will evaluate performance under the optimum operating conditions determined in the 2018 DFS and opportunities for process optimisation and resulting flowsheet simplification. This will include:

- Follow-up testwork to demonstrate the benefits of the Lewatit® TP107 resin by testing it in a small scale mini-plant configuration to benchmark against DFS pilot plant results. That testwork will investigate the following:
    - Screening and fouling characteristics of the resin;
    - Leach/RIP and elution properties in a continuous configuration;
    - Potential increase in overall uranium recoveries (each 1% increase in recovery may result in a ~A$1/lb $U_3O_8$ decrease in operating cost);
    - Improving recycling of the resins and minimising resin loss; and



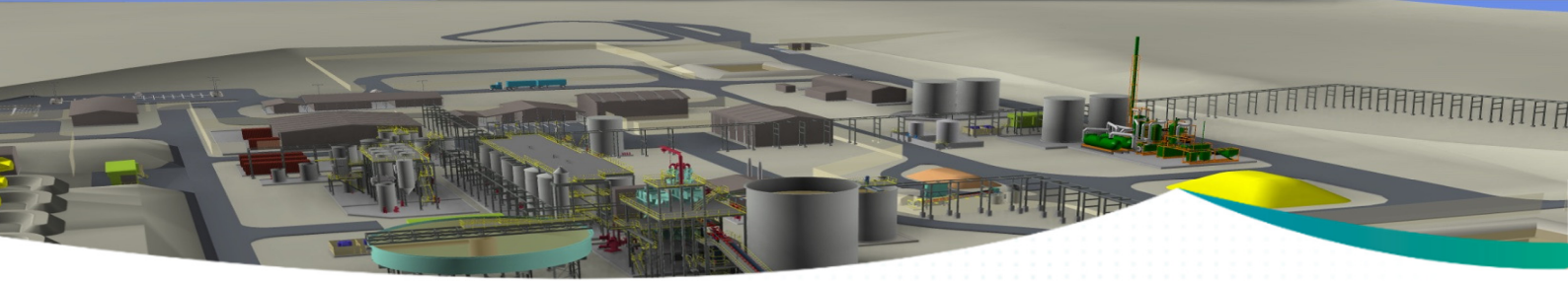
- Process integration and design: Given the potential for very high uranium concentration in the eluate, it is possible that the nanofiltration circuit, with a capex of ~A$7M, might not be required in the Mulga Rock process flowsheet.

**Steven Michael**

**Interim CEO**

Tel: +61 8 9389 2700

Released for and on behalf of the Board of Vimy Resources Limited





## Appendix – Technical details on testwork reported

### Mechanical testwork

Mechanical testwork on the Lewatit® TP107 resin involved:

- Sizing analysis
- Ball Mill test

The resins were used as received for the mechanical testwork.

The bead size distribution for the Lewatit® TP107 is shown below, relative to other IX resins, including the resin retained for the Mulga Rock 2018 DFS, which was screened to >600 µm. The Lewatit® TP107 resin features a relatively large bead size relative to the 2018 DFS resin. Its size distribution would be suited to the Resin-In-Pulp (**RIP**) equipment screens selected in the DFS (500 µm cut-off), suggesting a >90% retention rate.

