

NON-CHLORINE BLEACHING
FOCUS ON SOUTH AND LATIN AMERICA

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BRAZIL

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There are no doubts that the pulp and paper industry is living in a different world. In this world the survival laws are no longer simple to be understood. The environmental approach is part of the day-by-day life, together with ISO 9000 standards, financial performance, raw material costs, etc.

The green globalism came to stay. Following it, the green management. Man is now worried not only about his immediate surroundings, but about the whole earth.

On the other hand, quality standards for paper products are very tight, not just because consumer demands but mainly because of market competition.

Joining these higher and higher quality standards, quality of life and environment with quality mean improved business and more space gained in market share.

In this turbulent world, where a huge environmentalistic wave came with a weak market and low prices, pulp and papermakers are feeling not so confident about the future. It's a moment of crisis and opportunities.

1991 was a terrible year. Higher costs associated with lower market prices brought losses to almost all pulp mills in the world.

South American export-oriented pulp mills were recognized to be the only few which could work above break even point in 1991, making some profit. The reason is not because in these regions environmental pressures do not exist. It's a mistake to think

this way. They do exist and they are consequence of the chlorphobia and dioxin panic, and consequence of the new market pulp requirements.

The so called ABC countries (Argentina, Brazil and Chile) have proved to be very competitive in market pulp production. Mill capacity expansions are going on in reasonable speed and most are export-oriented pulp mills. This is just the time to talk about new bleaching technology, when you need to invest to build a new greenfield mill, or to debottleneck the existing facility to raise capacity.

Thus, South and Latin America couldn't be out of the race for new bleaching technology. Driving forces are primarily market forces, other than pressures from the communities. Second, mill personnel are becoming more and more aware of their role in preserving environment. Elemental chlorine gas free bleaching is now a must. Total chlorine free bleaching is something to be carefully considered.

However, every move means quite a lot of money involved and a risk factor. And today the moment is typically a time of money shortage.

Since South America is becoming stronger and stronger in pulp exports, the market forces from the consumer side have sharp influence in our market pulp mills.

AOX, dioxin, chlorine, ToCl , are the most common technical words being pronounced. The disadvantages we have are the difficulties to measure chlorinated organics to evaluate mill operation and pulp and effluent qualities.

Few companies have equipments to measure AOX levels, and dioxin evaluation must be performed abroad in all cases. An analytical laboratory to evaluate dioxin costs approximately 0,8 to 1,2 million dollars. Easier and less expensive is to buy analyses in the USA, Germany or England. Analyses of individual chlorinated organics are simpler and some labs are qualified to do it.

Dioxin phobia is up to now concentrated on pulp mills (products and effluents). Attention will also have to be paid to recycled paper. Countries like Mexico, with enormous recycling rates and huge imports of wastepapers, are very soon going to demand "environmentally friendly" wastepapers.

Brazil is regarded as the "home of the eucalyptus" and in Chile the radiata pine found a suitable place for growth. However, in the three ABC countries, both eucalyptus and pines grow well and wood cost is the key factor for competitiveness.

The steps to reach non-chlorine bleaching are the same everywhere:

1. Improving cooking and pulp washing to guarantee low kappa number and minimum dissolved organic carry-over;
2. Use of oxygen in both oxygen delignification and oxidative caustic extraction;
3. Substantial substitution rates. Chlorine dioxide is becoming the dominant bleaching chemical. Results are amazing. Effluent treatment and bleaching chemicals consumption have improved dramatically.

During years, high substitution rates have been placed in second in the technological road mainly because of cheap chlorine. Now this road has turned the way.

Chlorine gas free pulps (CGF pulps) show strong appearance and they deserve market preference.

