Consumers’ Co-operative Refineries Limited

Project Proposal
for
Expansion Project -
Section V & Revamps

Regina, Saskatchewan

December 3, 2007
EXECUTIVE SUMMARY

The Co-operative Retailing System (CRS) has experienced substantial continuous growth and this trend is expected to continue. The CRS’s demand for finished fuel products is projected to surpass Consumers’ Co-operative Refineries Limited’s (CCRL’s) current refining capability by the year 2011. Additional refining capacity is required to address this demand. An expansion of the Refinery-Upgrader Complex by an initial nominal 30,000 barrels per day is being proposed to satisfy this growth. The Expansion Project – Section V & Revamps will be designed on the basis of a sweet synthetic crude feedstock. This will mitigate the environmental impact of the expanded Complex due to the low sulphur content of the feedstock.

The proposed Expansion Project – Section V & Revamps (the Expansion Project) will be located within CCRL property and will be integrated into the existing process units and tankage. There are significant advantages to expanding at the existing Refinery-Upgrader Complex, as opposed to constructing a separate stand-alone facility. The expansion will initially add 30% (with the potential of 40%) more processing capacity. Physically, it will add only 15% to 20% of new facilities to the existing infrastructure. An expansion of the existing facility will ensure safe, efficient, and reliable operations with our experienced, technical and competent personnel. This project will also make the best use of all existing infrastructure, safety and environmental systems.

The Expansion Project has been divided into two phases. Phase I work includes the front-end engineering design and cost estimates for Section V and Revamps. The Phase I work is nearing completion and includes the process definition appropriate for CCRL to meet future product demands and current environmental objectives. Phase I is scheduled for completion in the first quarter of 2008.

Phase II work will include the detailed engineering designs, procurement of equipment and construction of the new and revamped facilities. Phase II is scheduled for completion by the third quarter of 2011 and will include the start-up of the Expansion Project.

The Expansion Project is estimated to cost approximately $1.5 billion on a preliminary basis and will require about 5.9 million person-hours to complete. During the engineering and construction phase, local labour, food, accommodation and transportation sectors will benefit substantially. The Expansion Project will have a very significant positive impact on the economy of Regina and the Province of Saskatchewan.

Once operational, the expansion facilities will require approximately 100 additional permanent staff. This will increase tax revenue for the local and provincial economy, increase income tax revenue for the provincial and federal governments, and create significant spin-offs from the additional employment for the City of Regina’s service industry.

The environmental impact associated with the Expansion Project – Section V & Revamps is anticipated to be minimal.
Golder Associates Ltd. was retained to conduct a comprehensive Air Quality Study of the existing and expanded Complex. The Air Quality Study was developed through discussions with Saskatchewan Environment regarding the applicable air quality models and compounds.

The results of the air quality study indicate that there is the potential for minor reductions in air quality due to the Expansion Project; however, the modeled increase in emissions is expected to be small. Based on the air quality assessment results, Golder Associates Ltd. provided the following recommendations.

- For sources where additional conservatism was applied to the emission rates (e.g., waste water ponds), further monitoring should be conducted.
- During upset conditions (e.g., a sulphur train down), additional supplemental lift gas should be considered to allow for better mixed gas flaring and consequently reduced ground level concentrations of flared emissions.
- Additional ambient air quality monitoring of selected compounds (e.g., Hydrogen Sulphide, benzene and Particulate Matter) should be considered at some of the community receptors (e.g., spot measurements) and in the vicinity of the new Section V expansion area (e.g., continuous measurements) to provide additional confirmation of the modeling predictions and to allow for implementation of further emission management processes (if required).

As a result of this recent study, CCRL will work closely with Saskatchewan Environment to evaluate and implement additional measures to monitor air quality in the vicinity of the Complex.

- Overall, emissions per barrel of throughput will decrease with the increase of crude throughput and will remain below existing permitted operating limits. This means that overall environmental efficiency improves per unit of production.

- In conjunction with the Expansion Project, a separate capital project for wastewater system improvements is budgeted to be completed prior to the expansion and will result in a significant net decrease in groundwater consumption from 8,200 to 7,200 m$^3$/day and a major reduction in effluent discharged to the City of Regina from 4,700 to 1,700 m$^3$/day.

- The completion of work in 2007, to improve the Complex’s stormwater system, ensured that the Complex would contain a one in one hundred year precipitation event. Existing stormwater management systems were evaluated by Water Resources Consultants Ltd. and determined to be adequate to manage additional stormwater associated with the Expansion Project. The Complex will, therefore, still be able to contain a one in one hundred year precipitation event.

- Ground Engineering Ltd. was retained to conduct a geotechnical investigation for the proposed expansion process units and storage tank areas. CCRL will implement the
foundation and piling recommendations outlined in the reports after approval is received
from regulatory authorities.

- The Expansion Project will not impact groundwater quality. Implementation of the
  recommendations in the Ground Engineering Ltd reports will ensure the integrity of the new
  infrastructure and protection of the aquifers underlying the site. Approved engineering
  controls including tank liners and berms, concrete aprons and hydrocarbon drains will also be
  implemented to protect the aquifers beneath the Complex.

- CCRL will expand the existing groundwater monitoring program to include additional
  monitoring wells in the vicinity of the Expansion Project. CCRL will work cooperatively
  with all appropriate regulatory agencies to develop an acceptable monitoring network for the
  expanded Complex.

CCRL will maintain its current high standard of operation after the expansion and will remain in
full compliance with its existing Permit to Operate with Saskatchewan Environment. CCRL will
work with Saskatchewan Environment and the City of Regina to ensure that the Expansion
Project is constructed in accordance with all applicable development requirements.

In 1985, a very thorough and comprehensive Environmental Impact Statement (EIS) was
prepared for the environmental assessment of the NewGrade Energy Inc. Heavy Oil Upgrading
Project. The Heavy Oil Upgrading Project involved the construction and operation of new
facilities for heavy oil upgrading and modifications to the then existing older Co-op Refinery to
enable integration of the Upgrader. Therefore, the 1985 environmental impact assessment
addressed the net environmental impact of the then expanded Complex, including all facilities.
The 1985 EIS is a valid and relevant baseline.

In 1999, CCRL submitted a project proposal outlining plans to expand the Complex from the
previous 1985 EIS baseline. In 2000, approval was given from the Environmental Assessment
Branch to proceed with the Refinery Expansion Project. The approval was given based on the
opinion of the Environmental Assessment Review Panel that the project was not a
“development”. CCRL proceeded with construction, and start-up of the Refinery Expansion
Project occurred in August 2003.

In February 2003, CCRL received approval from the Environmental Assessment Branch to
amend its approval and recognized that the refinery capacity would be 100,000 barrels per
operating day. Approval was given on the basis that the planned de-bottlenecking to achieve
additional capacity was consistent with the initial expansion proposal.

We believe that this current expansion proposal should be considered again not as a
“development”, but as a required and very efficient step expansion of the existing Complex from
the 1985 EIS baseline, plus the 2000 approval of the last step expansion.

CCRL recognizes and acknowledges its responsibility to preserve and protect the environment as
stated in the following Federated Co-operatives Limited (FCL) objective. “To conduct company
activities in a manner that is sensitive to the environment and to ensure compliance with the law.”

This responsibility is also acknowledged in CCRL’s Core Principles. Specifically, Core Principle #3 is to “Ensure the management of environmental affairs and responsible stewardship is always at the highest level.” CCRL always endeavors to be environmentally responsible and proactively tries to do the right thing.

It is CCRL’s experienced opinion that the Expansion Project - Section V & Revamps;

- Will not effect any unique, rare, or endangered feature of the environment;
- Will not use any other provincial resources that would pre-empt the use, or potential use, of those resources for any other purpose;
- Will not cause the emission of any other pollutants or create by-products, residual, or waste products that are not regulated as per our current operating permit or other Acts or Regulations;
- Will not cause widespread public concerns as potential environmental changes are minimal;
- Will not involve any new technologies that may induce significant environmental change; and
- Will not have a significant impact and will not necessitate a further development that is likely to have a significant impact on the environment.

This expansion is being proposed on a site that has efficiently operated as a refinery for over 72 years. CCRL will utilize commercially proven technology and equipment in the proposed expansion that is equal or superior to the technology and equipment currently in operation. CCRL’s operational staff has a track record of performance excellence. Therefore, it is CCRL’s opinion that the Expansion Project should not be considered a “development” in accordance with The Environmental Assessment Act.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AP</td>
<td>Air Pollutants</td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>Approval to Construct and Operate</td>
<td>Approval to Construct, Install, Alter and Expand a Storage Facility and Store Hazardous Substances and/or Waste Dangerous Goods</td>
</tr>
<tr>
<td>bpd or bbls/day, BPOD</td>
<td>Barrels per day, Barrels per operating day</td>
</tr>
<tr>
<td>C3</td>
<td>Propane</td>
</tr>
<tr>
<td>C4</td>
<td>Butane</td>
</tr>
<tr>
<td>Cat.</td>
<td>Catalytic</td>
</tr>
<tr>
<td>Cat. Poly</td>
<td>Catalytic Polymerization</td>
</tr>
<tr>
<td>CEPA</td>
<td>The Canadian Environmental Protection Act</td>
</tr>
<tr>
<td>CCME</td>
<td>Canadian Council of Ministers of the Environment</td>
</tr>
<tr>
<td>CCRL</td>
<td>Consumers’ Co-operative Refineries Limited</td>
</tr>
<tr>
<td>CRS</td>
<td>Co-operative Retailing System</td>
</tr>
<tr>
<td>CWHP</td>
<td>Contaminated Water Holding Pond</td>
</tr>
<tr>
<td>dam^3</td>
<td>cubic deca (ten) metres</td>
</tr>
<tr>
<td>Demin.</td>
<td>Demineralization</td>
</tr>
<tr>
<td>DHU</td>
<td>Distillate Hydroprocessing Unit</td>
</tr>
<tr>
<td>DIP</td>
<td>De-Isopentanizer</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>ESP</td>
<td>East Stormwater Pond</td>
</tr>
<tr>
<td>°F</td>
<td>degrees Fahrenheit</td>
</tr>
<tr>
<td>FCC, FCCU</td>
<td>Fluid Catalytic Cracking Unit</td>
</tr>
<tr>
<td>FCL</td>
<td>Federated Co-operatives Limited</td>
</tr>
<tr>
<td>FHQTC</td>
<td>File Hills Qu’Appelle Tribal Council</td>
</tr>
<tr>
<td>Gas Con.</td>
<td>Gas Concentration</td>
</tr>
<tr>
<td>GDS</td>
<td>Gasoline Desulphurization</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gases</td>
</tr>
<tr>
<td>gpm, USgpm</td>
<td>United States gallons per minute</td>
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<tr>
<td>HDS</td>
<td>Hydrodesulphurization</td>
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<tr>
<td>H₂S</td>
<td>Hydrogen Sulphide</td>
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<tr>
<td>HCN</td>
<td>Heavy Catalytic Naphtha</td>
</tr>
<tr>
<td>HSWDG Rules</td>
<td>The Hazardous Substance and Waste Dangerous Goods Regulations</td>
</tr>
<tr>
<td>kg</td>
<td>kilograms</td>
</tr>
<tr>
<td>kV</td>
<td>kilo-Volts</td>
</tr>
<tr>
<td>lbs/hr</td>
<td>pounds per hour</td>
</tr>
<tr>
<td>LCN</td>
<td>Light Catalytic Naphtha</td>
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<tr>
<td>LCO</td>
<td>Light Cycle Oil</td>
</tr>
<tr>
<td>LNU</td>
<td>Light Naphtha Unifiner</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>m^3/d, m^3, m</td>
<td>cubic meters per day, cubic meters, meters</td>
</tr>
<tr>
<td>MBPD</td>
<td>Thousand Barrels per Day</td>
</tr>
<tr>
<td>MDU</td>
<td>Middle Distillate Unifiner</td>
</tr>
<tr>
<td>MMSCFD</td>
<td>Million standard cubic feet per day</td>
</tr>
<tr>
<td>MW</td>
<td>Mega (million) Watts</td>
</tr>
<tr>
<td>NEI</td>
<td>NewGrade Energy Inc.</td>
</tr>
<tr>
<td>NOx</td>
<td>Nitrous Oxide</td>
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<tr>
<td>Permit to Operate</td>
<td>Permit to Operate Heavy Oil Upgrader and Refinery Complex File: N6-2-3 CCRL/NEI</td>
</tr>
<tr>
<td>PM10</td>
<td>particulate matter with a mean diameter of less than 10 microns</td>
</tr>
<tr>
<td>psig</td>
<td>pounds per square inch gauge</td>
</tr>
<tr>
<td>PVC</td>
<td>Poly Vinyl Chloride</td>
</tr>
<tr>
<td>RFE</td>
<td>Request for Expenditure</td>
</tr>
<tr>
<td>scfd</td>
<td>Standard cubic feet per day</td>
</tr>
<tr>
<td>scfmm</td>
<td>Standard cubic feet per minute</td>
</tr>
<tr>
<td>SE</td>
<td>Saskatchewan Environment</td>
</tr>
<tr>
<td>SO₂</td>
<td>Sulphur Dioxide</td>
</tr>
<tr>
<td>TIP</td>
<td>Tank Integrity Program</td>
</tr>
<tr>
<td>UOP</td>
<td>Universal Oil Products</td>
</tr>
<tr>
<td>ULSD</td>
<td>Ultra Low Sulphur Diesel</td>
</tr>
<tr>
<td>wt %</td>
<td>Weight Percentage</td>
</tr>
<tr>
<td>Zoning Bylaw 9250</td>
<td>The City of Regina Zoning Bylaw No. 9250</td>
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BACKGROUND