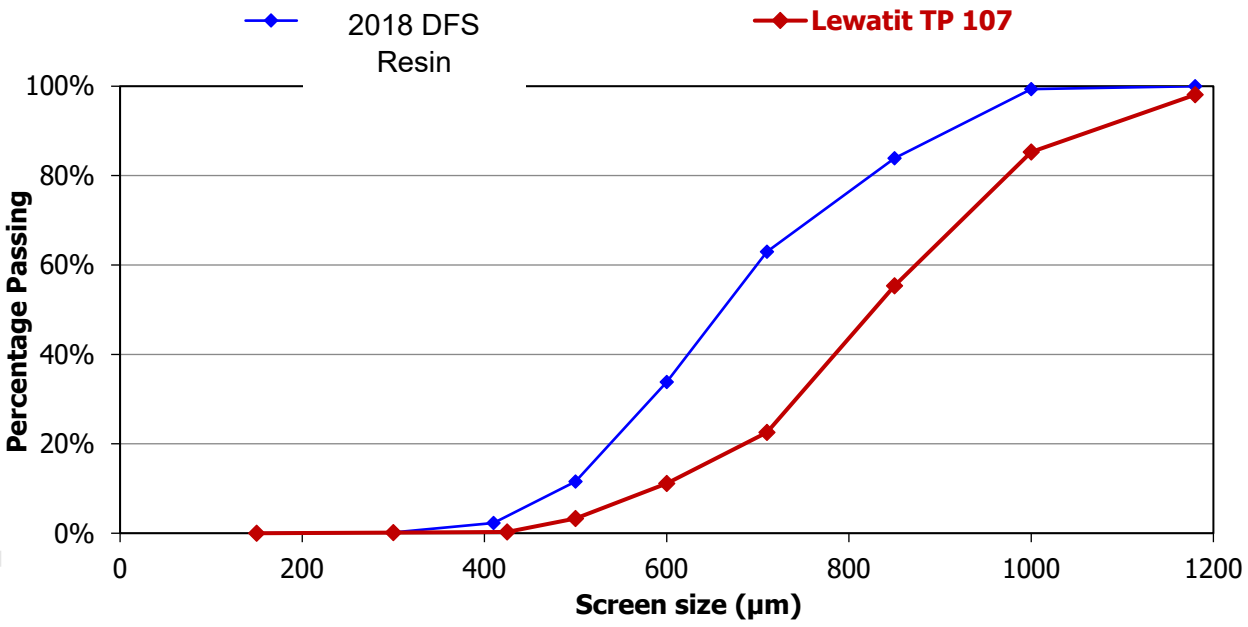



**Figure 1: Bead size distribution of Lewatit® TP107 relative to other IX resin**

Ball Mill test results confirm that the Lewatit® TP107 resin is RIP-grade and behaved better than the Weak-Base Anion resin initially retained in the Mulga Rock DFS. This should translate into lower resin attrition losses for the Lewatit® TP107 resin. Resin sizing data was also collected for the Lewatit® TP107 resin.

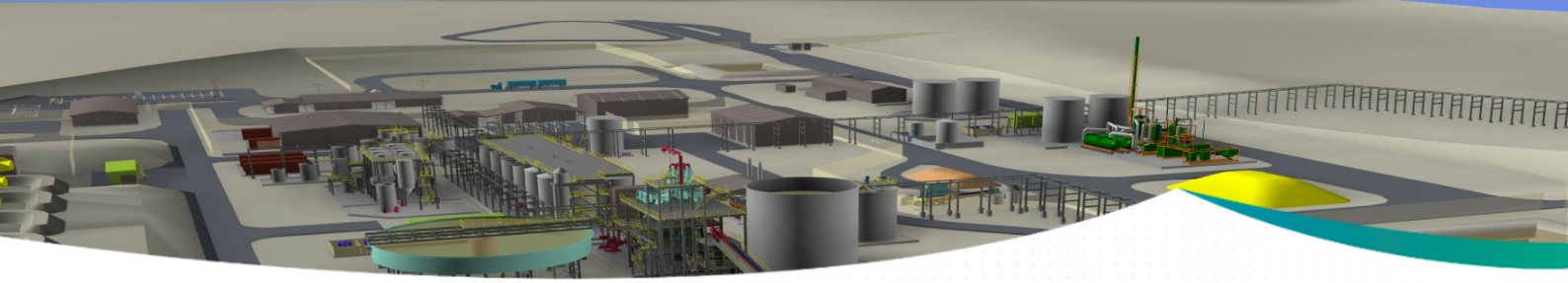




**Table 1: Russian Ball Mill test results**

| Resin | V1 ≥ 500 µm (mL) | V2 ≤ 500 µm (mL) | Hydro-mechanical Strength (%) |
|---|---|---|---|
| 2018 DFS Resin | 99 | 1.6 | 98 |
| **Lewatit® TP 107 (this work)** | **99** | **0.7** | **99** |

1 Rounding has been applied.

Preliminary chemical testwork carried out on the Lewatit® TP107 resin included loading and elution tests.

