# TABLE OF CONTENTS

**SECTION 6: RESERVOIR CHARACTERIZATION**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagenesis and Formation Damage Induced by Steam Injection: A Computer Simulation Study</td>
<td>3</td>
</tr>
<tr>
<td>A.R. Kessel and G.O. Berim, Tatarstan</td>
<td>17</td>
</tr>
<tr>
<td>Crosshole EM for Oil Field Characterization and EOR Monitoring: Field Examples</td>
<td>19</td>
</tr>
<tr>
<td>Michael Wilt and Clifford Schenkel, USA; Carlos Torres-Verdin, Mexico; Ki Ha Lee and Hung-Wen Tseng, USA</td>
<td>27</td>
</tr>
<tr>
<td>Hydrothermal Stability of the Clay Minerals from the Clearwater Reservoirs at Cold Lake, Alberta</td>
<td>37</td>
</tr>
<tr>
<td>Desmond A. Wynne, Daryl M. Wightman, Michelle Attalla, Tim Berezniuk, and Michel Brulotte, Canada</td>
<td>51</td>
</tr>
<tr>
<td>Application of an Outcrop Analogue to Reservoir Characterization, McMurray Formation, Northeastern Alberta</td>
<td>77</td>
</tr>
<tr>
<td>Ghanshyam D. Sharma, Santanu Khataniar, Shirish L. Patil, and Ansar Ali, USA</td>
<td>85</td>
</tr>
</tbody>
</table>

**SECTION 7: WELL COMPLETIONS AND ARTIFICIAL LIFT METHODS**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Electromagnetic Surveying/Ranging Method for Drilling Parallel Horizontal Twin Wells</td>
<td>87</td>
</tr>
<tr>
<td>José Goite and Geovanny Joubert, Venezuela</td>
<td>97</td>
</tr>
<tr>
<td>Experience in the Bolivar Coast Fields with Progressive Cavity Pump</td>
<td>105</td>
</tr>
<tr>
<td>Luis L. Bortolin, Venezuela</td>
<td>113</td>
</tr>
</tbody>
</table>
HEAVY CRUDE AND TAR SANDS — FUELING FOR A CLEAN AND SAFE ENVIRONMENT

AUTOMATIC SPEED CONTROL OF CONVENTIONAL BEAM PUMPING UNITS IN HEAVY OIL PRODUCTION
Larry Best, USA ........................................119

PRODUCTION OF HEAVY OIL WITH A HYDRAULIC GAS PUMP
Mahmood Amani, USA ....................................121

SAND REMOVAL FROM HEAVY OIL HORIZONTAL WELLS
Garth Dedora, Canada ......................................127

CEMENT SLURRY FOR STEAM INJECTION WELLS
Wilfredo Rodriguez, Aiskely Blanco, and Urbano Medina, Venezuela .....................129

USE OF BAUXITE AS PACKING MATERIAL IN STEAM INJECTION WELLS
J. Scoglio, G. Joubert, and B. Gallardo, Venezuela ........................................135

SUMMARY OF AWACT ANTI-WATER CONING APPLICATIONS — SUCCESSES AND FAILURES
W.K. Good, M.A. Bilozir, M.J. Chmilar, and B.S. Anderson, Canada .....................143

FLUID MONITORING OF CALCITE SCALING IN CYCLIC STEAM WELLS PRODUCING FROM A TAR SANDS CLEARWATER RESERVOIR, COLD LAKE, ALBERTA, CANADA
W.D. Gunter, B.K. Kadatz, and R. Jonasson, Canada; G.J.J. Williams and N.C.C. Walklin, England ....155

SECTION 8: EXTRACTION AND SEPARATION ........................................167

LIGHT SWEET CRUDE OIL FROM ATHABASCA MINEABLE OIL SANDS — AN ECONOMIC COMPARISON OF THREE OPTIONS
James I. Chambers, Riaz Padamsey, and Roman Koszarycz, David W. Deyenny, Canada ............169

SOLVENT EXTRACTION OF BITUMEN FROM TAR SANDS
A. Young Hoon and S. Thomas, Trinidad, W.I. ........................................185

