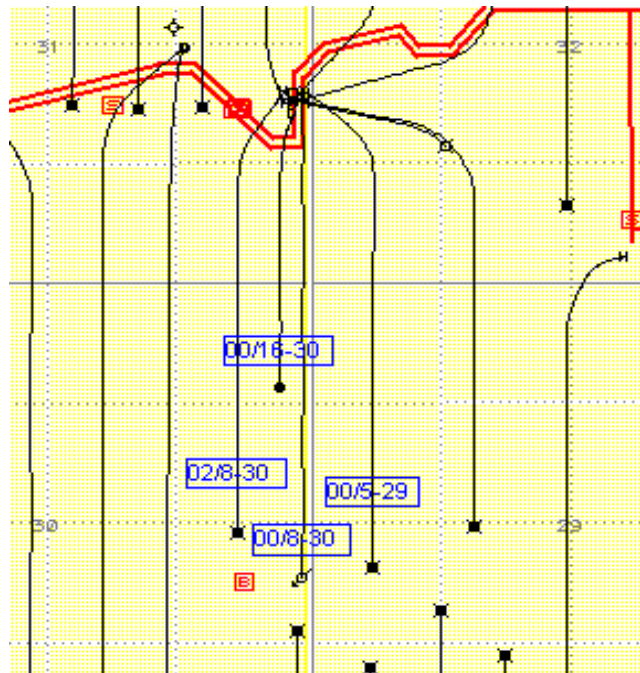


**SUMMARY OF APPROVAL 8988  
EXPERIMENTAL SCHEME UTILIZING AN EMULSION  
FOR THE ENHANCED RECOVERY OF CRUDE BITUMEN**

**Overall Performance**

**Background**

- Experimental scheme for a pilot emulsion flood
- Injection pattern was one horizontal injector flanked by two horizontal producers with a spacing of 200 meters



TWP 80, R22W4

- OOIP and Primary Recoverable Reserves
  - ◆ Porosity: 0.29
  - ◆ Sw: 0.35
  - ◆ Bo: 0.98
  - ◆ Recoverable oil-in-place (ROIP) determined from decline analysis

Well UWI	Drainage Length (m)	Drainage Width (m)	Net Pay (m)	OOIP (e3m3)	ROIP (e3m3)	Recovery Factor (frac)
00/05-29-080-22W4/0	1463	200	6.5	351.3	34.6	0.099
00/08-30-080-22W4/0	1439	200	6.5	345.6	25.0	0.072
02/08-30-080-22W4/0	1356	200	6.5	325.6	22.6	0.070

Injection Pattern
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684.1	53.7	0.078
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- Emulsion formed from Brintnell produced oil and water
- Experimental objectives:
  - ◆ Test emulsion mixing technology

- ◆ Determine long term emulsion injectivity
- ◆ Determine emulsion stability
- ◆ Evaluate flood performance from injector and producer response

● Approval History

Approval	Date	Application	Details
8988	Dec-01	1092559	Initial application for experimental scheme
8988A	Feb-02	1253969	G-51 application for 00/08-30-080-22W4/0 injector
8988B	Dec-02	1281044	G-51 submission (hydraulic isolation log) for 00/08-30-080-22W4/0 injector
8988C	Feb-03	1290025	Application to include 00/16-30-080-22W4/0 observation well into experimental scheme
8988C	Dec-04		Approval expired Dec 31, 2004.

- Emulsion injection started 11 April 2002
- Observation well 00/16-30-080-22W4/0 rig released 2 February 2003; bottom pressure monitored with injection; production started 26 April 2003; 704 meter horizontal length; 60 meter spacing to injector

**Actual Performance vs Predicted Performance**

Year	Predicted		Actual	
	Emulsion Injection (m3/cd)	Oil Production (m3/cd)	Emulsion Injection (m3/cd)	Oil Production (m3/cd)
2002	72	12	56	4.1
2003	55	13	16	3.5
2004	48	19		

- average maximum injection rate of 150 m3/d
- restricted by surface pressure limitation due to high pressure loss in tubing
- rate reduced further by maximum bottomhole pressure of 7000 kPa
- maximum BH pressure reached at approximately 12000 m3 cum injection
- no flood response apparent in producers

**Reasons for Major Differences Between Actual and Predicted Performance**

- Reservoir pressure at injector was estimated at 1800 kPa. Actual BH pressure in the injector was 236 kPa. Estimated time for flood response probably extended due to very low reservoir pressure.
- Emulsion viscosity was estimated at 8000 to 10000 cp at reservoir temperature of 15C. Viscosity of stable emulsion in laboratory and field conditions was approximately 20000 cp at 15C. The higher viscosity emulsion is more resistive to flow in the reservoir and introduces a high pressure drop in the near wellbore area.
- Lower than expected injection rates and higher than expected injection pressures extends response time.
- Progression of the flood was very slow due the low injection rates.

## **Learnings**

- Viscosity of emulsion was too high. Field and laboratory attempts to reduce the viscosity, while maintaining a stable emulsion, were unsuccessful.
- Pressure data from the 16-30 observation well indicated a possible response from injection.
- Response time on 200 meter interwell spacing is too long to support an economic project.
- High operating costs: emulsion mixing sensitive to various factors and required high levels of operator attention; oil and water trucking costs; corrosion problems due to the high pH of the water; HCl acid costs and safety concerns; cost of oil

## **Compliance Issues**

- CNRL was compliant with Regulatory Requirements through the pilot project. Approval 8988 has expired. No injection is ongoing. As per meeting with EUB Jan 21, 2005, the approval area will become part of Approval 9466 again.
- CNRL was compliant with Gas Conservation guidelines during the pilot
- CNRL Field Staff and Contractors respected Landowner/Occupant concerns

## **Future Plans**

- Assess area for restarting producers on primary drive.