## Loading testwork

The feed solution used in this testwork was a synthetic solution used in earlier testwork for the Mulga Rock Project carried out by ANSTO Minerals (2015) and representative of expected conditions in the RIP circuit. The composition of that feed solution is shown in Table 2.

**Table 2: Composition of synthetic feed solution (pH 1.5)**

| Element | Al | Ca | Co | Cu | Fe | Mg | Na | Ni | S | $U_3O_8$ | Zn | Cl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Concentration (mg/L) | 646 | 661 | 108 | 320 | 2,144 | 1,925 | 8,187 | 324 | 9,315 | 479 | 1,379 | 10,100 |

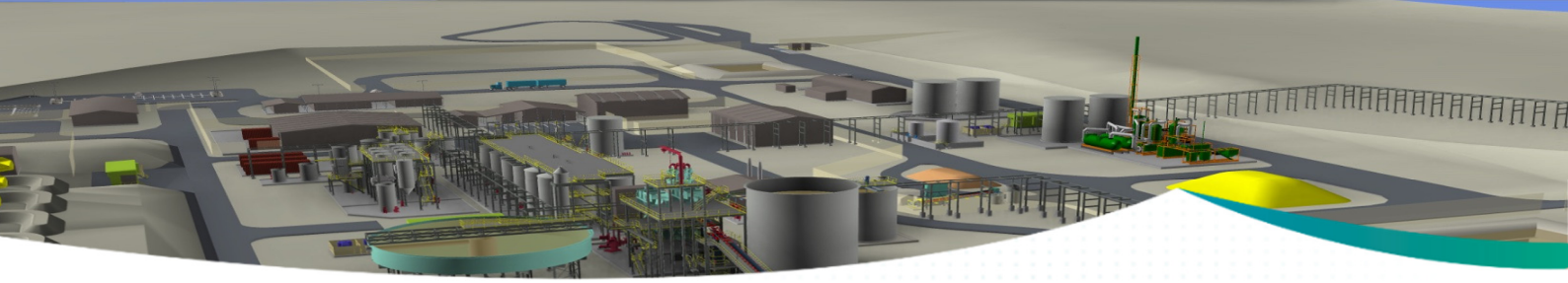
Two resin samples were used in this testwork, the 2018 DFS Weak Base Anionic (WBA) resin extensively tested for the DFS pilot plant and ore variability testwork and the Lewatit® TP107, a high-capacity SBA resin.

Two loading tests were performed on each resin with the synthetic feed solution, with tests performed at 10g/L and 20 g/L chloride concentrations.

### Results

- The loading for the Lewatit® TP107 resin was approximately three times that of the 2018 DFS WBA resin at 10g/L Cl (about 2% salt), with a loading of ~76 g $U_3O_8/L_{wsr}$ compared to the 25g/$L_{wsr}$[1] assumed in the DFS
- At higher salinity and lower uranium concentrations, the relative loading improvement is even more pronounced (almost six-fold at 20 g/L Cl (~47 vs 8 g $U_3O_8/L_{wsr}$, see below). This suggests that the Lewatit® TP107 resin could potentially be used in a much more saline environment than the 2018 DFS resin
- The loading isotherm for the Lewatit® TP107 was considerably steeper, suggesting that a lower tailings concentrations could be obtained and fewer tanks required in the RIP circuit (see *Uranium Process Plant* below)
- Slower loading kinetics for the Lewatit® TP107 are consistent with the much greater loading on the resin