Due to chlorine dioxide lack of availability and higher chemical costs, the pulp market is aware not to demand such high brightness levels. CGF pulp finds a place in the 87 - 88% ISO brightness range. However, we can not forget competition is a strong force, and soon brightness levels may go up again;

4. Use of hydrogen peroxide after oxygen delignification to reach 70 - 75% ISO, in some cases 80% ISO brightness (one, two or more P stages). This semi-bleached pulp has a good market, specially in Europe, for tissue manufacturing;

5. Attempts to use hydrogen peroxide in the flash drying of pulp.

This technology is an adaptation and it has been used by groundwood market pulp manufacturers. Gains of 10 - 15% on brightness are the maximum one can expect;

6. Traditional use of hydrogen peroxide in NSSC pulp bleaching of hardwoods, bamboo or bagasse.

Small tonnage NSSC pulp mills are still common in Latin America. This type of pulp can be semi-bleached to 75 - 80% brightness using hydrogen peroxide at high consistencies;

7. Total chlorine free fully bleached market pulps are expected to come on stream in a few years. Reasons are market opportunities, competitiveness and confidence on technology. Expected brightness levels are 86 - 88% ISO, but again market competition and technological achievements will push this level up;

8. Ozone is being considered the most feasible alternative, despite the well known difficulties associated with manufacturing this chemical (i.e. energy, cold water and oxygen demands);

9. Enzymes are still a question mark, however there are active biotechnologists working on it.

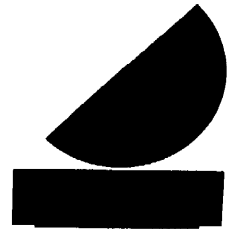
CONCLUSION

Non-chlorine bleaching is not a dream or a future plan. Since the ABC countries are golden areas for market pulp production, it's possible that very soon TCF (total chlorine free) fully bleached pulps will be available in the international market coming from South and Latin America. It's just a matter of time, better saying, short time.

***NON - CHLORINE BLEACHING
FOCUS ON SOUTH AMERICA***



CELSO FOELKEL
Director of Technology and Environment
Riocell S. A.
Brazil



NON - CHLORINE BLEACHING

PRESENT SITUATION

- DOMESTIC MARKET***
- EXPORT - ORIENTED MARKET PULP***
- PROJECTION FOR GROWTH***

**THE ENVIRONMENT
A CORPORATE CHALLENGE**

**ADAPTED FROM A CELSO FOELKEL 'S
INTERVIEW TO NEWSWEEK INTERNATIONAL:**

" THE GLOBAL APPROACH TO GREEN MANAGEMENT IS CRUCIAL, TO SAY THE LEAST. A CUSTOMER IN EUROPE, JAPAN, USA, AUSTRALIA OR SOMEWHERE ELSE MAY NOW BE WORRIED ABOUT THE LEVEL OF POLLUTION IN BRAZIL, CANADA, SWEDEN, ETC.

THEY ARE DEMANDING WE DO NOT POLLUTE A RIVER THAT THEY DON'T KNOW, AND PROBABLY WILL NEVER SEE DURING THEIR ENTIRE LIFE.

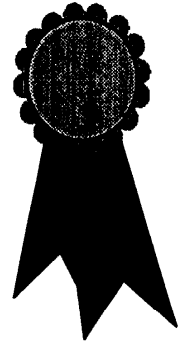
THIS IS THE NEW GLOBALISM, MAN WORRIED NOT JUST ABOUT HIS IMMEDIATE SURROUNDINGS BUT ABOUT THE WHOLE EARTH "

Environment Quality or Environment with Quality



THE NEW TECHNOLOGICAL ENVIRONMENT

- Higher Standards**
- Lower Costs**
- Better Processes**
- Quality of Life**
- Customer Support**