Consumers’ Co-operative Refineries Limited (CCRL), the world’s first co-operatively owned refinery located in Regina, Saskatchewan, is a wholly owned subsidiary of Federated Co-operatives Limited (FCL) based in Saskatoon, Saskatchewan. Both FCL and CCRL exist to serve the Co-operative Retailing System (CRS). From a very modest beginning in 1934, with $32,000, the support of 10 retail Co-ops, a need, and a vision, CCRL has grown to what it is today - a modern 100,000 barrels per operating day (BPOD) Refinery-Upgrader Complex.

1.1 The Co-op Refinery-Upgrader Complex

CCRL manages and operates the totally integrated Refinery-Upgrader Complex that began processing heavy Saskatchewan crude in 1988. CCRL shared ownership of the NewGrade Energy Inc. (NEI) Upgrader with the Province of Saskatchewan until November 1, 2007 when CCRL purchased the Province’s NEI shares, making the NEI Upgrader a wholly owned subsidiary of CCRL.

The next major addition to the Complex after the Upgrader was the Refinery Expansion Project, which came on-line in 2003. This increased the total plant processing capability from 60,000 to 100,000 BPOD of crude oil. The high quality finished fuel products are marketed through the Co-operative Retailing System and high quality synthetic crude is marketed to other refiners.

The Refinery-Upgrader Complex provides a significant impact to the local and provincial economies. In 2006, the CCRL/NEI Refinery-Upgrader Complex purchased approximately $1.8 billion worth of crude oil feedstock and $155 million of natural gas for processing.

The Refinery-Upgrader Complex employs approximately 570 people on a full-time basis. Each spring during the Maintenance Turnaround period, approximately 900 additional people are employed directly or by contract. The Complex’s annual payroll is in excess of $51 million.

On an annual basis, the Refinery-Upgrader Complex pays over $3.2 million in property taxes and over $3.2 million in municipal surcharges on utilities to the City of Regina.

The Complex purchases approximately $2.2 million worth of supplies, over $34 million in maintenance goods and services, and over $25 million worth of catalyst and chemicals each year in support of the Refinery-Upgrader operation.

1.2 Environmental Considerations

As a major corporate citizen of Saskatchewan, CCRL recognizes and acknowledges its responsibility to preserve and protect the environment.
This is given credence in the Annual Business Plan of CCRL’s owner, Federated Co-operatives Limited (FCL) where the environmental activities of the organization are cited for public record in both the Mission and Objectives Statements:

Federated Co-operatives Limited
MISSION AND OBJECTIVES
As approved and adopted by the Board of Directors
June 1981
Revised March 2003

“THE MISSION of the Co-operative Retailing System is to improve the economic position of its member-owners by co-ordinating procurement, processing, manufacturing, distribution of goods and provision of services within a financially-sound, socially and environmentally responsible democratic structure.”

One of the objectives in the annual Business Plan for Federated Co-operatives Limited is “to conduct company activities in a manner that is sensitive to the environment and to ensure compliance with the law.” Since CCRL is a part of FCL, the same objectives are applicable to the management of environmental affairs for the entire Refinery-Upgrader Complex.

The following four core principles must be in place before the Refinery-Upgrader Complex will operate. These core principles are posted throughout the Complex.

**CCRL Core Principles**

The Management of Consumers’ Co-operative Refineries Limited is totally committed to four Core Principles that are always to take priority over production. These Core Principles, in order of priority, are to:

1. Ensure the safety of all personnel and the public at large.

2. Ensure that all equipment is of high integrity and is maintained and operated to mitigate safety risks.

3. Ensure that the management of environmental affairs and responsible stewardship is always at the highest level.

4. Ensure that quality products and services are provided by all CCRL work groups.
CCRL’s responsible management of environmental affairs is a very high priority guided by a comprehensive Permit to Operate and the 1995 Partnership Agreement with Saskatchewan Environment (SE), which outlines a long-term schedule of priorities of environmental activities to improve management practices and remediate the site condition of the Complex. CCRL endeavours to not only be compliant with the Permit to Operate and the Partnership Agreement but, moreover, to be evolving in a manner that provides ongoing enhancements to environmental practices and performance.

On October 21, 1998 SE acknowledged CCRL’s environmental performance in a letter of commendation stating “… The Company’s excellent and innovative approach in remediation and other environmental projects has been carried out in an environmentally sound and sustainable manner. The Company has shown their strong commitment to the protection of the environment…”

On December 9, 2004, SE acknowledged CCRL’s environmental performance in a second letter of commendation stating CCRL/NEI’s “strong corporate commitment in fulfilling their regulatory obligations and for achieving exemplary results under the partnership agreement…[The] agreement with CCRL/NEI was one of the first in the province and continues to be a model for other major industrial companies in Saskatchewan.”

In 1985, a very thorough and comprehensive Environmental Impact Statement (EIS) was prepared for environmental assessment of the NewGrade Energy Inc. Heavy Oil Upgrading Project. The Heavy Oil Upgrading Project involved the construction and operation of new facilities for heavy oil upgrading and modifications to the Co-op Refinery to enable integration of the Upgrader. No changes are required to the Heavy Oil Upgrader with this Expansion Project. Therefore, the 1985 environmental impact assessment addressed the net environmental impact of the then expanded Complex, including all facilities. The 1985 EIS is a valid and relevant baseline.

In this Project Proposal, reference is made to the 1985 EIS as it is a valid baseline for the current Refinery-Upgrader Complex and most aspects are applicable for an expanded Refinery-Upgrader operation.

In 1999 and 2000, CCRL submitted a project proposal and addendum reports outlining plans to expand the Complex from the previous 1985 EIS baseline to 80,000 barrels per day (bpd) capacity. On August 10, 2000, approval to proceed with the application pursuant to all other regulatory requirements was given after review from members of the Environmental Assessment Review Panel. The panel’s opinion was that the project was not a “development” as defined by The Environmental Assessment Act. CCRL proceeded with construction, completing all other regulatory requirements. The construction of the Refinery Expansion Project was completed in the summer of 2003 and start-up occurred in August 2003.
In February 2003, CCRL applied for and received approval from the Environmental Assessment Branch to amend its previous approval to update the refinery capacity to 100,000 bpd and add the new Gasoline Desulphurization (GDS) Unit to the Refinery Expansion Project approval. Approval was given by the Assessment Branch on the basis that the planned de-bottlenecking to achieve additional capacity and the addition of the GDS Unit was consistent with the initial expansion proposal.

1.3 Safety Considerations

CCRL has a well-established and comprehensive Emergency Response Manual (Plan). CCRL has trained personnel and equipment to respond immediately to any incident, whether minor or major. CCRL’s Process Operators provide initial “first response” and have the ability to activate the Emergency Response Plan in the event that assistance is required. Upon activation of this plan, the CCRL fifty-member Emergency Fire Crew, nine-member Technical Rescue Team and eight-member HazMat Team respond to the emergency and are accompanied by members of the Incident Command Centre. Outside emergency response services are called to back-up CCRL’s team, as required.

CCRL’s HazMat Team is responsible for all emergencies that involve hazardous material. The HazMat Team members are fully trained and certified as HazMat Technicians, and fully equipped to handle almost any emergency. This team is available on 24-hour call-out by activating the Paging System for the HazMat Team. In addition to responding to on-site emergencies, the HazMat Team can respond to off-site incidents involving:

1. **Co-operative Retailing System:**

   At the request of FCL or a Co-operative Retail, the HazMat Team may be requested to assist in an emergency situation. This could also include a Petroleum Distribution Department transportation incident.

2. **LPG Emergency Response Corporation:**

   CCRL has signed a contract to provide a certified Emergency Response Team trained to respond to emergencies involving liquefied petroleum gases (LPG). Basic coverage is provided for all of Saskatchewan with backup support to southern Alberta and Manitoba.

3. **City of Regina:**

   Upon request in a declared emergency, the HazMat Team could be activated to assist at an incident in Regina.
4. **Pipeline Emergencies:**

Membership in the Area 6 Emergency Response Co-operative (A co-operative emergency response group for pipeline companies in southern Saskatchewan) provides for members to request assistance from any member in a pipeline emergency until that company has sufficient manpower and equipment at the site.

The Emergency Response Plan was developed in conjunction with and incorporates all of the City of Regina’s emergency services. Cooperative action between CCRL and the community has long been recognized and is well established.

CCRL works hard to ensure that any incident such as a spill, leak, fire or explosion involving its facilities or operations is met with an immediate and comprehensive response to protect the public and the Complex’s personnel, property and the environment.