[1] Litre of wet settled resin



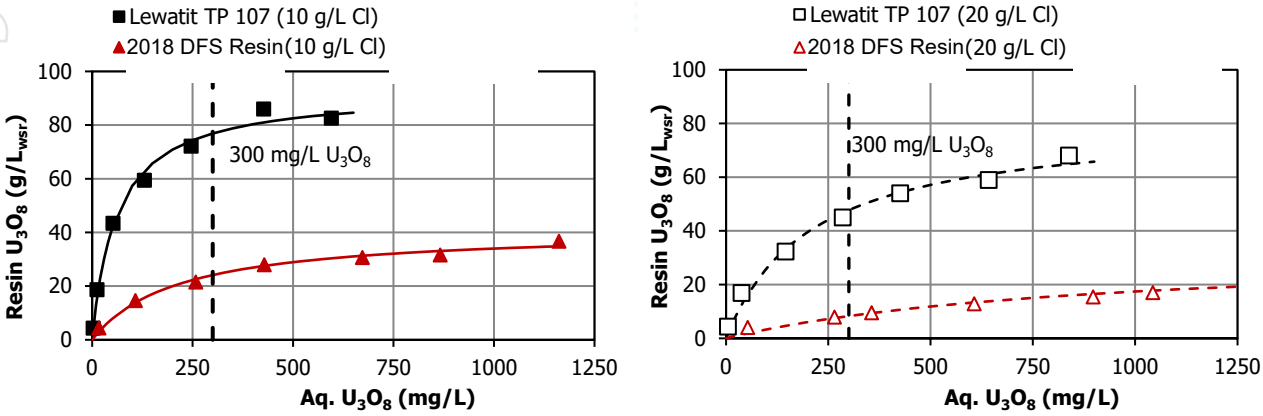



**Figure 2: Uranium loading curves at 10 and 20 g/L Cl**

## Elution testwork

Previous work with the Lewatit® TP107 resin showed that it is difficult to elute by conventional means (i.e. NaCl or $H_2SO_4$).

ANSTO subsequently developed a novel elution method based on a two-step process:

- Conversion step: achieved by contacting the resin with a minimal quantity of sodium carbonate (a readily available low-cost reagent) to convert the uranyl sulphate complexes loaded on the resin to uranyl carbonate complexes
- Elution step: elution with sodium chloride solution to elute the weakly bound uranyl carbonate complex

The elution testwork was carried out at ambient laboratory temperature (21°C).

### Results

Two-stage elution tests were equally successful, despite the preliminary nature of the testwork:

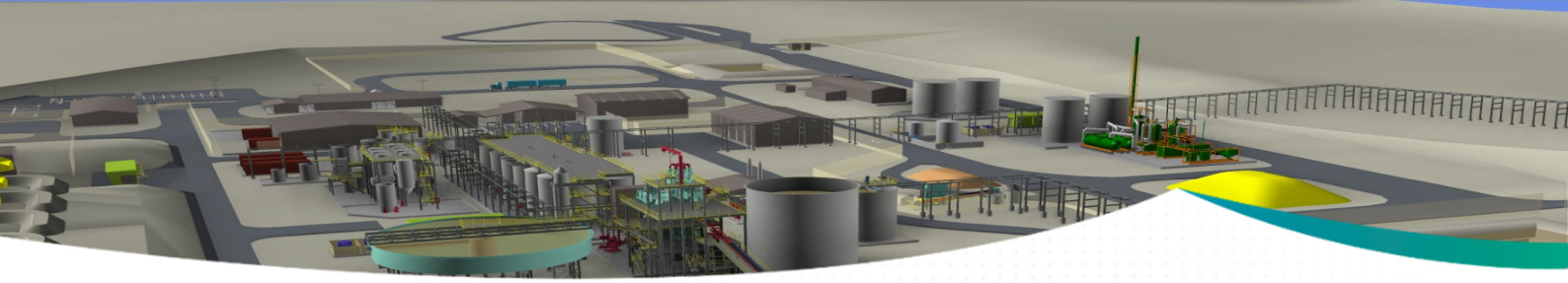
- Steep elution profile, nearing completion within 10-bed volumes
- A peak eluate concentration greater than 20 g/L $U_3O_8$ and an average eluent tenor of 7.4 g/$L_{wsr}$
- Very low residual loading on the resin following elution (<1g$L_{wsr}$ $U_3O_8$)
- Deportment of impurities to the eluate was very low, with average concentrations over the first 10 Bed Volumes (**BV**) of elution of < 1-2 mg/L
- Results suggest that this resin might be well suited to a continuous style elution (similar to the one retained in the DFS)

## Uranium process plant

The process design of the Mulga Rock Project uranium process plant is the result of extensive testwork and design programs culminated in a DFS pilot plant and ore variability testwork completed in 2017.