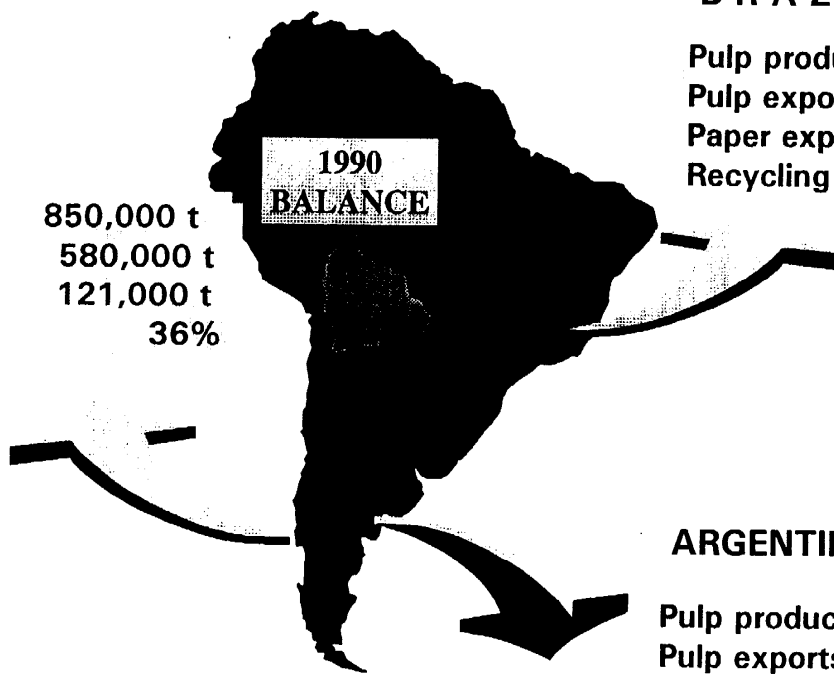
SOUTH AMERICA : GREAT POTENTIAL FOR MARKET PULP PRODUCTION

B R A Z I L

Pulp production: 4,500,000 t
Pulp exports: 1,050,000 t
Paper exports: 950,000 t
Recycling rate: 30%

C H I L E

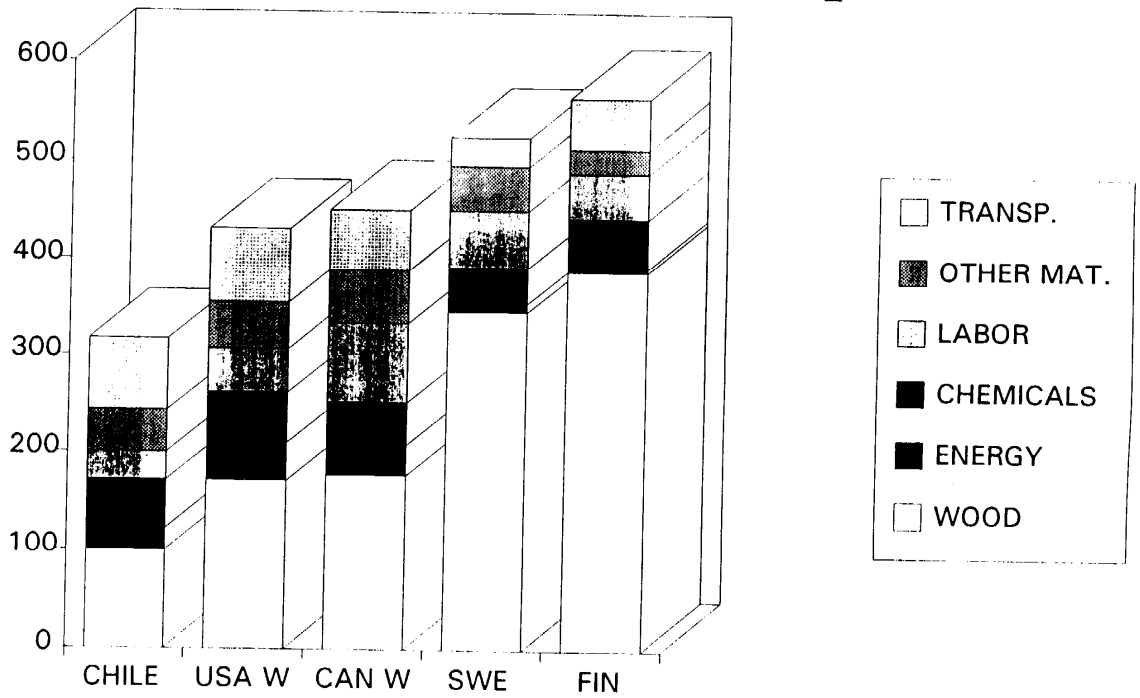
Pulp production: 850,000 t
Pulp exports: 580,000 t
Paper exports: 121,000 t
Recycling rate: 36%