SUPERCRITICAL FLUID EXTRACTION OF UINTA BASIN BITUMENS
M. Subramanian, M.D. Deo, and F.V. Hanson, USA ......................................193

PYROLYSIS OF UINTA BASIN OIL SANDS IN FLUIDIZED BED AND ROTARY KILN REACTORS
S. Nagpal, J.V. Fletcher, and F.V. Hanson, USA ........................................205

CO-PROCESSING OF HEAVY OIL
M. Rashid Khan, USA ........................................213

THE BITUMOUNT CO-PRODUCTION PROJECT (THE NEXT GENERATION IN OIL SANDS TECHNOLOGY)
S.J. (Steve) Lane, Alex Logwinuk, and Massoud Ahghar, USA .........................215
# TABLE OF CONTENTS

## SECTION 9: CONVERSION TECHNOLOGIES

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM HEAVY OILS TO MARKETABLE PRODUCTS: IFP PROPOSES NEW SCHEMES FOR MAXIMUM CONVERSION</td>
<td>J.P. Peries, A. Billon, A. Hennico, E. Morrison, and F. Morel, France</td>
<td>227</td>
</tr>
<tr>
<td>ROSE® — A FLEXIBLE PROCESS FOR UPGRADING HEAVY CRUDE, ATMOSPHERIC RESIDUE, OR VACUUM RESIDUE</td>
<td>Kelly Zachgo Lynch and Richard L. Hood, USA; Oswaldo Gomez and Luis G. Aquino, Venezuela</td>
<td>245</td>
</tr>
<tr>
<td>DEASPHALTING AND GASIFICATION — A NEW APPROACH FOR CONVERTING HEAVY CRUDES INTO PETROCHEMICALS</td>
<td>Edgar Tellez, Nicola Moca, and Oswaldo Gómez, Venezuela</td>
<td>253</td>
</tr>
<tr>
<td>(HC)₃ PROCESS — AN ECONOMICAL TECHNOLOGY FOR UPGRADING BITUMEN AND HEAVY OIL</td>
<td>Riaz Padamsey, Roger T. Bailey, Ted J. Cyr, and Roger Lott, Canada</td>
<td>261</td>
</tr>
<tr>
<td>BITUMEN UTILIZATION VIA PARTIAL UPGRADING AND EMULSIFICATION</td>
<td>Bruce M. Sankey, Mainak Ghosh, and Tapan Chakrabarty, Canada</td>
<td>269</td>
</tr>
<tr>
<td>UPGRADING OF HIGH METALS BOSCAN RESIDUUM VIA CO-PROCESSING WITH NOVA SCOTIA BITUMINOUS COAL</td>
<td>Robert H. Stalzer and John E. Duddy, USA</td>
<td>277</td>
</tr>
<tr>
<td>CATALYST REJUVENATION TECHNOLOGY AND ECONOMICS</td>
<td>John E. Duddy, Steven J. Hildebrandt, and Refa O. Koseoglu, USA</td>
<td>285</td>
</tr>
</tbody>
</table>

## SECTION 10: UPGRADING AND REFINING

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECONOMIC INCENTIVES FOR U.S. REFINERS TO PROCESS INCREMENTAL DOMESTIC HEAVY CRUDE OIL</td>
<td>Guillermo Guariguata U., USA</td>
<td>293</td>
</tr>
<tr>
<td>IMPACT OF EXPANSION OF DOMESTIC (U.S.) HEAVY OIL PRODUCTION ON THE U.S. REFINING INDUSTRY</td>
<td>David K. Olsen, USA</td>
<td>295</td>
</tr>
<tr>
<td>EMERGING STRATEGIES AND PROCESSES FOR MINIMIZING HEAVY FUEL OIL PRODUCTION</td>
<td>Bernard L. Schulman and Ronald L. Dickenson, USA</td>
<td>309</td>
</tr>
<tr>
<td>CHARACTERISTICS AND UPGRADING TECHNOLOGIES OF CHINESE HEAVY OIL</td>
<td>Guanghua Yang and Jinsen Gao, People’s Republic of China</td>
<td>325</td>
</tr>
<tr>
<td>COMPOSITION OF HEAVY CRUDE OILS — DEEP-CUT CRUDE OIL ASSAY</td>
<td>Mieczysław M. Boduszynski, David A. Grudoski, Carl E. Rechsteiner, and Richard M. Angus, USA</td>
<td>329</td>
</tr>
<tr>
<td>UPGRADING OF HEAVY HYDROCARBONACEOUS FEEDS</td>
<td>Ajit K. Bhattacharya, David A. Storm, Thomas F. DeRosa, and Rodney L.-D. Sung, USA</td>
<td>335</td>
</tr>
</tbody>
</table>