The processing facility consists of four main sections (Figure 3), which are separated by surge tanks between the respective sections in the process flowsheet:

- Ore beneficiation



- Uranium extraction circuit (Leach/Resin In Pulp/Elution)
- Ultra-filtration/nano-filtration (**UF/NF**) circuit
- Uranium precipitation circuit

Resin-In-Pulp (**RIP**) has been selected for the Mulga Rock Project due to the 'preg-robbing' nature of the carbonaceous material associated with the uranium ore. This phenomenon occurs when leaching Mulga Rock ore, where some uranyl sulphate formed during acid leaching is adsorbed onto the carbonaceous ore.

Extensive testwork performed on Mulga Rock ore has shown that contacting the acid leach slurry with an ion exchange resin in a RIP circuit reverses this preg-robbing phenomenon.

This improvement in extraction delivers greater than 90% overall uranium recovery in a continuous RIP circuit.

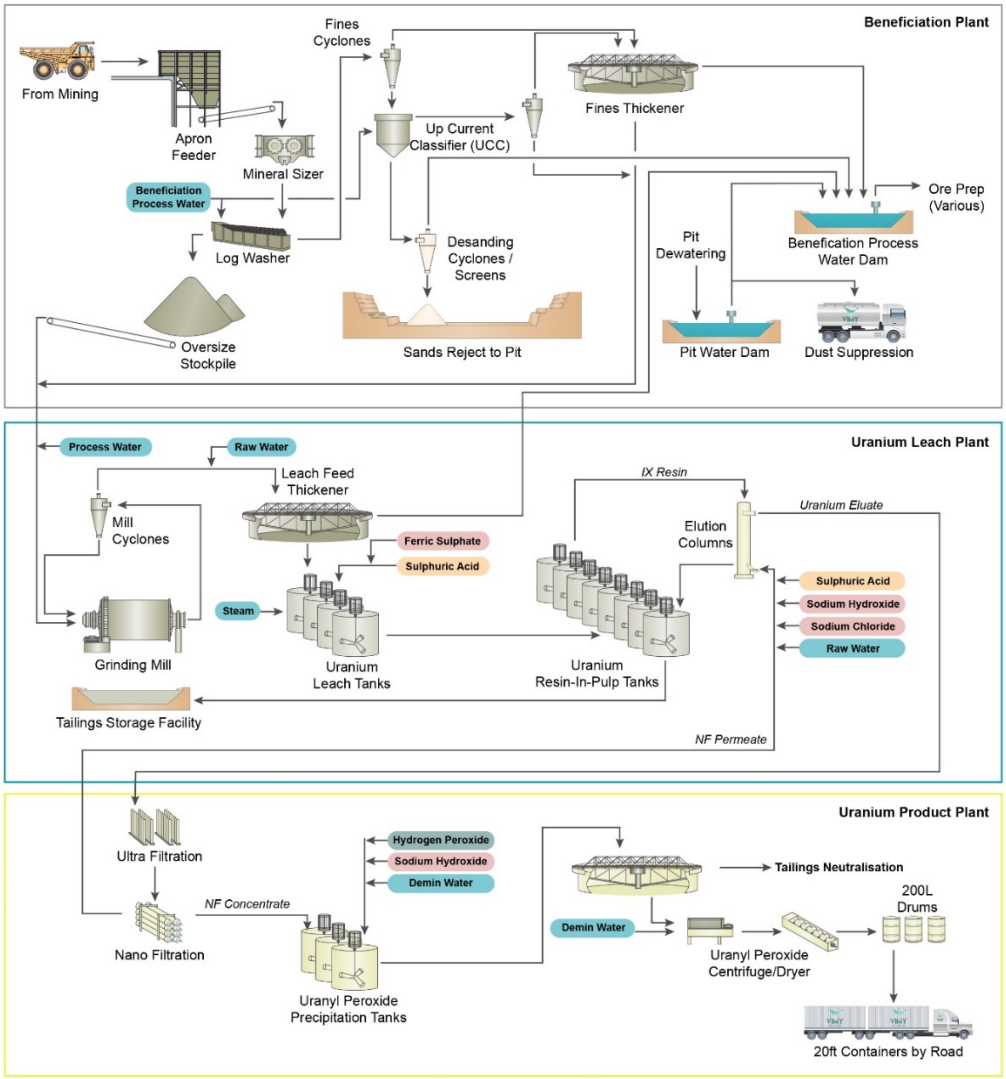
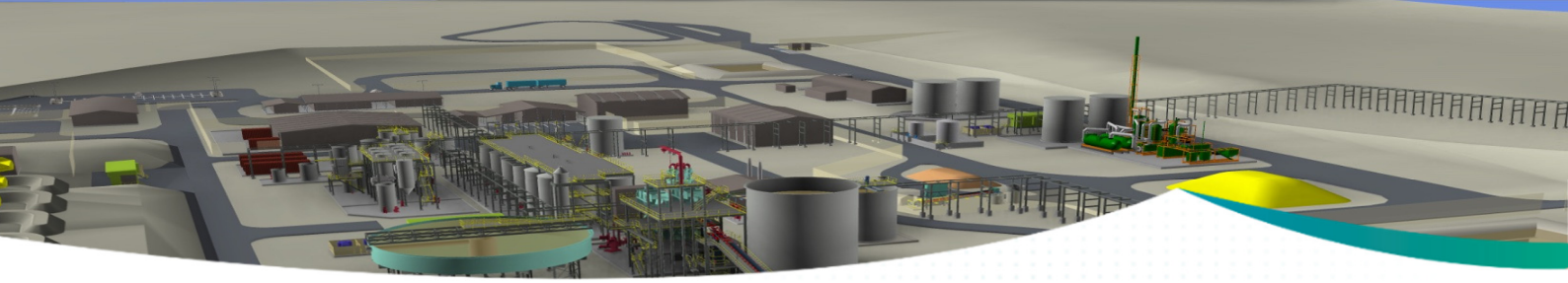