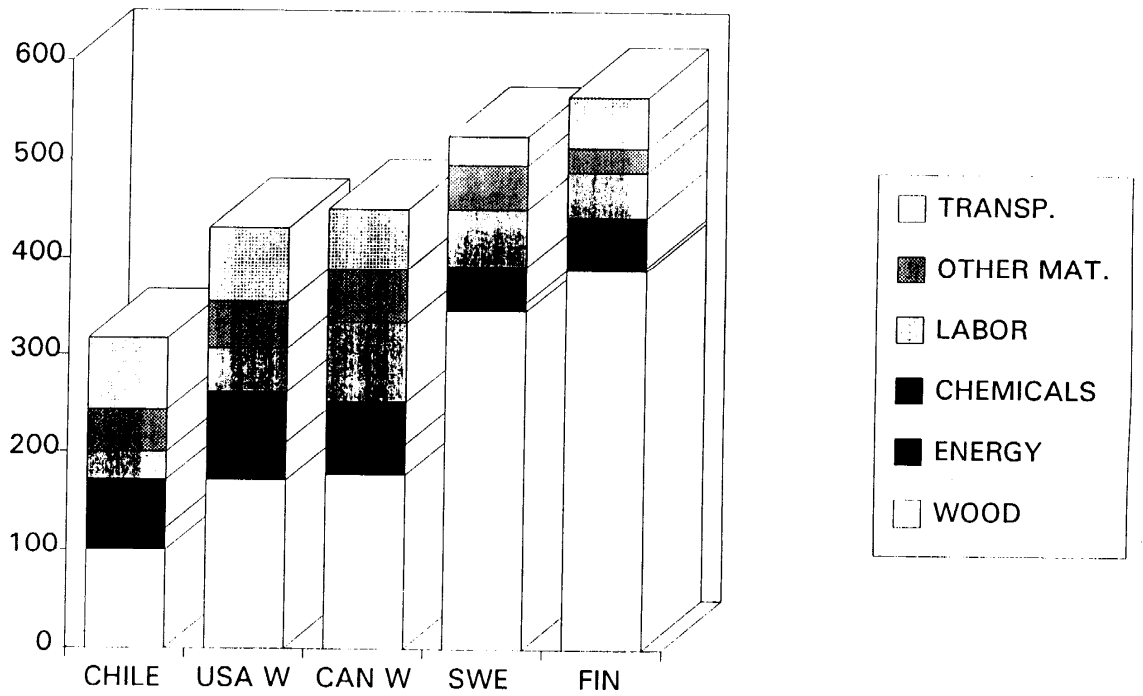
A R G E N T I N A

Pulp production: 720,000 t
Pulp exports: 120,000 t
Paper exports: 135,000 t
Recycling rate: 36%

BSKP Variable Costs 1990 Delivered Northern Europe



BSKP Variable Costs 1990 Delivered Northern Europe



STEPS TO REACH NON CHLORINE BLEACHING

1. OXYGEN DELIGNIFICATION AND OXIDATIVE CAUSTIC EXTRACTION

2. SUBSTANTIAL SUBSTITUTION: CHLORINE X CHLORINE DIOXIDE

" AMAZING SURPRISES "

3. USE OF HYDROGEN PEROXIDE AFTER OXYGEN DELIGNIFICATION TO REACH 70 - 75% ISO, IN SOME CASES 80% ISO (TWO OR MORE P STAGES)

4. ATTEMPTS TO USE HYDROGEN PEROXYDE IN THE FLASH DRYING OF PULP

RESULTS: 10 - 15% ISO BRIGHTNESS GAINS

**5. TRADITIONAL USE OF HYDROGEN PEROXIDE
IN NSSC PULPS OF HARDWOODS, BAMBOO OR
BAGASSE.**

**BLEACHING ON HIGH CONSISTENCIES, ONE
OR TWO STAGES (3.5 TO 6.0% H₂O₂)**

NON CHLORINE BLEACHING TO 75% ISO

**6. TOTAL CHLORINE FREE MARKET PULPS
EXPECTED TO COME ON STREAM IN A FEW YEARS
(MARKET PRESSURES AND COMPETITIVENESS FOR
GAINING MARKET SHARE)**