(vii)
HEAVY CRUDE AND TAR SANDS — FUELING FOR A CLEAN AND SAFE ENVIRONMENT

THE PREFERRED ROUTE FOR UPGRADING HIGH METALS RESIDUA: HYDROGEN ADDITION OR CARBON REJECTION?
Eric D. Peer and Lawrence I. Wisdom, USA .......................................................... 351

IMPROVING PERFORMANCE OF ELECTROSTATIC HEATER-TREATERS FOR LIGHT CRUDE DOPED HEAVY CRUDE: A CASE STUDY
A. Bhattacharya, S. Ray, and R. Rai, India .......................................................... 359

SLUDGE FORMATION DURING HEAVY OIL UPGRADING
David A. Storm, Stephen J. Decanio, John C. Edwards, and Eric Y. Sheu, USA .................................................. 365

MOLECULAR THERMODYNAMICS AND EXCESS VISCOSITY IN MIXTURES OF HEAVY CRUDE WITH DILUENTS, LIGHT AND MEDIUM CRUDES
Norman F. Carnahan, USA, and Simon J. Antunez, Venezuela .................................................. 373

MECHANISMS OF COKE FORMATION AND FOULING IN THERMAL CRACKING
Roger K. Lott, Huseni A. Rangwala, Chu Hsi, and Ted Cyr, Canada; Ming Zhao and Yu-Min Xu, China .................................................. 379

ASPHALTENES AS A SURFACE ACTIVE AGENT
Eric Y. Sheu, Michael B. Shields, and David A. Storm, USA .................................................. 385

PROCESS INTEGRATION FOR RESID UPGRADING OPTIMIZATION
R. Iqbal, V. Patel, and H.D. Sloan, USA .......................................................... 393

UPGRADING OF THE BELAYIM ATMOSPHERIC RESID
Emilio Micheli, Raffaele Russo, and Sabatino Di Carlo, Italy; Jesper Bartholdy and Barry Cooper, Denmark .................................................. 401

NEW COAL-DERIVED CATALYST FOR TRANSFER HYDROCRACKING OF VACUUM RESIDUE
Ikusei Nakamura and Kaoru Fujimoto, Japan .................................................. 405

THE USE OF THE SHELL COAL GASIFICATION PROCESS (SCGP) IN HEAVY CRUDE- AND TAR SANDS-DERIVED PETROLEUM COKE GASIFICATION
Nick Hauser, USA .......................................................... 413

HEAVY OIL HYDROPROCESSING
Roy Earl Pratt, Govannon Nongbri, Glenn Allen Clausen, and Farshad Bavarian, USA .................................................. 423

HYDROTREATING UINTA BASIN BITUMEN-DERIVED HEAVY OILS
D.C. Longstaff, G.V. Balaji, J.W. Kim, S. Kwak, C.H. Tsai, and F.V. Hanson, USA .................................................. 427

PEMEX SELECTS THE H-OIL ® PROCESS FOR THEIR HYDRODESULFURIZATION RESIDUE COMPLEX AT THE MIGUEL HIDALGO REFINERY
Lawrence I. Wisdom and James J. Colyar, USA .................................................. 441

ECONOMIC ASSESSMENT OF HEAVY OIL AND BITUMEN PROJECTS WITH Veba COMBI CRACKING
Andreas Schleiffer, Gelsenkirchen .................................................. 451
HEAVY OIL UPGRADING USING AN INTEGRATED GASIFICATION PROCESS  
Manuel E. Quintana and James S. Falsetti, USA .................................................. 463