**Figure 3: Mulga Rock Project - Uranium process flowsheet schematic**

The resin, now loaded with uranyl sulphate, is recovered from the leach pulp, washed and then eluted (stripped) using sodium chloride. This generates a clean solution (eluate) containing essentially sodium chloride and uranyl sulphate, characterised by large molecular size differences.



Thus, ultra-filtration/nanofiltration (**UF/NF**) is used to remove sodium chloride and water (which is also a small molecule compared to uranium) and to concentrate the uranyl sulphate. The sodium chloride solution is recycled to the elution circuit to strip further resin.

The UF/NF concentrated uranium-rich solution is now ready for final precipitation and drying prior to packing in drums.

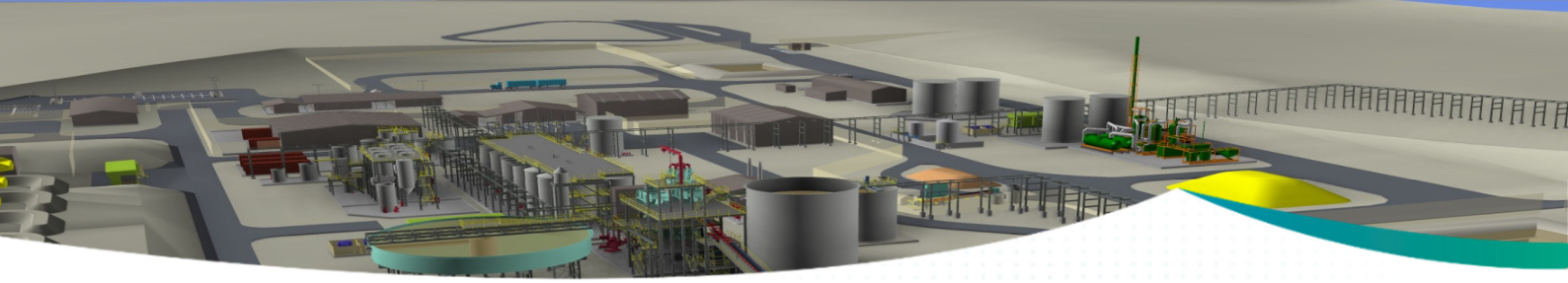
## Implications for continuous operation

A RIP process typically operates best in a moving bed style elution configuration, where the resin moves through the elution equipment in a counter-current to the eluent.

In a moving bed process, it should be possible to achieve a significantly higher average eluate tenor than the average of 7.4 g/L $U_3O_8$ measured in the fixed bed test reported here (with the eluate constantly in contact with a relatively highly loaded resin).