CCRL implemented an Environmental Emergency Plan based on requirements by the Environmental Emergency Regulations enacted under the Canadian Environmental Protection Act 1999 (CEPA). CCRL utilized existing programs and documented plans to comply with the regulations. These plans include the management of environmental emergencies, which incorporate standards, codes and guidelines related to prevention, preparedness, response and recovery. Exercises are held on an annual basis to test the plan in accordance with the Environmental Emergency Regulations.
1.4 Project Objective

The Co-operative Retailing System (CRS) has experienced substantial continuous growth and this trend is expected to continue. The CRS’s demand for finished fuel products is projected to surpass CCRL’s current refining capability by the year 2011. Additional refining capacity is required to address this demand. An expansion of the Refinery-Upgrader Complex by an initial nominal\(^1\) 30,000 barrels per day is being proposed to satisfy this growth. The Expansion Project – Section V & Revamps will be designed on the basis of a sweet synthetic crude feedstock. This will mitigate the environmental impact of the expanded Complex due to the low sulphur content of the feedstock.

Figure 2.1 provides an overview of the crude capacity for expanded the Refinery-Upgrader Complex.

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**Figure 2.1 - Crude Capacity for the Current and Expanded Complex**

Nominal\(^1\): The term “nominal” refining capacity refers to the minimum design rate for which a process licensor must guarantee performance when specifying a process unit. The current Complex, rated at a nominal 80,000 barrels per day is currently capable of processing as high as 100,000 barrels per day. A nominally rated refining facility has the potential to exceed the nominal barrels per day by approximately 20% through efficiency improvements, process debottlenecking, and the type of crude feedstock selected.
Table 2.1 provides a preliminary comparison of inputs and outputs for the current and expanded Refinery-Upgrader operation. These inputs and outputs are preliminary in nature and subject to change pending the final design. The Expansion Project will incorporate commercially proven petroleum refining technology comparable to the technology already used at the Refinery-Upgrader Complex.

Table 2.1 - Inputs and Outputs for the Current and Expanded Complex

<table>
<thead>
<tr>
<th></th>
<th>Current Complex</th>
<th>Expanded Complex at Nominal Rated Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INPUTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Oil (m³/day)</td>
<td>15,900</td>
<td>20,700</td>
</tr>
<tr>
<td>(bbls/day)</td>
<td>100,000</td>
<td>130,000</td>
</tr>
<tr>
<td>Electrical (MW)</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>Natural Gas (10⁶m³/day)</td>
<td>750</td>
<td>675</td>
</tr>
<tr>
<td>Fuel</td>
<td>1050</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Plant</td>
<td>1050</td>
<td></td>
</tr>
<tr>
<td>Water (m³/day)</td>
<td>600</td>
<td>100</td>
</tr>
<tr>
<td>City Supply</td>
<td>8,200</td>
<td>7,200</td>
</tr>
<tr>
<td>Well Supply</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Average Sulphur Content in Feedstock (wt.%)</td>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Total Sulphur Content in Feedstock (Tonnes/day)</td>
<td>447</td>
<td>452</td>
</tr>
<tr>
<td><strong>OUTPUTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finished Fuel Products (m³/day)</td>
<td>13,200</td>
<td>16,700</td>
</tr>
<tr>
<td>(bbls/day)</td>
<td>83,000</td>
<td>105,000</td>
</tr>
<tr>
<td>Synthetic Crude (m³/day)</td>
<td>2,700</td>
<td>4,000</td>
</tr>
<tr>
<td>(bbls/day)</td>
<td>17,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Wastewater (m³/day)</td>
<td>4,700</td>
<td>1,700</td>
</tr>
<tr>
<td>To City Sewer System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphur Recovered (Tonnes/day)</td>
<td>429</td>
<td>434</td>
</tr>
<tr>
<td>Sulphur Emitted to Atmosphere (Tonnes/day)</td>
<td>4.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Hydrocarbon Contaminated Sludges (m³/day)</td>
<td>9.3</td>
<td>9.3</td>
</tr>
</tbody>
</table>

These inputs and outputs of the current and expanded Complex will be described in more detail in Sections 5.0 and 6.0 of this report.
1.5 Site Selection

To meet the CRS’s demand for finished fuel products, CCRL is the proponent of an expansion of an initial nominal 30,000 barrels per operating day of refining capacity to the existing Refinery-Upgrader Complex located in Regina, Saskatchewan. The expansion of the Refinery-Upgrader Complex will minimize effects on the environment because the existing site already has experienced technical staff (safety, operations, maintenance, environment, engineering, etc.), Environment Stewardship systems (environmental monitoring, emergency response, environmental response, etc.), and most of the necessary infrastructure (roads, water, sewer system, etc.) to ensure continued safe, efficient, and reliable operations.

The Refinery-Upgrader Complex is located in the northeast corner of Regina between Winnipeg Street and McDonald Street, north of 9th Avenue North. Figure 2.2 illustrates the general location of the Refinery-Upgrader Complex relative to the City of Regina.

Figure 2.2 - Co-op Refinery-Upgrader Complex Relative to the City of Regina
An expansion to the existing Refinery-Upgrader Complex infrastructure, as compared to the construction and operation of a stand-alone facility, will have the following significant advantages.

- Experienced, well-trained, safety, operating, maintenance, environmental, and engineering personnel are immediately available to ensure the continued safe, efficient, and reliable operation.

- The site already has the environmental monitoring capabilities and an established baseline for this type of industrial activity.

- Estimated initial investment costs and environmental impacts are significantly lower when compared to construction of a similarly rated stand-alone refinery at another site.

- Ongoing operational costs and environmental effects are substantially reduced as a result of increased efficiencies through use of existing facilities.

- Existing crude supply pipeline facilities will provide feedstock for the expansion.

- Products from the expansion will be moved to market by existing transportation systems.

The planned location of the Expansion Project Section V’s new processing units is adjacent to the 2003 Refinery Expansion units on the east side of the property. The expansion will add 30% (with the potential of 40%) more processing capacity, while physically, it will add only 15 to 20% of new facilities to the existing infrastructure. Approximately 41 acres of additional land was purchased from the City of Regina. This land is adjacent to the existing east property line. The Expansion Project’s new units, tankage, and associated facilities will be located within the new property boundary of the Refinery-Upgrader Complex (Figure 2.3).
1.6 Expansion Project Economic Benefits

Petroleum refining is a value-added manufacturing process. Any new or additional value-added manufacturing performed in Regina will have a net positive impact on the local and provincial economy. The City of Regina will realize an increase in its tax base from industrial development as a result of the Expansion Project’s construction and operation. The additional staff required for construction and operation of the Expansion Project and supporting industries will positively affect the City’s tax base. During the construction phase, there will be a major increase in cash flow throughout the city. This is a direct result of local procurement for the project and spending by its large construction workforce.
PROJECT SCHEDULE AND DETAILS

1.7 Processing Technology Evaluation

CCRL commenced studies in 2005 directed toward economic feasibility, process selection, preliminary design, environmental management, procurement planning, and the socio-economic effect of the Expansion Project. One of the criteria for the project was to evaluate only commercially proven “state of the art” technologies, which will best meet CCRL’s future product demands and current environmental objectives well into the future. Commercially proven “state of the art” technologies means all processes considered for the Expansion Project will be low (acceptable) risk and will be commercially proven to be safe, reliable, and environmentally responsible.

CCRL selected proven technologies identical to the existing process facilities that are currently in operation at CCRL. All new process units specified for the expansion project are licensed by Universal Oil Products. Modifications to existing process units (Revamp units) are also required to accommodate the product streams from the new units.

1.8 Phase I

On October 25, 2006 the Board of Directors of Consumers’ Co-operative Refineries Limited (CCRL) approved the Request for Expenditures (RFEs) to proceed with Phase I, the Front End Engineering Design of the Expansion Project – Section V & Revamps. Phase I work is scheduled for completion in the first quarter of 2008 and will include the following.

- Technology licensors selection for the new process units.
- Feedstock for the new process units will be confirmed.
- Process configuration will be optimized for integration into the existing Complex.
- Modifications to the existing Complex will be fully scoped to support the process streams from the new facilities.
- The project proposal will be submitted for environmental review.
- Appropriate discussions will be conducted with federal, provincial, and municipal agencies.
- The project cost estimates will be developed and RFEs will be submitted to the CCRL Board of Directors for approval.
1.9 Phase II

Phase II work will proceed subject to CCRL Board of Directors approval. Phase II work is scheduled for completion by the third quarter of 2011 and will include the following.

- Detailed multi-discipline engineering to design the new process units and revamp existing process units as necessary.
- Procurement of major equipment and materials.
- Construction of the new facilities.
- Construction of the revamp facilities.

1.10 Engineering and Construction

The engineering and construction Phase II of the Expansion Project is scheduled to begin in 2008 and is expected to require 36 to 42 months to complete. Detailed engineering of the expansion project will be contracted to competent and experienced engineering and construction firms.

A large majority of the construction work will be performed utilizing the available local labour market.

The following are key dates for the Expansion Project:

- October 2006 Received CCRL Board of Directors approval to proceed on Phase I work.
- December 2007 Submit Project Proposal to SE.
- January 2008 Complete Phase I work on new process units to include project specifications, detailed cost estimates, and feasibility study.
- February 2008 Initiate Phase II engineering and construction for new process units.
- April 2008 Complete Phase I work on revamping existing process units to include project specifications, detailed cost estimates, and feasibility study.
- May 2008 Start Phase II engineering and construction for revamp units.
- June 2008 Start site preparation.
- October 2008 Install piling and foundations.
- August 2009 Start installing major equipment.
- January 2010 Start installing piping and electrical equipment.
- March 2010 Start construction of storage tanks.
- January 2011 Initiate commissioning and equipment checkouts.
- March 2011 Complete mechanical and electrical construction.
- Third Quarter 2011 Start-up of expansion facilities.

1.11 Commissioning, Operation, and Maintenance

Final tie-ins of new equipment to the existing equipment will be completed during the 2011 Major Maintenance Turnaround.

CCRL operations personnel will undergo intensive training for several months prior to the start-up of the expansion units. The trained personnel will conduct commissioning, start-up, and operation of the Expansion Project facilities in 2011.

Operational maintenance and regular major maintenance turnarounds of the expansion facilities will be completed by CCRL Maintenance personnel and will be integrated into the Complex’s existing inspection, maintenance and turnaround programs.
PROJECT FACILITIES

1.12 New Processing Units

The Expansion Project will include the addition of the following crude oil processing facilities.

- A new 30,000 barrels per operating day (BPOD) Synthetic Crude Pre-Fractionator
- A new 22,000 BPOD Fluid Catalytic Cracking (FCC) Unit
- A new Gas Concentration (Gas Con.) Unit
- Two new Extractive Merox Process Units
- A new Catalytic Polymerization (Cat. Poly) Unit

A block diagram of the new process units for the expansion project is shown in Figure 4.1.

![Figure 4.1 - New Process Units for the Expansion Project](image)

1.12.1 Synthetic Crude Pre-Fractionator

Crude fractionation is the primary petroleum refining process in refinery operations. The new Pre-Fractionator Column will perform a function
similar to existing Crude fractionation units in the Refinery-Upgrader Complex.