BRIGHTNESS 86 - 88% ISO

**7. OZONE IS BEING CONSIDERED AS THE MOST
FEASIBLE ALTERNATIVE**

O Z Eo P

O Z Eo PP

**BLEACHING EUCALYPTUS KRAFT PULP
NON CHLORINE BLEACHING SEQUENCE**

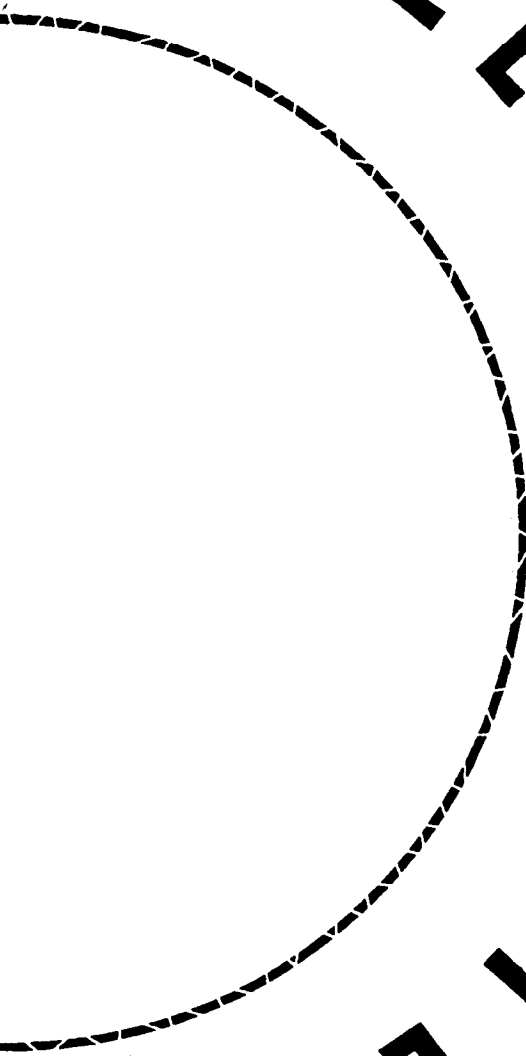
	O	Z	E₀	P
% CHEMICAL CHARGE	1.3	0.5	1.5% NaOH 0.4% O₂	1.25
KAPPA NUMBER	8	1.8	< 1	----
VISCOSITY	25	16	14	12
% ISO BRIGHTNESS	50	70	80	87

XMCC UNBLEACHED KRAFT PULP - KAPPA NUMBER = 13 - 14
0.5% CED VISCOSITY = 40 cP

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SESSION I—ENVIRONMENTAL ISSUES & TECHNICAL TRENDS

Panel: Regulatory Issues by Country

Dr. Nils Hartler, Professor, The Royal College of Technology, Sweden

Matthew B. Van Hook, Senior Environmental Counsel, American Paper Institute

Dr. Walter Peter, Production Manager, Lenzing AG, Austria

Dr. Peter Sligh, Environmental Manager, Tasman Pulp & Paper Co., New Zealand

Dr. Raimo Malinen, Vice President, The Finnish Pulp & Paper Research Ins., Finland

Doug Pryke, Environmental Consultant, Canada

Tutorial: Critical Examination of Bleach Plant Operations

Dr. Rudra P. Singh, President, Emerging Technology Transfer, Inc.

The Economic Impact of Implementing Chlorine-Free and Chlorine Compound-Free Bleaching Processes

Dr. Richard B. Phillips, Vice President/Director, International Paper

SESSION II—PRE-BLEACHING TECHNOLOGIES

Tutorial: Extended Delignification in the Mills

Dr. Martin MacLeod, Senior Scientist, Pulp and Paper Research Institute of Canada (Paprican)

Worldwide Survey of Mill Installations

Dr. Martin MacLeod, Paprican, Canada

Reduction of Chlorine by Vai-Xylanase in Kraft Pulp Bleaching

Dr. Michael Sinner, Vice President, Voist-Alpine, Austria

Status of Enzyme Bleaching R&D and Mill Work

Dr. Roberta L. Farrell, Executive Director of Research, Repligen-Sandoz Research Corp.

SESSION III—OXYGEN DELIGNIFICATION & BLEACHING

Tutorial: Basic Principles of Oxygen Delignification & Oxidative Extraction

Dr. J.S. Gratzl, Distinguished Professor, North Carolina State Univ.

Tutorial: Process Technology, Machinery, Advantages & Disadvantages

W.J. Miller, Manager of Process Technology, Ingersoll-Rand, IMPCO Division

Worldwide Survey of Oxygen Bleach Plants

Anthony P. Johnson, Senior Staff Specialist, Simons-Eastern Consultants, Inc.

Panel: Supplier Systems Update

Vincent Magnotta, Technical Manager, Air Products and Chemicals, Inc.