Other operational parameters to be explored that might contribute to higher eluate concentrations include:

- Composition of the eluent, in particular, the chloride concentration in the elution step
- Elution temperature





**Prior ASX announcements relevant to the Mulga Rock uranium process plant**

| Date | Title | Component |
|---|---|---|
| 26 August 2020 | *DFS Refresh significantly improves Mulga Rock Project economics* | DFS Refresh<br>Uranium market<br>Implementation timeline<br>Future opportunities |
| 30 January 2018 | *Mulga Rock Project Definitive Project Feasibility Study confirms world-class uranium project* | DFS Executive summary<br>Key project physical and financial metrics<br>Uranium Mineral Resources and Ore Reserve<br>Mining<br>Process flow sheet (**uranium** and base metals)<br>Metallurgical Piloting (**uranium** and base metals)<br>Infrastructure and logistics<br>Project implementation plan<br>Capital cost estimate<br>Operating cost<br>Uranium market<br>Financial evaluation |
| 4 September 2017 | *Major Ore Reserve update – "Moving to the go line"* | Maiden Proved Ore Reserve<br>Ore Reserves update<br>Updated Project economics |
| 12 July 2017 | *Significant uranium resource upgrade – Mulga Rock cracks 90Mlbs* | Uranium Mineral Resource update |
| 6 March 2017 | *Vimy's Project approved by Federal Minister* | Commonwealth environmental Ministerial approval of Mulga Rock Project, subject to conditions |
| 19 December 2016 | *Vimy's Project approved by WA Government* | State environmental Ministerial approval of Mulga Rock Project, subject to conditions |
| 23 June 2016 | *Significant resource upgrade for Mulga Rock Project* | **Uranium** Mineral Resources |
| 17 November 2015 | *Pre-feasibility study reaffirms Mulga Rock Project as one of Australia's leading undeveloped uranium projects* | Pre-feasibility study for the Mulga Rock Project (**uranium** and base metals)<br>Physical and financial metrics<br>Diluted Mineral Inventory<br>Metallurgical Processing<br>Capital and Operating costs estimate<br>Project financial analysis<br>Project development schedule |



# About Vimy Resources

**Vimy Resources Limited (ASX: VMY, OTCQB: VMRSF) is a Perth-based resource development company. Vimy's flagship project is the Mulga Rock Project (100%), one of Australia's largest undeveloped uranium resources, which is located 290km by road ENE of Kalgoorlie in the Great Victoria Desert of Western Australia.**

**Vimy also wholly owns and operates the largest granted uranium exploration package in the world-class Alligator River uranium district, located in the Northern Territory. Vimy is exploring for large high-grade uranium unconformity deposits identical to those found in the Athabasca Basin in Canada.**

**Vimy acknowledges the Traditional Custodians of the country on which we work and travel, throughout Australia, and respects their associated connections.**

## Directors and Management

The Hon. Cheryl Edwardes AM
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David Cornell
Non-Executive Director

Dr Tony Chamberlain
Non-Executive Director

Steven Michael
Interim Chief Executive Officer

Marcel Hilmer
Chief Financial Officer

Scott Hyman
Vice President Sales and Marketing

Matthew Foy
Company Secretary

Xavier Moreau
General Manager, Geology and Exploration


For a comprehensive view of information that has been lodged on the ASX online lodgement system and the Company website, please visit **asx.com.au** and **vimyresources.com.au,** respectively.

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Towards Sustainable Mining

Vimy has adopted
**Towards Sustainable Mining** ®
an award-winning accountability framework which helps minerals companies evaluate, manage and communicate their sustainability performance.

Adopting the independently verified system will reinforce Vimy's commitment to continuous improvement in safety, environmental and social governance (ESG).

**Committed to:**

ESG

The amount of natural uranium produced from Mulga Rock (3.5Mlbs pa $U_3O_8$) if utilised in nuclear reactors which displaced coal-fired electricity would reduce carbon dioxide equivalent emissions by approximately

**64 million tonnes**

$CO_2$

That is equivalent to
**about 12%**
of Australia's greenhouse gas emissions
**and 70%**
of Western Australia's