The additional 30,000 barrels per day of sweet synthetic crude oil feed will be taken from refinery tankage and heated before being processed by the new Pre-Fractionator Column. The crude oil will undergo separation into overhead naphtha \((C_3 \text{ to } 380^\circ F \text{ endpoint})\), distillate side product \((380^\circ F \text{ to } 550^\circ F)\) and gas oil bottoms \((550^\circ F \text{ to } 1,000^\circ F)\). Each of these streams will undergo further processing in downstream units to remove sulphur compounds and meet finished product quality requirements. The overhead naphtha and distillate streams will be processed through existing hydrotreating units that will be revamped to accommodate these streams. The gas oil stream from the Pre-Fractionator will be processed through the new Fluid Catalytic Cracking Unit (FCCU) #2.

The Pre-Fractionator Unit will be designed to optimize heat/energy recovery with due consideration for stable operations along with upset and emergency conditions. The Pre-Fractionator Charge Heater will be fired with fuel gas that normally consists of a combination of sweet natural gas and amine treated refinery fuel gas. The fuel gas system design will also include provisions to enrich the fuel gas with butane product.

Approximately 96% of the sulphur compounds in the synthetic crude will be converted and captured in the Refinery-Upgrader Complex and then recovered as molten sulphur product. The incremental sulphur production will be approximately 5 tonnes per day. This is within the capacity of the existing Sulphur Plant, however, a revamp of the Sulphur Plant is under consideration to enhance performance and reliability.

1.12.2 Fluid Catalytic Cracking Unit (FCCU) #2

The new FCCU #2 will process gas oil from the new Pre-fractionator, along with gas oil produced from the existing Hydrodesulphurization (HDS) Unit. The FCCU #2 will have a design operating capacity of 22,000 BPOD. The function of the FCCU #2 is to convert gas oil to lighter hydrocarbon products using a process called catalytic cracking, whereby large gas oil molecules are converted to smaller molecules with the aid of catalyst and heat. The production focus for the FCCU #2 is to maximize production of gasoline and distillate for further processing into finished product.

The name, Fluid Catalytic Cracking, comes from the use of fluidized beds of a fine powdered catalyst, which, when aerated, will behave like a liquid. The catalyst can be moved through pipes, and at higher gas velocities, picked up and carried with the gas. This ease of movement is important because a heavy carbonaceous material, coke, is deposited on the catalyst during the cracking reactions, rendering it inactive. Fluidization allows the
catalyst to be moved from the reactor to the catalyst regenerator, where the coke contamination is removed through combustion. The heat generated by the combustion raises the temperature of the catalyst to provide the heat required for the cracking process.

The cracking process occurs when gas oils are contacted with a hot catalyst in the FCCU reaction section. The gas oil molecules are instantly vaporized and cracked. The converted hydrocarbon vapours flow from the FCCU reaction section and are condensed and separated in the FCCU main fractionation column. The fractionator’s overhead vapours contain the lightest hydrocarbon molecules boiling at less than 300°F. This stream is partially condensed to liquid and is directed to the Gas Concentration Unit for further separation.

Heavier compounds, Heavy Cat. Naphtha (HCN) and Light Cycle Oil (LCO), are withdrawn from the side of the main fractionator. These streams will require further processing to meet product specifications. The HCN product will be processed through the existing Gasoline Desulphurization (GDS) Unit and the LCO will be processed through the existing Distillate Hydroprocessing Unit (DHU).

The heaviest compounds form a bottoms product from the main fractionator, called slurry oil. This is a by-product that is sold as fuel oil.

All sour water streams from the crude pre-fractionator, FCCU #2, Gas Con #2 and Poly #2 will be collected in a closed system and routed to the sour water stripping section for H₂S and Ammonia removal.

1.12.3 Gas Concentration (Gas Con.) Unit #2

The Gas Concentration Unit #2 processes light hydrocarbon liquids and vapours from the FCCU #2 main column. The unit is designed to concentrate and separate the following streams:


2. Liquefied Propane and Butane (LPG) for feedstock to the new Catalytic Polymerization Unit #2.

3. Light Cat. Naphtha (LCN) product for feed to the new LCN Extractive Merox Unit.

Product separation is achieved through a series of contactors and fractionators operating at approximately 200 pounds per square inch gauge (psig).
Gas and LPG product streams containing H\(_2\)S will be processed through new amine contactors.

1.12.4 Extractive Merox Process Units

The Extractive Merox process utilizes a contactor, containing a caustic solution, to extract mercaptan sulphur compounds from a hydrocarbon stream. The process also includes a caustic regeneration system that reactivates the caustic solution and forms a disulfide oil byproduct that can be processed through existing hydroprocessing units to remove the sulphur.

The following two Extractive Merox Units are incorporated in the project:

**LPG Extractive Merox:**

For treatment to remove H\(_2\)S and mercaptan compounds in the Propane and Butane product from the Gas Con. Unit #2. This process is required to condition the feedstock to the Cat. Poly Unit #2 to achieve the required sulphur specification in the poly gasoline product, which is utilized for low sulphur for gasoline blending.

**LCN Extractive Merox:**

For treatment to remove mercaptan compounds in the LCN product from Gas Con. Unit #2 to produce a low sulphur product stream for gasoline blending.

1.12.5 Catalytic Polymerization (Cat. Poly) Unit #2.

The new Cat. Poly Unit #2 processes the combined Propane (C\(_3\)) and Butane (C\(_4\)) product from the LPG Extractive Merox Unit. The function of this process is to convert the C\(_3\) and C\(_4\) compounds to gasoline product. This is achieved by passing the heated feedstock through a reactor containing a solid catalyst. The catalyst acts upon olefinic compounds in the feedstock, causing them to polymerize to heavier products.

The Cat. Poly Unit #2 consists of a reaction section (two reactors operating in parallel) and a product separation section. Product separation is achieved using a series of fractionators. The unit will produce three product streams that include Propane, Butane, and Poly gasoline, which is a gasoline-blending component.

1.13 Existing Unit Revamp Projects

The expansion project units will increase the production of gasoline and diesel intermediates and light end by-products. Identified revamp units are currently
utilized to improve the quality of intermediate products by removing contaminants or upgrading the quality of the intermediate products to finished products. The following unit revamps will debottleneck exiting units enabling them to process the increased volumes of intermediate feeds from the new expansion units and ensure the continued blending of high quality finished fuel that complies with federal quality regulations. A Process Flow Diagram illustrating the existing Refinery-Upgrader Complex is shown in Figure 4.2.
1.13.1 Platformer Unit

The current Platformer Unit was designed for a feed rate of 14,000 BPOD. The unit will be revamped to operate at a lower pressure. This revamp will increase the yield of high-octane gasoline blending component and hydrogen produced. The new design will not result in higher throughputs.

The Platformer Unit utilizes Universal Oil Products (UOP) licensed process that converts low octane heavy naphtha into high-octane motor fuel. The process utilizes catalyst and a hydrogen-rich gas stream to promote dehydrogenation of naphthenes to aromatics to elevate the road octane number of the product. A byproduct of the reactions is hydrogen, which is recovered and purified to supplement the overall hydrogen production in the Complex.

1.13.2 Light Naphtha Unifiner (LNU) and Penex Units

The current LNU and Penex Units process 4,400 BPOD of light naphtha coming from the bottoms of an upstream De-Isopentanizer (DIP) column. The product from the LNU feeds the existing downstream Penex Unit. Both units will be revamped to increase the feed rate from 4,400 to 6,000 BPOD.

The LNU Unit is a UOP licensed process that utilizes catalyst and a hydrogen-rich gas stream to remove sulphur, oxygen and nitrogen contaminants from the light naphtha. The process also removes organo-metallic compounds, and saturates olefinic compounds. The main function of the process is to lower the sulphur and nitrogen levels in the light naphtha which is required for two reasons. First sulphur and nitrogen compounds are poisons for the downstream Penex catalyst and second the lower sulphur product is required in order to be a viable blending component for finished gasoline.

The Penex Unit is a UOP licensed process that utilizes catalyst and a hydrogen-rich gas stream to promote isomerization of the treated light naphtha to increase the road octane number. The resulting higher-octane product is then used as a gasoline-blending component. A secondary function of the process is to saturate aromatic molecules, like benzene, to reduce the level of aromatics in the product.

1.13.3 Middle Distillate Unifiner (MDU) Unit

The current MDU processes 8,500 BPOD of straight run distillate product from Crude Unit #1. The unit will be revamped to increase the feed rate
from 8,500 to 12,000 BPOD mixture of a 50/50 blend of straight run distillate from Crude Unit #1 and distillate from the synthetic crude. The product streams from the unit will become a blending component in our ultra low sulphur diesel (ULSD) pool.

The MDU Unit is a UOP licensed process that utilizes catalyst and a hydrogen-rich gas stream to remove sulphur, oxygen and nitrogen contaminants from the feed. The process also removes organo-metallic compounds, and saturates olefinic compounds. The MDU typically processes straight run distillate material with a boiling range of 380 – 580 °F.

1.13.4 Distillate Hydroprocessing Unit (DHU)

The current DHU processes 18,000 BPOD. The unit feedstock is comprised of a variety of hydrocarbon streams including, naphtha, distillates, diesels, and gas oils. The unit will be revamped to process 22,000 BPOD of the same feedstocks.

The DHU is a UOP licensed process that combines hydroteating catalyst, hydrocracking catalyst and a hydrogen-rich gas stream to remove sulphur, oxygen nitrogen and organo-metallic compounds, saturate olefins and aromatics and crack larger gas oil molecules to the smaller naphtha and distillate molecules.

The distillate and diesel product streams from the unit become blending components for ULSD diesel. The naphtha and LPG product streams from the unit are further processed in existing process units for purification and quality upgrading to finished product.

1.13.5 Gasoline Desulphurization (GDS) Unit

The current GDS Unit processes 17,000 BPOD of FCCU gasoline. The unit will be revamped to process 22,000 BPOD comprised of the current feedstock and the heavy cat naphtha product produced by the FCCU #2.

The GDS Unit is an Axens licensed process that utilizes catalyst and a hydrogen-rich gas stream to remove sulphur compounds. The purpose of the GDS is to achieve deep hydrodesulphurization of the feedstock making it acceptable as a blending component for the finished low sulphur gasoline product.

1.13.6 Saturated Gas (Sat Gas) Unit

The current Sat Gas Unit processes 6.95 million standard cubic feed per day (MMSCFD) of various refinery light gas streams and 19,264 BPOD of various light refinery liquid streams. The unit will be revamped to process
9.86 MMSCFD of light gases and 21,500 BPOD of light liquids. A unit revamp is required to process the expected increased flows from the other revamped units.

The main purpose of the Sat Gas Unit is to recover propane, butane and naphtha from the waste light gas and light liquid streams from the refinery processes. Any remaining gases are sent through a fuel recovery system to remove H₂S and then are used to supplement the refinery fuel system.