THERMAL AND CATALYTIC UPGRADING OF EXTRA HEAVY CRUDE OIL USING METHANE AS A SOURCE OF HYDROGEN  
César Ovalles, Antonia Hamana, Rafael A. Bolivar, and Alfredo Morales, Venezuela .................................................. 473

THE USE OF THE SHELL GASIFICATION PROCESS (SGP) IN REFINING HEAVY CRUDE AND TAR SANDS  
Nick Hauser, USA, and Chris Higman, Germany .................................................. 477

CHARACTERIZATION OF VENEZUELAN VACUUM RESIDUA AND PRODUCT VACUUM RESIDUA OBTAINED USING THE HDH™ TECHNOLOGY  
Alejandro Izquierdo, Youssef Espidel, and Rebeca Fraile, Venezuela .................................................. 487

HDH™ COMMERCIAL APPLICATION  
Roger Marzin, Bruno Solari, and Jorge Duque, Venezuela .................................................. 493

THE START-UP OF THE BI-PROVINCIAL UPGRADER  
Sherwin Chase, Canada .................................................. 503

INITIAL HUSKY BPU H-OIL® UNIT OPERATIONS AND PERFORMANCE  
T.H. Faupel and K.G. Tasker, USA, and M.A. Bannayann, Canada .................................................. 513

PROGRESS OF HEAVY OIL RESEARCH AT THE UNIVERSITY OF PETROLEUM, CHINA  
Shixiong Lin, Guanghua Yang, and Jiujin Yang, People's Republic of China .................................................. 525

SECTION 11: HANDLING AND TRANSPORTATION .................................................. 533

PREVENTING OIL ADHESION TO PIPE WALLS IN HEAVY CRUDE TRANSPORTATION  
M. Rivero, E. Guevara, J. Jaua, and N. Carabaño, Venezuela, and D. Joseph, USA .................................................. 535

ADDITION OF A HEAVY CRUDE MAY FACILITATE PIPELINING OF SOME WAXY CRUDES  
Jingjun Zhang, Tanghua Zhao, and Haihao Wu, China .................................................. 545

A COMPARISON STUDY OF SARA FRACTIONS FROM CONVENTIONAL AND HEAVY CRUDE OILS IN RELATION TO THEIR DEPOSITION TENDENCY IN PRODUCTION PIPELINES  
LANTE CARBOGNANI AND YOUSSEF ESPIDEL, VENEZUELA .................................................. 551

FUNDAMENTALS OF RHEOLOGICAL PROPERTIES OF HEAVY OILS AND HEAVY OIL EMULSIONS  
M. Rashid Khan, Christine Albert, and Jeffrey Harrison, USA .................................................. 561

RHEOLOGY AND FLOW OF WATER-IN-OIL EMULSIONS IN POROUS MEDIA  
Roy Woo, Clive Jackson, Brij B. Maini, and Roman Zrobok, Canada .................................................. 565

USE OF MULTIPHASE PUMPS IN HEAVY AND EXTRA HEAVY OIL PRODUCTION  
Ruben Gonzalez, Emilio Guevara M., and J. Colmenares D., Venezuela .................................................. 567


STUDY ON SHUTDOWN AND RESTART OF OFFSHORE HEAVY CRUDE PIPELINE
Xiaoheng Yang, Dabin Chen, Peng Zhang, Yiquan Cai, and Xiaoping Li, China ..............................................573

ASPHALTENE-COMPATIBLE FLUID DESIGN FOR WORKOVER OPERATIONS
A.K.M. Jamaluddin, T.W. Nazarko, S. Sills, and B.J. Fuhr, Canada .................................................................579

TRANSPORTABLE AND STABLE HYDROCARBONS IN BUFFER SOLUTION DISPERSIONS
A. Padrón, L. Castro, and G. Zamora, Venezuela ...........................................................................................587

EVALUATION OF SEVERAL METHODS USED FOR PREDICTING PRESSURE DROP IN CORE ANNULAR LIQUID-LIQUID FLOW
J.A. Jaua and E. Guevara, Venezuela ...........................................................................................................597

SECTION 12: ENVIRONMENTAL STUDIES ........................................................................................................599