Lewis Shackford, Products & Technology Manager, Ingersoll-Rand, IMPCO Division

Robert H. Collins, Director of Marketing, Kamy, Inc.

Mike Dimitriou, Manager of Sales & Marketing, Ozonia

Jeffrey E. Angulo, Technical Service Engineer, Du Pont

Nils Johansson, Director, Technical Marketing, Eka Nobel, Sweden

**SESSION IV—TECHNICAL TRENDS IN OXYGEN, PEROXIDE
DELIGNIFICATION & BLEACHING**

Tutorial: Peroxide Delignification & Bleaching

Ross Anderson, Market Development Manager, Du Pont Canada Ltd., Canada

The Potential of Lignox and Complementary Combinations

Dr. Jiri Basta, Eka Nobel, Sweden

Current State-of-the-Art of E/O, E/P, & E/OP Technologies

Calvin Hastings, Senior Process Engineer, H.A. Simons Ltd. and Kristina Idner, AF-IPK, Sweden

Panel: Mill Operations Update

Gene Boatwright, Technical Director, Alabama River Pulp Co.

Dr. Walter Peter, Lenzing AG, Austria

Dr. Celso Foelkel, Technology & Environment Director, Riocell, Brazil

Fred Munro, Process Engineer, E.B. Eddy Forest Products, Canada

Bruce Burns, Technical Manager, Crestbrook

Cathy Ali, Chemical Engineer, Procter & Gamble

SESSION V—OZONE BLEACHING I—GENERAL CONSIDERATIONS

Tutorial: Ozone Bleaching: Chemistry, Technology, Process Variables,

Pulp Quality: Advantages & Disadvantages

Dr. Rudra P. Singh, Emerging Technology Transfer, Inc.

Commercial Implementation of Ozone Bleaching Technology

Lewis Shackford, Ingersoll-Rand, IMPCO Division

Ozone Bleaching Technology '92

Brian F. Greenwood, Manager of R&D, Kamyr Inc.

SESSION VI—OZONE BLEACHING II: EMERGING TECHNOLOGIES TODAY

Piloting of Ozone Bleaching on the Global Scene

Norman Liebergott, Paprican, Canada

Status of Pilot Plant Activities Worldwide:

AUSTRIA: Albert Vitan, Project Manager, Voest-Alpine;

CANADA: Fred Munro, E.B. Eddy Forest Products; Norman Liebergott, Paprican;

FRANCE: Dr. Dominique Lachenal, Prof., Grenoble Univ.;

GERMANY: H.W. Schubert, Leader of Pilotplant, ASAM Beinfurt

Experience with a MC-Ozone Bleaching Prototype in the Mill

Dr. Walter Peter, Dr. H. Sixta, Lenzing AG, Austria

SESSION VII—CHLORINE-FREE BLEACHING--CURRENT STATUS & FUTURE TRENDS

State-of-the-Art by Region

EUROPE: Dr. Hans U. Suess, Degussa AG, Germany;

SCANDINAVIA: Dr. Raimo Malinen, Finnish Pulp & Paper Institute, Finland;

NORTH AMERICA: Doug Pryke, Canada;

SOUTH AMERICA: Dr. Celso Foelkel, Riocell, Brazil;

PACIFIC RIM: Dr. Robert W. Allison, Group Leader, Chemical Engineering, PAPRO, New Zealand

Panel: Emerging Technologies in the Future

Dr. Ronald J. Slinn, Vice President, American Paper Institute;

Dr. Rudra P. Singh, Emerging Technology Transfer, Inc.;

Dr. Dominique Lachenal, Center Technique Du Papier, France;

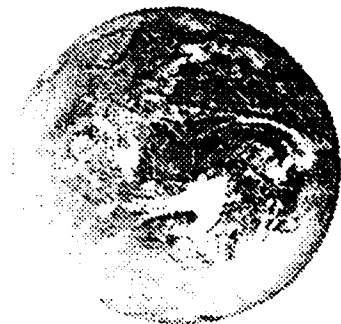
Dr. Raimo Malinen, The Finnish Pulp & Paper Research Institute

Dr. Steve Moldenius, Technical Director, Sodra Cell, Sweden

Dr. Hans U. Suess, Degussa AG, Germany

NON-CHLORINE BLEACHING

**Emerging
Technologies
Today and in
the Future**



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PROCEEDINGS

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