1.14 Additional Tankage

CCRL uses storage tanks throughout the Complex to store many types of petroleum feedstock, partially processed petroleum, chemicals, and petroleum products. A program is in place at CCRL to document compliance with good operating practices and requirements identified by Provincial Regulations and CCRL’s Permit to Operate. CCRL utilizes industry standard practices for a risk based inspection and maintenance program of the Complex’s storage tanks. The program was improved in January 2006, with the creation of CCRL’s Tank Integrity Program (TIP) manual. The TIP outlines the standards and procedures that are employed by CCRL to manage the TIP for aboveground storage tanks. CCRL’s TIP includes requirements and standards for aboveground storage tanks identified in the Government of Saskatchewan’s Hazardous Substances and Waste Dangerous Goods Regulations (HSWDG Regulations). These requirements include the design and construction of new storage tanks and inspection, maintenance, and repair of existing storage tanks.

All provincial and municipal approvals are obtained prior to construction of new storage tanks. An application for “Approval to Construct, Install, Alter and Expand a Storage Facility and Store Hazardous Substances and/or Waste Dangerous Goods” (Approval to Construct and Operate) required by the HSWDG Regulations is submitted to Saskatchewan Environment, and a “Discretionary Use Application” is submitted to the City of Regina as required by the City of Regina Zoning Bylaw No. 9250.

Atmospheric storage tanks installed at CCRL are designed, fabricated, erected, inspected and tested to meet, as a minimum, the requirements of American Petroleum Institute (API) standard 650 Welded Steel Tanks for Oil Storage and CCRL’s internal engineering requirements specified in CCRL SP-10-01 Specification for Atmospheric Storage Tanks.

All tanks are installed with engineered compacted clay liners and berms for secondary containment. The tank liners and berms are constructed to the requirements specified in CCRL SP-110-01 Specification for Earthwork. Relevant specifications presented in SP-110-01 include the following.

“Section 7.2 Liner Materials: The liner material shall be either Geosynthentic Systems or approved clay liner. The Geosynthetic Systems
shall be Bentomat ST as manufactured by Nilex or approved equal. The clay liner material selection, thickness and construction method shall be determined by an independent testing laboratory approved by CCRL.

Section 10.7: Tank Lot and Containment Berms: The tank lot and containment berms shall be provided with a 20 inch thick soil liner to protect against offsite movement or spillage.

The construction shall conform to the following:

a. Excavate and waste all vegetation, organic soils, fills and other deleterious materials within the proposed tank lot area and to at least 6 feet beyond the edges of the berms.

b. The soil liner shall be extended to comply with one of the following options:
   - Either to the top of the interior face of the berms, or
   - To the underside center line of the berm.

c. Place a sand or gravel layer to protect the liner from desiccation as shown on the drawings.

d. The berm shall be at 2 – horizontal to 1 – vertical side slopes with 6 feet minimum width at the top except where specified otherwise.

The soil liner and berms shall be constructed of select, low permeable clay soil (e.g. native soil). The material shall be placed in thin lifts (6 inches maximum) and then uniformly compacted to a minimum of 97 percent standard proctor maximum dry density with the placement moisture content between 0-2 percent wet of optimum moisture content.”

In 1998, Ground Engineering Ltd. (GE) was consulted to review CCRL’s tank pad and berm design and to determine if the design met applicable guidelines. A sample was taken of the native Regina Clay that would be used in the construction of the clay liner beneath storage tanks. The applicable SE guideline at the time of the report for aboveground tankage design Interim Guidelines for the Design and Construction of Containment Dikes Section 8 stated that “The ground area enclosed by the berm shall be compacted bentonite modified clay having a permeability rate to water equal to or less than $1 \times 10^{-7}$ cm/s and a thickness of 0.5 meters.” Laboratory test results of the native Regina Clay indicated the hydraulic conductivity of the clay sample was $4.0 \times 10^{-9}$ cm/s. The GE report states “the clay available on site has a hydraulic conductivity of $4.0 \times 10^{-9}$ cm/s which is equivalent to the majority of soil-bentonite liners.” The report concluded, “CCRL design meets or exceeds the SERM guidelines.” The GE report and its conclusions are still valid for the construction of all tank liners at the Complex.
The berm areas will be constructed to contain the “volumetric capacity of not less than 110% of the capacity of the tank” as specified in CCME guideline *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.* In the event of a spill, fire-fighting capabilities are available to avoid the potential of a fire occurring. Spilled product will be recovered and appropriately handled for re-use.

A cathodic protection system is utilized for protection from under-floor corrosion of all tanks at the Complex. New tanks are added to the existing cathodic protection system when constructed.

All hydrocarbon transfer lines for the expansion will be located above ground with the exception of the crude delivery line. This transfer line is discussed in more detail in Section 5.5 of this report. The crude delivery line will be located below ground adjacent to an existing crude transfer line and will be equipped with an appropriate leak detection system.

The additional tankage required to meet the needs of the expanded Complex will include:

- One 250,000 barrel Synthetic Crude Oil storage tank (This tank is being constructed in the expansion area to meet current storage needs of the Complex and is not part of the Expansion Project.)
- Two 150,000 barrel Synthetic Crude Oil storage tanks
- One 60,000 barrel Pre-Fractionator Distillate storage tank
- Two 60,000 barrel Light Cat Naphtha storage tanks
- One 80,000 barrel Light Cycle Oil storage tank
- One 20,000 barrel Cat Feed storage tank
- One 20,000 barrel Cat Slurry storage tank
- One 4,000 barrel Cat Slurry storage tank
- Three 2,000 barrel Butane storage vessels
- One 10,000 barrel Butane storage sphere
- Two 1,000 barrel Propane storage vessels

The tankage will be located in the proposed expansion areas identified on Figure 2.2 with the exception of the 20,000 barrel Cat Slurry storage tank, which will be located adjacent to the existing Cat Slurry tanks, and the Propane and Butane storage vessels, which will be located in the existing liquefied petroleum gas storage area.

CCRL will install four surface monitoring wells around the perimeter of each tank and additional monitoring wells will be installed into the Condie Aquifer, for monitoring purposes.
### 1.15 Additional Utilities

Additional utilities are required to facilitate the operation of the new process units. The utilities will be constructed in accordance with all the regulatory requirements applicable to CCRL. These requirements may include an application for *Approval to Construct and Operate*, required by the **HSWDG Regulations**, and a *Discretionary Use Application*, as required by **Zoning Bylaw No. 9250**. The additional utilities are described in detail below.

#### 1.15.1 Firewater System

A firewater system is required to supply the new process units with fire fighting capabilities. A new firewater pond and pump system will be located in the northeast area of the refinery adjacent to the new Section V process facilities and tankage. The pond will be designed for 6,000,000 gallons and will have one 3,000 gallons per minute (gpm) pump to deliver the firewater. CCRL evaluates and utilizes all sources of Complex water to meet the operational requirements of the fire water system; this includes utilizing stormwater and process water to maintain firewater pond levels.

#### 1.15.2 Flare System

The new flare system will be utilized to control discharges of vapours and liquids from pressure relieving devices and blow downs from the Expansion process units during start-up, shutdown, or emergencies. The flare system will consist of a gathering system for all discharges, a knockout drum to separate vapours and liquids, and a flare to ensure the complete combustion of all vapours. The liquids will be diverted to the existing Refinery-Upgrader slop system for reprocessing.

The estimated maximum gas flow rate of the flare is 400,000 lbs/hr with a stack height of 76 meters. Smokeless flaring will be achieved with the use of steam. The flare system will operate primarily to handle emergencies. Flaring may occur for short durations during start-up and shutdown of the facilities.

#### 1.15.3 Cooling Tower

A dedicated, double cell cooling tower will be provided to support the cooling water needs of the Expansion Project. The design cooling water circulation rate is 5,500 gpm and the cooling water supply temperature will be 85°F with a return temperature of 120°F. The anticipated overall dimensions of the cooling tower are 23 ft (wide), 49 ft (long), and 22 ft (high).
1.15.4 Main Electrical Substation

A new 138 kilovolt (kV) substation will be added on the southwest corner of the proposed expansion site, to support the new Section V process equipment. The proposed substation will be configured with an incoming termination structure for termination of the utility 138 kV service conductors and shield wire(s), provided with an isolating disconnect switch, load side ground switch, and lightning arresters. The switch will connect via rigid bus to SaskPower metering (3 voltage transformers and 3 current transformers in accordance with SaskPower requirements).

A grounded chain link fence will surround the substation yard with sufficient clearances to contained equipment. From this point, a transfer bus will supply two 35 mega volt-amp (MVA) 138 to 13.8 kV transformer circuits, each with a primary circuit breaker and separate isolating disconnect switches. Each transformer will be bus duct connected to 13.8 kV secondary switchgear within a switchgear building. The 13.8 kV secondary voltage will supply 3 smaller substations located adjacent to the processing units. The substation transformers are sized for the large motor starting requirements as well as providing full capacity redundancy and future load growth capability.

1.15.5 Boiler #11

New Boiler #11 will supply the additional steam requirements for Section V. This boiler will be designed for 150,000-lbs/hr steam generation capacity at 600 psig and will be connected into the existing steam system to allow for 600 psig steam production to existing units. The boiler will utilize best available technology including a low NOx burner and flue gas recirculation technology.

1.15.6 Oily Water Collection System

A closed drain hydrocarbon collection system will be utilized in the expansion process units. This collection system will require a manual connection for draining of hydrocarbon material from the process equipment. Hydrocarbon collected in this system will be re-processed as slop oil. This system will effectively minimize any hydrocarbon in the wastewater system from the expansion process units.

1.15.7 Plant and Instrument Air Systems

A new plant and instrument air system will be required for the Section V process units. This system will be connected into the existing air systems to provide backup capability to the existing Refinery-Upgrader Complex. Plant and instrument air requirements for Section V are approximately 1,800 standard cubic feet per minute (scfm). This system will consist of
two 2,500-scfm air compressors, one compressor will be on standby while the other is in operation. Two 2,500 scfm drier skids will also be installed for removal of moisture from the plant and instrument air.

1.15.8 Demineralization (Demin.) Plant

A new stand alone 500 gpm Demineralization Plant is required to supply water to the expanded facility. The new Demin. Plant will be located north of the existing Demin. Plant and will contain similar equipment to the existing plant. The new Demin. Plant will require an acid storage tank and a caustic storage tank.
ANCILLARY REQUIREMENTS

1.16 Electrical

Currently, the Refinery-Upgrader Complex uses approximately 50 megawatts (MW) of electrical power. The proposed nominal expansion will increase electrical energy consumption to approximately 70 MW. This additional power will be supplied by the Saskatchewan Power Corporation through a new 138 kV feeder line.

1.17 Natural Gas

The Refinery-Upgrader Complex currently uses approximately 1,800,000 m$^3$ of natural gas per operating day as feedstock for hydrogen generation and to supplement fuel requirements. The proposed nominal expansion is a net fuel gas producer; therefore, Complex natural gas feedstock requirements will be reduced to 1,725,000 m$^3$/day. However, an additional natural gas pipeline operated by Trans Gas Limited will be required to supply natural gas to the new section for heater pilots and flare purges.