ALBERTA'S OIL SANDS: UPDATE ON REGULATORY AND DEVELOPMENT ISSUES
P.L. Precht, R.R. Germain, and D.R. McMurray, Canada ..............................................................................601

THE ROLE OF HEAVY CRUDE AND TAR SANDS OIL IN THE GLOBAL ENERGY MIX IN THE 1990S: A REPORT ON ENERGY AND ENVIRONMENTAL SUSTAINABILITY
Lawrence Boms and Francisco Pérez-Trejo, Geneva .....................................................................................613

MARGINAL RESERVES OF ENERGY AND ENVIRONMENTAL PROBLEMS
Elisé A. Raveloson and Etienne Rakotomaria, Madagascar; Joelle P. Gazerian, François L. Rigaud, and Jean Michel Ruiz, France .................................................................627

A GLOBAL ASSESSMENT OF THE IMPACT ON THE ENVIRONMENT OF AN IN SITU COMBUSTION PROCESS AT A HEAVY OIL FIELD
Iuliu Marius Cucuia and Vladimir Ciovârniche, Romania ...........................................................................635

ESTONIA'S OIL SHALE INDUSTRY — MEETING ENVIRONMENTAL STANDARDS OF THE FUTURE
Teemu Tanner, Finland; Gordon Bird, Dean Wallace, Sam Wong, Linda Coates, and William Taciuk, Canada; Guido Paalme, Tiit Purre, and Vello Tohver, Estonia ........................................647

PHYSICAL STRUCTURE OF THE PRIMARY FROTH FROM OIL SAND EXTRACTION: CRYOGENIC SAMPLING AND MICROSCOPIC OBSERVATIONS OF FROTH FROM COMMERCIAL EXTRACTION PLANTS
W.W. Lam, W.J.R. Tyerman, C. Payette, R.J. Mikula, J. Czarnecki, and G. Stevens, Canada .......................653

A COMPARATIVE STUDY OF SLUDGES FROM ATHABASCA AND NORTHERN HOLLAND
P. Muszalski, L. Kotlyar, B. Sparks, A. Majid, and V. Horrof, Canada ..........................................................665

A NEW METHOD OF PETROLEUM SLUDGE DISPOSAL AND UTILIZATION
R.D. Kanakamedala and M.R. Islam, USA ......................................................................................................675

COMPARISON OF TAR SANDS AND PHOSPHATIC CLAY TAILINGS PROPERTIES, DISPOSAL, AND RECLAMATION OPTIONS
Wayne A. Ericson and W.D. Carrier, III, USA; Robert Burns, Canada .........................................................683
<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIL SANDS FINE TAILINGS — A RESOURCE MATERIAL FOR POTENTIALLY MARKETABLE PRODUCTS</td>
<td>A. Majid, B.D. Sparks, R.D. Coleman, and F. Toll, Canada</td>
<td>691</td>
</tr>
<tr>
<td>HYDROPHOBIC SOLIDS AND STRUCTURE FORMATION IN OIL SANDS FINE TAILINGS</td>
<td>A. Majid and B. D. Sparks, Canada</td>
<td>697</td>
</tr>
<tr>
<td>ENVIRONMENTAL ISSUES ON RECLAMATION OF OIL SANDS FINE TAILS</td>
<td>L. Richard Nelson, J.R. Gulley, and M. MacKinnon, Canada</td>
<td>705</td>
</tr>
<tr>
<td>RECLAMATION IN OIL SANDS MINING</td>
<td>Bruce Friesena, Canada</td>
<td>719</td>
</tr>
<tr>
<td>DETERMINATION OF TOXIC ELEMENTS IN THE ECOLOGICAL EVALUATION OF METALLIFEROUS DEPOSITS OF HEAVY OIL AND NATURAL BITUMENS</td>
<td>Iosif S. Goldberg, USA</td>
<td>721</td>
</tr>
</tbody>
</table>

**AUTHOR INDEX**

<table>
<thead>
<tr>
<th>Volume</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLUME 1</td>
<td>729</td>
</tr>
<tr>
<td>VOLUME 2</td>
<td>731</td>
</tr>
</tbody>
</table>