

CONTENTS

Fertilizer: Solving the Food Problem for the Developing World	1
Start-up Damage to a Carbon Dioxide Absorber	9
Protecting Cooling Towers from Overpressure	11
Stress Corrosion Cracked Synthesis Gas Line in an Ammonia Plant	18
Failure at the Inlet Nozzle Weldment of an Ammonia Synthesis Converter	21
Production vs Safety: How Shall We Allocate Our Resources?	29
On-Stream Repairs on Reformer Bottom Manifold Insulation	32
Reformer Riser Pressure Shell Leaks	37
Computer Control Stabilizes Ammonia Operations	39
Computer Control Without the Computer	44
Atmospheric Emissions and Control	51
Organometallically Catalyzed Hydrazine for Maximum Protection of Steam-Generating Systems	57
Refrigerated Ammonia Storage: Design and Practice	61
Safety Wall Systems for Ammonia Storage Protection	69
Ammonia Vapor Detectors: Their Application and Performance	73
The Pensacola Ammonia Accident	76
Ammonia Storage Vent Accident	80
Performance and Maintenance of an Ammonia Plant Using the Braun Purifier Process	82
Strip-Wound Pressure Vessels: Manufacture and Operating Experience	89
Ammonia Separator Accident	95
On-Stream Repair Methods	100
Extending Catalyst Life	105
Urea Reactor Failure	111
Compression Systems For Ammonia Plants	119
Spark Erosion Damage to Compressor Bearings in Ammonia Plants	124
Operating Experience with a Cryogenic Syngas Purifier	130
Safety, Simplicity and Saving with Selectoxo Catalyst Process in a 600 T/D Kellogg Ammonia Plant	138
Sulphur-Tolerant Shift Process and Catalyst	145
Operating Experience with a Benfield Carbon Dioxide Removal System	149
Carbon Dioxide Removal in Ammonia Synthesis Gas by Selexol	152
Amine Guard III	156
Technical Improvements in the Strong Nitric Acid Process	164
Particulate Removal From $\text{NO}_x$ Abatement Off-Gas in a Nitric Acid Plant	171
Single Pressure or Dual Pressure Nitric Acid: An Objective Comparison	173
The Humphreys and Glasgow/Bolme Nitric Acid Process	184

# TABLE OF CONTENTS

World Ammonia Supply and Demand <i>Pierre L. Louis</i> .....	1
Dissimilar Weld Cracking and Repairs on Primary Reformer Exit Header <i>Andrew Walker and Neil Mackenzie</i> .....	13
Vibration Problems with Revamped Air Compressor <i>Georg Grossmann and Roland Schober</i> .....	20
Electric Heaters for Safe Startup of Ammonia Synthesis Process <i>Carl-Vilhelm Rasmussen</i> .....	29
Simple, Safe and Reliable KRES: First Commercial Application <i>J.R. LeBlanc, Robert V. Schneider, III, Kenneth W. Wright, and Bob Lai</i> .....	38
Residual Lifetime of Reformer Tube Outlet Crossover Lines <i>J.G. Keltjens and T.L. Hurdeman</i> .....	52
Catastrophic Failure of Ammonia/Air Mixture <i>W.D. Verduijn</i> .....	67
EPA's RM Regulation: Communicating Worst-Case Scenarios to the Public <i>John E. Auger and William F. Burkhard</i> .....	78
Elimination of Carbon Formation in Secondary Reformer System <i>Ross Murdoch and Kevin Still</i> .....	82
Copper Catalyst Removal from Process Condensate in NH <sup>3</sup> Plants <i>Zoraida R. Diaz</i> .....	94
Failure of Cooling Water Circulating Pump and Remedial Actions <i>P.P. Singh and D.K. Paul</i> .....	101
Problematic Low-Temperature Shift Catalyst Reduction <i>I.R. Barton</i> .....	111
Nitriding of Thermowell Protection Tubes in Ammonia-Quench Reactor <i>Georg Grossmann, Roland Schober, and Jürgen Korkhaus</i> .....	121
Successful Repair of Absorber in Amine Service with Organic Coating <i>Juan Carols Ruiz Rico</i> .....	128
Installing a Job Documentation System <i>James R. Sawers, M.R. Eastman, Arthur C. Ball, Steven Mistretta, Dale Savoy, Thomas Clyburn, Ian E. Welch</i> .....	137
Fatigue Cracking of Adsorber on Hydrogen PSA Unit <i>R. Davies, S. Hewerdine, and J. Chapman</i> .....	148

Mechanical Seals with Oil as Buffer in High-Pressure Centrifugal Pumps <i>Arif Jamal</i> .....	160
Experience with Metal Dusting in H <sub>2</sub> /CO/CO <sub>2</sub> /H <sub>2</sub> O Atmosphere <i>T. Shibasaki, K. Takemura, T. Mohri, and H. Hashimoto</i> .....	165
Survey of Worldwide Experience with Metal Dusting <i>Henrik Stahl and Søren Gyde Thomsen</i> .....	180
Revamp of the 1,000-STPD Ammonia Plant Steam Reformer <i>M. Boumaza and M. El Ketrroussi</i> .....	192
Equipment Performance of Ammonia Plant at 120% Load <i>Jagmohan Singh and J.J. Patel</i> .....	198
Crack Formation in Welds in Ammonia Converter-II Outlet Lines <i>David W. Dean, Henry W. King, Robert J. Mack, Craig T. Miller, and J. Ted Schultz</i> .....	207
Effects of Internal Lining Welds on Safety of Urea Plant Equipment <i>Cesare Miola</i> .....	223
Failures in Urea Reactor Vessels <i>Helmut Thielsch and Florence Cone</i> .....	232
Use of Bimetallic Tubes in Urea Strippers <i>Cesare Miola, Franco Granelli, and Giampiero Testa</i> .....	254
Coproduction of Ammonia and Methanol <i>V. Larry Shields, Niels R. Udengaard, and Bob Brinker</i> .....	259
Commissioning/Operation of Leading Concept Methanol Process <i>P.W. Farnell</i> .....	268
Ammonia Transfer Operations between Docks and Barges <i>William D. Stegbauer, Frank Holloman, and Arne Christiansen</i> .....	278
Ammonia Release from Conservation Vent during Barge Unloading <i>George M. Volker and Kenneth W. Farias</i> .....	286
Synthesis Gas Compressor Coupling Failure <i>Bob Morris and Wes Ridenhour</i> .....	296
Retrofitting the Ammonia Plant with Integrated Turbine-Compressor Control <i>Thomas R. Bailey and C. Scott Harclerode</i> .....	305
Large-Scale Multivariable Controllers for Ammonia Plant <i>Akio Ishikawa, Takehiko Baba, Takatsugu Miki, Hitoshi Ochi, and B.J. Minter</i> .....	313
Operating Experience with Thick Tubesheet Synloop Steam Generator <i>M. Podhorsky, U. Hesel, and P. Blommaert</i> .....	321