1.18 Supply Water

Currently, the Refinery-Upgrader Complex uses an annual average of 600 m$^3$/day of potable water from the City of Regina, 500 m$^3$/day for process and 100 m$^3$/day for domestic use. Current Complex well water usage is 8,200 m$^3$/day; therefore, total process water requirements are 8,700 m$^3$/day. Although the proposed nominal expansion requires an additional 2,500 m$^3$/day of process water, a capital project is budgeted to be completed prior to the Expansion Project that will re-use existing wastewater, providing approximately 4,000 m$^3$/day of re-usable process water. This will decrease the Complex water usage to 7,200 m$^3$/day.

1.19 Wastewater

Approximately 4,700 m$^3$/day of effluent wastewater is currently being discharged to the City of Regina for additional treatment. The proposed nominal expansion is expected to produce 1,000 m$^3$/day of effluent wastewater, although as stated above, 4,000 m$^3$/day will be treated and re-used. The effluent wastewater discharged to the City of Regina will be reduced to approximately 1,700 m$^3$/day after the proposed expansion. The Effluent Discharge Agreement signed November 10, 1988 with the City of Regina allows for discharge of up to 6,900 m$^3$/day.

1.20 Crude Oil Supply

The current Refinery-Upgrader Complex receives crude oil deliveries via a pipeline from Enbridge Pipelines Inc. The Expansion will require a separate crude pipeline for delivery of low sulphur crude oil. The new pipeline will follow
the same route through the Complex as the existing crude oil pipeline and will be constructed with an appropriate leak detection system. This system will detect hydrocarbon leaks from buried flanges on the pipeline and alarm when hydrocarbon is detected. This leak detection system will be designed in accordance with Canadian Council of Ministers of the Environment (CCME) guideline *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.*
ECOLOGICAL OVERVIEW

1.21 Air Quality

The Expansion Project includes additional infrastructure that will have an impact on air quality. Additional emission sources associated with the Expansion Project include process heaters, a new FCCU stack, a new boiler and a new flare stack. Golder Associates Ltd. was retained to conduct a comprehensive air quality study. This study was performed to assess the impact of the expansion project on the existing air quality in the vicinity of the Refinery-Upgrader Complex. A detailed evaluation of air quality issues related to CCRL’s current operation and the proposed expansion project was completed. A copy of the Golder Associates Ltd. report *Air Quality Assessment of the Refinery – Upgrader Complex Expansion Project Section V and Revamps* is included as Appendix A.

The results of the air quality study indicate that there is the potential for minor reductions in air quality due to the Expansion Project; however, the modeled increase in emissions is expected to be small.

Based on the air quality assessment results, Golder Associates Ltd. provided the following recommendations. (Page 134, Golder Associates Ltd – Appendix A)

- For sources where additional conservatism was applied to the emission rates (e.g., waste water ponds), further monitoring should be conducted.

- During upset conditions (e.g., a sulphur train down), additional supplemental lift gas should be considered to allow for better mixed gas flaring and consequently reduced ground level concentrations of flared emissions.

- Additional ambient air quality monitoring of selected compounds (e.g., H2S, benzene and PM<sub>10</sub>) should be considered at some of the community receptors (e.g., spot measurements) and in the vicinity of the new Section V expansion area (e.g., continuous measurements) to provide additional confirmation of the modelling predictions and to allow for implementation of further emission management processes (if required).

CCRL will work closely with Saskatchewan Environment to evaluate and implement additional measures to monitor air quality in the vicinity of the Complex.

Although the Air Quality Assessment indicated a small reduction in air quality due to the Expansion Project, air emissions will remain below existing permitted operating limits. Overall, emissions per barrel of throughput will decrease with the increase of crude throughput and will remain below existing permitted operating limits. This means that overall environmental efficiency improves per unit of production.
Table 6.1 below indicates the atmospheric emissions in kilogram per barrel of crude per day and the percent change from the current 100,000 barrel per day rated Complex to the expanded 130,000 barrel per day Complex.

### Table 6.1 - Atmospheric Emission per Barrel of Crude Throughput

<table>
<thead>
<tr>
<th>Atmospheric Emission</th>
<th>Current Complex (kg per barrel of crude)</th>
<th>Expanded Complex (kg per barrel of crude)</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>0.120</td>
<td>0.096</td>
<td>-25%</td>
</tr>
<tr>
<td>NOₓ</td>
<td>0.030</td>
<td>0.026</td>
<td>-15%</td>
</tr>
<tr>
<td>CO</td>
<td>0.034</td>
<td>0.029</td>
<td>-16%</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>0.0052</td>
<td>0.0055</td>
<td>6%</td>
</tr>
<tr>
<td>VOC</td>
<td>0.1048</td>
<td>0.0968</td>
<td>-8%</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.0007</td>
<td>0.0006</td>
<td>-14%</td>
</tr>
<tr>
<td>Toluene</td>
<td>0.0014</td>
<td>0.0013</td>
<td>-7%</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>0.0004</td>
<td>0.0004</td>
<td>-4%</td>
</tr>
<tr>
<td>Xylene</td>
<td>0.0027</td>
<td>0.0025</td>
<td>-10%</td>
</tr>
<tr>
<td>H₂S</td>
<td>0.0010</td>
<td>0.0008</td>
<td>-18%</td>
</tr>
</tbody>
</table>

**GHG Emissions**

<table>
<thead>
<tr>
<th>GHG Emission</th>
<th>Current Complex (kg per barrel of crude)</th>
<th>Expanded Complex (kg per barrel of crude)</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>49.397</td>
<td>46.701</td>
<td>-6%</td>
</tr>
<tr>
<td>CH₄</td>
<td>0.0006</td>
<td>0.0005</td>
<td>-15%</td>
</tr>
<tr>
<td>N₂O</td>
<td>0.0005</td>
<td>0.0005</td>
<td>-18%</td>
</tr>
<tr>
<td>CO₂eq</td>
<td>49.584</td>
<td>46.860</td>
<td>-6%</td>
</tr>
</tbody>
</table>

1.22 Greenhouse Gases and Air Pollutants

On April 26, 2007, the Federal Government released the *Regulatory Framework for Air Emissions (Federal Framework)*, which sets out greenhouse gas (GHG) and air pollutant (AP) emission reduction targets. Industry has been divided into sixteen sectors and the Refinery-Upgrader Complex falls into two sectors - the Petroleum Refining Sector and the Oil Sands Sector (for Upgrading).

CCRL is actively participating in the consultation process with industry and Environment Canada to validate air pollutants and greenhouse gas targets. CCRL is also a participant of an Industry-Environment Canada working group that will provide input for the upcoming GHG and AP regulations.

CCRL is working on validating all of its GHG and AP emissions. The Air Quality Study performed by our independent consultant will be utilized to identify opportunities for improvements in CCRL’s estimated emissions. CCRL is currently developing a strategy to meet all of the proposed GHG and AP reduction requirements.
The *Federal Framework* has proposed GHG emissions reductions by 18% between 2007 and 2010, and 2% annually thereafter. CCRL is currently investigating appropriate options to capture CO₂ from the Complex’s Hydrogen Plants, where the majority of the CO₂ is generated. Once captured and compressed, the CO₂ may be sequestered or sold for enhanced oil recovery projects. CCRL recognizes the presence and potential of saline aquifers beneath the Complex for CO₂ storage. The CO₂ from the Hydrogen Plants accounts for approximately 30 to 40% of the total GHG generated by the facility. Capturing and removing these CO₂ streams will offset the additional GHG emissions associated with the Expansion Project and position CCRL to meet the requirements of the *Federal Framework*.

The AP reductions are scheduled for implementation between 2012 and 2015. It is unknown how significant these reductions will be for CCRL, especially since the Refinery-Upgrader Complex falls into two sectors and the reduction requirements for the sectors may be significantly different. Air pollutants that will be regulated for the Refinery-Upgrader Complex as stated in the *Federal Framework* and other material received from Environment Canada will include Sulphur Dioxide (SO₂ or SOx), Nitrogen oxides (NOx), Particular Matter (PM), Volatile Organic Compounds (VOC) and Benzene.

CCRL continuously strives to reduce AP emissions from the Complex. All capital projects are evaluated using environment guidelines and regulatory compliance to determine if there are opportunities to reduce Complex emissions. During the design of projects, CCME guidelines are referenced to ensure new infrastructure complies with today’s standards. For example, the CCME’s *National Emission Guidelines For Commercial/Industrial Boilers and Heaters*, has been used as a guide for the last three boiler installations, which have been approved by SE.

The following capital projects are currently being considered and upon completion will reduce AP emissions from the Complex.

- A project is currently being evaluated to reduce SO₂ emissions from the incinerator by approximately three tonnes per day.
- A new boiler is currently being installed and will be commissioned in February 2008. The new boiler will be equipped with a low NOx burner and flue gas recirculation technology.
- A capital project for Wastewater System improvements, to re-use and reduce water usage, is budgeted to be completed prior to the Expansion Project. One of the goals of the project is to reduce and recover hydrocarbons in the wastewater.
1.23 Odours

Low-level errant emissions contribute to odour thresholds from the existing Complex. Specified components that contribute to the odour threshold of the Complex are addressed in the Air Quality section of this report. These odours can originate from the wastewater ponds, stack emissions, petroleum storage tanks, and sulphur storage tanks. The proposed expansion is not expected to add appreciably to the existing odour threshold. The expansion’s feedstock has low sulphur content and will have little or no impact on existing odour levels. However, the additional hydrocarbon storage tanks will result in increased hydrocarbon emission levels.

CCRL strives for continuous improvement as part of the SE Partnership Agreement and plans are in place to address known sources of Complex odours. CCRL identifies and evaluates opportunities for emission reduction improvements as part of the Complex’s capital budget process. Currently identified projects that will reduce Complex odours include improvements to the Wastewater System, ventilation improvements for the Sulphur Storage Tanks, and upgrades to floating roof seals on petroleum storage tanks. CCRL is currently evaluating the Complex’s emissions as part of the impending regulations of the Federal Framework. CCRL will comply with all the new regulations as they are developed and implemented.

1.24 Noise

This expansion is not expected to have a significant impact on Complex noise levels. Noise levels from new equipment will be minimized to meet Occupational, Health and Safety standards and ensure the safety of all CCRL employees and contractors. Engineering design controls and noise abatement will be utilized, if required, to ensure noise levels at the expanded Complex will not exceed the City bylaw limits. The expansion units are located on the opposite side of the Complex away from the nearest residential area. The nearest offsite noise exposure will be at the north end of the Ross Industrial Park, however, the proposed expansion facilities are further away when compared to existing facilities. The adherence to existing standards will ensure that there are no offsite concerns regarding noise levels from the Complex.

1.25 Wastewater

The existing Complex currently discharges approximately 4,700 m$^3$/day (850 USgpm) of effluent to the City of Regina sewer system for additional treatment. A capital project is budgeted for wastewater re-use for completion prior to the Expansion Project. This project is planned for completion by the fall of 2010 and will enable 70% of total wastewater to be re-used as process water. Initial estimates indicate that 70% re-use is achievable. Upon completion of the proposed nominal expansion, it is estimated the total wastewater volume will be approximately 5,700 m$^3$/day (1050 USgpm). Of this total treated wastewater
volume, approximately 4,000 m$^3$/day (750 USgpm) will be returned to the Complex to be re-used for process water, and approximately 1,700 m$^3$/day (300 USgpm) will be discharged to the City of Regina Sewage Treatment Plant. A comparison of these rates is shown in Table 6.2.

Table 6.2 - Effluent Discharge Rates for the Existing and Expanded Complex

<table>
<thead>
<tr>
<th></th>
<th>Effluent Discharge Rate Under Normal Operations (m$^3$/day)</th>
<th>Allowed Effluent Discharge Rate under the current Effluent Discharge Agreement with the City of Regina (m$^3$/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Complex</td>
<td>4,700</td>
<td>6,900</td>
</tr>
<tr>
<td>Expanded Complex</td>
<td>1,700</td>
<td>6,900</td>
</tr>
</tbody>
</table>

The reduction in effluent water volume will result in changes to the effluent water quality. A detailed wastewater process study, scheduled for completion in 2008, will provide CCRL with effluent water quality information. Upon completion of this study, discussions will occur with Saskatchewan Environment and the City of Regina regarding the Complex’s Permit to Operate and Effluent Discharge Agreement.

1.26 Stormwater

CCRL implemented a Surface Water Compliance Management Plan in July 2005. This plan identified several areas for improvement to enable the Complex to store, transfer, and utilize site runoff and stormwater. Improvement work included the construction of a Contaminated Water Holding Pond (CWHP), replacement of culverts, dredging of drainage ditches, dredging of the West Stormwater Pond, and the construction of containment berms. The containment berms were constructed along the southeast and southwest perimeters of the Complex in geographical low areas. The completion of this work in 2007 ensured that the Complex would contain a one in one hundred year precipitation event.

During the summer of 2007, Water Resources Consultants Ltd. was contracted to evaluate the effect of the proposed expansion on the existing stormwater system. The East Stormwater Pond (ESP) and the CWHP on the east side of the Complex are currently storing stormwater flows from the Section III and IV process units and the North Tank Farm area. The proposed expansion area will contribute runoff water to these surface water ponds with the construction of an engineered drainage system and an extension of the existing containment berm along the new east perimeter of the Complex. The planned expansion will have a relatively minor impact on the flood levels of these ponds, and the evaluation identified that no additional storage is required. Existing stormwater ponds will, therefore, still contain a one in one hundred year precipitation event. The report, titled
1.27 Groundwater

The groundwater system beneath the Refinery-Upgrader Complex has been extensively studied through third party investigations and annual monitoring required under CCRL’s Permit to Operate. As a result, groundwater conditions at the site are well understood. The Refinery-Upgrader Complex overlies two aquifer systems, the shallow Condie Aquifer and the deeper Regina Aquifer.

Condie Aquifer

The Condie Aquifer is a shallow aquifer comprised of 2 to 4 m of clay silt underlain by 7 to 14 m of fine to coarse-grained sand and generally flows from northeast to southwest beneath the site. The aquifer underlies 2.5 to 8 m of Regina Clay. The Condie Aquifer is not currently used as a raw water source at the Complex or within the City of Regina. CCRL acknowledges that localized areas of contamination are present within the Condie Aquifer beneath the Refinery-Upgrader site, associated with historical petroleum refining activities over the past 70 years.

Impacted areas have been delineated within the Complex boundaries and are being progressively addressed through groundwater remediation and monitoring programs under the Partnership Agreement with SE. CCRL’s Permit to Operate requires monitoring and sampling of an extensive groundwater monitoring network within the Condie Aquifer for typical groundwater quality indicators and hydrocarbon parameters. Monitoring has shown that hydrocarbon contamination remains relatively immobile allowing CCRL to develop and employ long-term remediation technologies to recover hydrocarbons. Groundwater contamination issues are given high priority and CCRL continues to direct its remediation programs for continuous improvements at the site. CCRL reviews remediation progress annually with Saskatchewan Environment.

Regina Aquifer

The Regina Aquifer is a deeper aquifer comprised of sand and gravel deposits approximately 20 m thick and is encountered at depths between 24 and 26 m at the site. The flow direction in the Regina Aquifer is radially towards the city centre and is influenced locally by drawdown cones from the existing CCRL water supply wells. The Regina Aquifer is separated from the Condie Aquifer by a highly impermeable clay till approximately 6 to 10 m thick.

CCRL places a high priority on the protection of the Regina Aquifer. Similar to the Condie Aquifer, CCRL’s Permit to Operate requires monitoring and sampling of a number of monitoring wells within the Regina Aquifer. Monitoring data to date has indicated that the Regina Aquifer is not being contaminated by
Refinery-Upgrader operations. Hydrocarbon parameters monitored have historically been below laboratory detection limits.

Supply

The Refinery-Upgrader Complex is licensed to withdraw well water from the Regina Aquifer at a rate of approximately 10,680 m$^3$/day (3,900 dam$^3$ per year). Current usage is approximately 8,200 m$^3$/day supplied by four onsite production wells that draw from the Regina Aquifer. The proposed nominal expansion and implementation of a capital project for wastewater improvements will result in a net decrease in total groundwater consumption to approximately 7,200 m$^3$/day.

Aquifer Sensitivity

Aquifer sensitivity classifications are determined relative to the presence of an aquifer and are described in the report, *Regina Aquifers Sensitivity Mapping and Land Use Guidelines*, prepared for Saskatchewan Environment and Public Safety (presently SE) by U.V.R. Roeper, in July 1990. Aquifer sensitivity ratings for most of the Complex are either low (*a major aquifer is present beneath no less than 10 metres of protective clay or till overburden*) or moderate (*a major aquifer is present beneath 5 to 10 metres of protective clay or till overburden*); however, the location of a portion of the Expansion Project processing units, tankage and some utilities may be classified as high sensitivity (*a major aquifer is present beneath 0 to 5 meters of protective clay or till overburden*).

The Roeper report acknowledges that, “Based on knowledge of aquifer sensitivity, guidelines can be developed for activities which are, or are not, appropriate over given parts of the aquifer” (Page 20 Roeper, 1999). CCRL has adopted these SE developed guidelines to protect the underlying aquifers. The Refinery-Upgrader Complex has in place all of the mitigative options recommended by SE’s report for a high sensitivity rating. These mitigation options are shown in Table 6.3.

“It should be recognized that the land use recommendations put forward in the tables”, as listed above for a high sensitivity case, “are deemed appropriate measures for common risk sources, using common mitigative technology. It is possible, through diligent engineering, application of superior mitigative technology and rigorous consideration of hydrogeologic principles to reduce the environmental risk of most any land use activity. Hence, any activity which would normally not be deemed compatible with a particular aquifer sensitivity classification can possibly be made compatible through proper design criteria. This limitation implies that the tables are general recommendations, which in no way are intended to replace prudent and case specific engineering judgment. This may be of particular significance for activities which are of such economic benefit that the cost of superior mitigative measures can be justified.” (Pages 26-27 Roeper, 1990)
Table 6.3 - Recommended Mitigation Options for Aquifer Sensitivity Rating

<table>
<thead>
<tr>
<th>Risks Source</th>
<th>Code</th>
<th>Mitigation Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboveground Storage Tanks</td>
<td>A2</td>
<td>Secondary containment by berm and liner</td>
</tr>
<tr>
<td>Chemical Use</td>
<td>C1</td>
<td>Do not allow hazardous materials except those essential to run operation</td>
</tr>
<tr>
<td>Excavations</td>
<td>E1</td>
<td>Keep excavations to a minimum</td>
</tr>
<tr>
<td>Runoff</td>
<td>R1</td>
<td>Contain all site runoff</td>
</tr>
<tr>
<td>Spill</td>
<td>S1</td>
<td>Excavate immediately and contain material</td>
</tr>
<tr>
<td>Underground Storage Tanks</td>
<td>U1</td>
<td>Do not allow underground storage tanks</td>
</tr>
<tr>
<td>Monitoring</td>
<td>M1</td>
<td>Implement appropriate monitoring</td>
</tr>
</tbody>
</table>

1.27.1 Mitigative Measures

Mitigative measures are outlined below with the exception of the TIP and design and construction of the liners and berms that have been discussed in Section 4.3.

In the 1985 *Environmental Impact Statement for the NewGrade Upgrader*, five areas were identified as potential sources of groundwater contamination, namely, wastewater ponds, stormwater ponds, catalyst disposal, tank bottom land spreading, and accidental hydrocarbon spills. Only the latter of these five areas is a potential source from the Expansion Project.

Engineered controls, such as liners and berms, concrete aprons and hydrocarbon drains are in place to minimize the risk of contamination in the event of a spill.

Spill Response

Accidental spills of crude oil or petroleum products are a potential risk at any refinery or upgrader. The increase in tankage and handling of hydrocarbon material, as a result of the expansion, may proportionally increase the potential for a spill to occur. Only ten liquid petroleum tanks are being added with the proposed Expansion Project compared to a current inventory of over 130 petroleum storage tanks.

Mitigative measures for spills that occur consist of quick response and cleanup as outlined in the CCRL Environmental Management Manual and the Emergency Response Manual. Effective spill response procedures have evolved over many years of operations at the Refinery-Upgrader Complex and with consultation of CCRL’s SE project officer.
Concrete Pile Installation

Ground Engineering Ltd. was retained to conduct a geotechnical investigation for the proposed expansion area. Ground Engineering provided recommendations for the design of piles and foundations in two reports - *Geotechnical Investigation and Analysis - Proposed ISBL Refinery Expansion – Section V* for the process unit area and *Geotechnical Investigation and Analysis - Proposed OSBL Refinery Expansion – Section V* for the storage tanks area. CCRL will implement the foundation and piling recommendations outlined in the reports after approval is received from regulatory authorities.

The piles will not penetrate the Regina Aquifer, but as stated in the Ground Engineering Ltd. reports will have to penetrate the Condie Sand Formation.

“In order to obtain the required pile load carrying capabilities at this site, it is necessary to penetrate the Condie (Aquifer) Sand Formation. There are no practical alternatives available to support the proposed structures. However, there are pile types available which can minimize the risk of contaminant migration along the soil/pile shaft interface. These include compacted concrete piles, augercast type bored concrete pile and driven type piles.” (Page 7 Ground Engineering Ltd.)

The reports continue on to state:

“The heavy vessels, buildings and pipe racks constructed for the Upgrader and the most recent Refinery expansion are supported on compacted concrete (expanded base) type piles. We recommend this type of pile be utilized to support heavy pile loads for this project.” (Page 8 Ground Engineering Ltd.)

“Augercast piles have been used on recent projects in similar conditions at IPSCO and at the Regina Correctional Facility where the piles were designed to penetrate into the Condie Sand. For lightly loaded structures where the piles will extend into the aquifer, we recommend augercast type bored concrete piles. Because the concrete is placed under high pressure with this type of pile, there is less risk of contaminated migration along the soil/pile interface.” (Page 8 Ground Engineering Ltd.)

The Ground Engineering Ltd. report recommends the standards for underground construction and piling for the Expansion units. These standard recommendations for construction will be reviewed and approved by Saskatchewan Environment and the City of Regina prior to commencement of construction.
Site plans showing the location of test holes and stratigraphic cross-sections are included as Appendices C and D for the proposed locations of the process units and storage tanks, respectively.

**Groundwater Monitoring**

The Refinery-Upgrader Complex’s Groundwater Monitoring Program adheres to CCRL’s **Permit to Operate** with SE as outlined in the CCRL Environmental Management Manual. A number of additional groundwater monitoring wells will be installed to supplement the extensive, existing groundwater monitoring network. Additional wells and monitoring will provide further information regarding groundwater conditions in the vicinity of the Expansion Project.

**Water Well Construction**

Appropriate Saskatchewan Watershed Authority approved measures for well construction have been implemented at all water supply wells. All water supply wells at the Complex are engineered and constructed with casing and cement to the base of the Condie Aquifer. This minimizes the risk of developing a preferential flow path between the Condie Aquifer and the Regina Aquifer.

**Process Line Installation**

As discussed in Section 5.5, all process lines will be located above ground with the exception of the crude delivery line, which will be equipped with an appropriate leak detection system. Constructing process lines above ground will minimize the risk of subsurface contamination.

1.28 Waste Management

In the upgrading and refining business, the risk of environmental liability cannot be totally eliminated, as some of the materials handled may be hazardous. CCRL established the Solid Waste Management Plan (SWMP), which is documented in its’ EMM to reduce, reuse or recycle and then mitigate long-term environmental liability. The main goal of any solid waste management plan is to reduce the risk of environmental liability. The environmental liability associated with any particular waste is directly proportional to its quantity and complexity. Preventing the creation of a waste is the best solution for reducing environmental liability.

1.28.1 Catalyst Disposal

Reuse, recycling or disposal of catalyst utilized by the Refinery-Upgrader operation is managed on an individual basis as outlined in the
Environmental Management Manual (EMM). All environmentally responsible options are considered and the last option is disposal at an approved industrial landfill. Extensive characterization of the waste type is performed and applicable authorizations are obtained prior to disposal. The Refinery-Upgrader Complex’s Solid Waste Management Program in the EMM is regularly reviewed and updated with the most current and environmentally responsible options.

Currently, the Complex recycles most of its spent catalyst for metals recovery and catalyst from FCCU #1 is sold for reuse in other refineries. Spent Poly catalyst is utilized for composting on-site. The acidic nature and abundant phosphorous content of the spent poly catalyst make it ideal for utilization in composting activities approved by Saskatchewan Environment.

The new FCC and Poly Units will require the use of catalyst for their operation. As with the FCCU #1 spent catalyst, the FCCU #2 spent catalyst will be sold to other refineries for use in their FCC Units. Spent catalyst from Poly Unit #2 will be identical in nature to spent catalyst from Poly Unit #1. This material may be used to enhance remediation activities on-site.

1.28.2 Hydrocarbon Contaminated Sludge

The crude feedstock for the Expansion Project will be an “ultra low solids” (solid contaminants) synthetic crude and it is not expected to generate any significant amount of hydrocarbon contaminated sludge. Sludge generated from the tank bottoms will be disposed of as per CCRL’s current Sludge Disposal Program. The final disposal option is determined after extensive characterization of the waste material to evaluate all environmentally responsible options.

1.29 Vehicle Traffic

There will be a temporary increase in vehicle traffic during the construction phase of the proposed Expansion Project. The volume of additional traffic will be similar to conditions, which exist during a Major Plant Maintenance Turnaround and similar to conditions experienced during the Refinery Expansion Project.

CCRL has met this past year with representatives from the City of Regina to address current traffic issues near the Complex. The discussion included the possibility of projects to upgrade 9th Avenue North and to install traffic signals near the Complex to deal with traffic congestion. CCRL will continue to work with the City to address and find solutions to traffic concerns in the area.
1.30 Aesthetics

Since all of the Expansion Project - Section V & Revamps will be located totally within the industrial area of the City of Regina, there should be no significant aesthetic impact.
SOCIO-ECONOMIC IMPACT

1.31 Personnel Requirements

Total project construction and engineering personnel requirements between 2008 and 2011 are estimated at about 5.9 million person-hours. Construction trades will represent the largest requirement at an estimated 4.7 million person-hours or 80% of the total. CCRL will endeavour to maximize the construction workforce with Saskatchewan content. The engineering and construction management component will account for the remaining 20% of the total or 1.2 million person-hours. Figure 7.1 shows the construction staffing projection for the Expansion Project.

![Figure 7.1 - Expansion Project Construction Staffing Projection](image)

The expansion facilities, when operational, are anticipated to require approximately 100 additional permanent staff.

1.32 Economic Impact

The proposed Expansion Project - Section V & Revamps will have a net positive impact on the local and provincial economy. The Project is expected to cost approximately $1.5 billion on a preliminary basis. It is estimated that approximately 25% of this amount will be spent locally. During the 36-42 month engineering and construction phase, labour costs will be approximately $30 million. Local spending for food, accommodations, and transportation by the construction workforce will be significant.
There will be additional tax revenue for the local and the provincial economies when the proposed Expansion Project is operational. The additional permanent staff required for the operation of the Expansion will add to CCRL’s annual payroll and in turn generate additional income tax revenue for both the Federal and Provincial Governments. These new skilled permanent positions will also create other additional spin-off employment in Regina’s service industry.

1.33 Public Awareness

Public involvement is a very important part of the environmental review process. CCRL is committed to communicating and working cooperatively with the community. To fulfill this commitment, CCRL began in the summer of 2007 to make the public aware of the proposed expansion project.

1.33.1 Open Forum

The community awareness campaign started with an advertisement in Section A, page 2 of the Regina Leader Post on Saturday, August 25, 2007. The advertisement is included as Figure 7.2.

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**OPEN FORUM**
Consumers’ Co-operative Refineries Limited

**PURPOSE:** To provide information and to facilitate discussion between the public and Consumers’ Co-operative Refineries Limited, relative to any environmental matters associated with the construction and operation of a proposed expansion of the Co-op Refinery in Regina.

**PLACE:** McDermid School Auditorium
139 Toronto Street
Regina, Saskatchewan

**DATE:** Tuesday, August 28, 2007

**TIME:** 7:00 p.m.

The public is invited to attend and participate.

For further information, call:
Vicki Goddard
Consumers’ Co-operative Refineries Limited
Regina, Saskatchewan
721-5207

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Figure 7.2 - Open Forum Newspaper Advertisement August 25, 2007
A news article titled, “Environmental concerns will be heard”, by Anne Kyle was published on August 27, 2007 in the Regina Leader Post. This article described the upcoming public forum relating to the proposed expansion of the Refinery on August 28, 2007.

Invitations were hand delivered to businesses in the Ross Industrial Park – the Complex’s closest neighbours, and were mailed or emailed directly to the following.

- City of Regina officials, that included the Mayor of Regina, the City Manager, and General Managers for Engineering & Works, Community & Protective Services, and Planning and Development.

- CCRL’s Government of Saskatchewan Member of Parliament.

- Saskatchewan Environment, which included the Director of Environmental Assessment, CCRL’s Project Manager for Environmental Assessment, CCRL’s Environmental Project Officer and Manager of Environmental Protection.

- McDermid School employees, including the McDermid School Principal.

- Uplands Community Association.

- Regina Regional Economic Development Authority.

- Regina and District Chamber of Commerce.

- Regina Eco-Industrial Network Association.

The Open Forum was held on August 28, 2007 at McDermid School Auditorium. The purpose of the Open Forum, as stated in the newspaper advertisement, was to provide information and to facilitate discussion between the public and CCRL relating to any environmental matters associated with the construction and operation of a proposed expansion. Twenty-two people from the public and government agencies attended the Open Forum. Attendees were given an agenda and comment forms and were requested to sign the guest book.

The Open Forum agenda included the following items.

- Presentation on CCRL’s plans for expansion by CCRL’s Refinery Manager, Bud Van Iderstine, which emphasized CCRL’s dedication to its four core principles, and the need for an expansion
due to the Co-operative Retail System’s growing demand for gasoline.

- Speech from the McDermid School Principal on behalf of the CCRL and McDermid School Partnership.

- Presentation on the Environmental Assessment Process by a Saskatchewan Environment Assessment Branch Project Manager.

- Speech from the General Manager of Planning and Development for the City of Regina on behalf of the City Manager’s Office.

- Speech from Councillor Bill Gray, on behalf of the Mayor of Regina.

- Question and Answer Period.

The public raised questions regarding odours associated with the Complex and the depth of cover over the aquifers. The inquires were addressed by CCRL at the Open Forum. Further discussion with respect to odours (Section 6.3) and aquifers (Section 6.7) at the Complex is provided in this report.

The forum started at 7:30 p.m. and concluded at 9:00 p.m. CCRL has not received any comment cards from the public, but has received requests for additional presentations. Presentations were made to the Rotary Industrial Park Branch and the Kinsmen Regina K-40 in November 2007.

1.33.2 File Hills Qu’Appelle Tribal Council

CCRL received a request from the File Hills Qu’Appelle Tribal Council (FHQTC) dated September 7, 2007 for a meeting. The current Complex and proposed development fall within the traditional territory of Treaty #4. The initial meeting was held on November 20, 2007 at CCRL to provide FHQTC with details on the nature and scope of CCRL’s proposed expansion project. FHQTC objective was to provide CCRL with an understanding of Treaty #4, and to gain knowledge of CCRL’s Complex and the potential impacts of the expanded Complex. Ongoing discussions will occur with representatives from FHQTC.
REGULATORY PROCEDURE

Required regulatory approval to commence construction of the proposed facilities will be sought from Saskatchewan Environment. This approval process is initiated by the submission of this Project Proposal to Saskatchewan Environment, Environmental Assessment Branch.

This expansion is being proposed on a site that has operated as a refinery for over seventy years, utilizes similar proven technologies and has a well-established baseline for this type of activity. In addition, a complete Environment Impact Statement was completed in 1985 that encompassed identical activities and processes proposed in this expansion. Therefore, it is CCRL’s experienced opinion that the Expansion Project should not be considered a “development” in accordance with The Environmental Assessment Act. The Expansion Project - Section V & Revamps;

• Will not effect any unique, rare, or endangered feature of the environment;

• Will not use any other provincial resources that would pre-empt the use, or potential use, of those resources for any other purpose;

• Will not cause the emission of any other pollutants or create by-products, residual, or waste products that are not regulated as per our current operating permit or other Acts or Regulations;

• Will not cause widespread public concerns as potential environmental changes are minimal;

• Will not involve any new technologies that may induce significant environmental change; and

• Will not have a significant impact and will not necessitate a further development that is likely to have a significant impact on the environment.

Regulatory requirements for the operations of an expanded Refinery-Upgrader Complex will be developed with SE’s Environmental Protection Branch and implementation of all regulatory requirements will be maintained at today’s high standards. All operations carried out at the Complex will be in accordance with CCRL’s four Core Principles identified in Section 1.2. CCRL always endeavors to be environmentally responsible and proactively tries to do the right thing.