# 4.0 CUMULATIVE IMPACT ASSESSMENT

The cumulative impact assessments include the potential effects associated with existing projects and conditions, those of the proposed projects, and those of other developments that are realistically defined at the time the assessment is prepared and would impact directly on the project area.

The projects' area of influence includes the primary project sites and related facilities; associated facilities that are not funded as part of the project but whose existence depends exclusively on the project and whose goods or services are essential for the project; areas potentially affected by cumulative impacts; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later in time or at a different location. The area of influence considered in this study is the western Uruguayan departments of Río Negro, Soriano and Paysandú as well as the Río Uruguay littoral of the Argentine department of Gualeguaychú.

For this CIS, the primary projects considered are the Orion and CMB pulp mills under development by Botnia and ENCE, respectively, and their associated facilities and areas of influence as described in their disclosed EIAs.

Additional projects or facilities have been incorporated into this CIS on an individual basis by discipline, based upon the judgments of the team members in that discipline. For example, the discharge from the Fray Bentos domestic waste water collection system has been included in the water quality assessment due to its significance in the existing environment, the possibility that it could be upgraded in conjunction with project development, and its implications for cumulative impacts on the aquatic environment in the vicinity.

The temporal boundaries for this CIS are provided by the major milestones in the projects' life cycles. The significant steps in their life cycles include: feasibility and detailed design; construction; operation and maintenance; and decommissioning. The timelines of the two proposed projects are not synchronous. One is under active construction and believed to be 1 or 2 years ahead of the other at the time of writing, although both companies had completed their EIAs for disclosure by mid-2005. Present expectations are that Botnia will be prepared to start operation of the mill in 2007 and ENCE would start up in 2009.

A forty year life for the plants has been adopted for this CIS, though the actual life of the plants may vary depending upon technological and economic developments that cannot be reliably predicted this far in advance. Decommissioning has not been considered in detail in this study for similar reasons; there is ample time during the projects' lives to develop and implement an appropriate decommissioning plan.

Finally, accidental or emergency events have not been included in this CIS due to their rare and unpredictable nature. Both companies have prepared emergency response plans for such unpredictable events and are making the necessary preparations for their

implementation at the appropriate phase of the projects' development. The individual project EIAs present each company's emergency preparedness and response plans as of the time of their release.

## 4.1 Methodology

### 4.1.1 CIS Process

The CIS process began in 2005 following the release of the individual project environmental and social impact studies and associated stakeholder consultations, at which time, the IFC decided that further study was required to assess the cumulative effects of the two pulp mills. The IFC contracted Pacific Consultants International (PCI) to complete the draft CIS report and contracted the Consensus Building Institute to conduct a stakeholder assessment. Further specialists and resources were contracted by PCI during the preparation of the draft CIS report. Among these specialists was a team of Uruguayan and Argentine social scientists commissioned to undertake a social assessment of Paysandú, Río Negro, Soriano and Gualeguaychú departments to strengthen the socio-economic baseline data considered in the CIS. In addition, Malcolm Pirnie Incorporated was retained to provide expertise on air and water modeling. IFC also retained a specialist consultant/advisor with expertise in cumulative impacts assessment to assist with the CIS.

Several developments influenced the CIS process. The conflict between Argentina and Uruguay concerning the two mills was escalating and affecting diplomatic relations, transportation, trade and tourism between the two countries. Opponents were concerned that the two mills would harm human health, the environment and the region's economy. Protests by Argentine residents and environmental groups from Argentina and Uruguay blocked routes to international bridges, with the longest blockade lasting 45 days. The conflict has also included complaints being filed at the International Court of Justice (ICJ) of The Hague and the Mercosur (Southern Common Market) Tribunal. The ICJ issued a provisional ruling that Uruguay could continue building the two pulp mills while the overall case was being considered. The ruling of the Mercosur Tribunal found that Argentina did not take necessary action to guarantee free circulation of goods and services into Uruguay however did not specify future conduct or compensation for losses.

In September 2005, the Centre for Human Rights and Environment (Centro de Derechos Humanos y Ambiente, CEDHA) filed a comprehensive complaint to the World Bank's Office of Compliance Advisory Ombudsman (CAO). The complaint was filed on behalf of the Entre Ríos Governor, the Citizens Environmental Assembly of Gualeguaychú and nearly 40,000 other signatories. Among a range of concerns articulated, the complaint requested that the CAO examine whether appropriate process was followed in the preparation of mill-related environmental and social assessments, whether the views of and issues raised by concerned citizens—particularly in Gualeguaychu—were taken into account, and asked that the CAO audit the extent to which IFC had complied with its environmental assessment

requirements and other related policies. The complaint also alleged that the Government of Uruguay had not complied with the Rio Uruguay Treaty.

Key findings of the CAO found that there were shortcomings in the earlier consultation process concerning the projects, particularly a lack of adequate engagement with concerned citizens in Gualeguaychú, that concerns regarding impacts of the plants on tourism and fisheries had not been adequately covered in the project EIAs, and. Among other steps, the CAO recommended that a cumulative assessment process already underway continue and that it should thoroughly address stakeholder concerns and include more specific information on plant technology and related environmental impacts (and how they relate to best practice in the industry). Subsequently, CAO encouraged all parties to participate in the consultation process associated with the draft CIS and engage on a more "respectful" basis. The CAO then undertook a subsequent audit which was released in February 2006 which found that IFC had prematurely agreed to release of the project EIAs prior to an adequate cumulative impact study being conducted and recommended that procedures be implemented related to posting of documentation on external websites, collaboration of IFC and MIGA, and completion of all material environmental impact assessment (in this case cumulative impact assessment) prior to public disclosure.

The draft CIS and the CBI stakeholder assessment were released in December 2005. As noted in the CBI stakeholder assessment, various stakeholders declined participation stating that the terms of engagement needed to be clarified and the assessment process was rushed. In recognition of the shortcomings of the previous consultation process, and to ensure thorough coverage of stakeholder concerns in a final CIS, IFC opened a 60-day consultation period on December 19, 2005 to receive feedback from stakeholders on the consultation process and the scope, methodology and findings of the draft CIS. With the intent of implementing a transparent and meaningful public engagement process, the IFC developed a consultation process that included: making the draft CIS available for public review; obtaining written stakeholder feedback through an online submission mechanism and at several meetings in Uruguay and Argentina facilitated by an independent third party (January/February 2006); inviting the governments of Argentina and Uruguay to nominate technical experts to assess stakeholder concerns; making the terms of reference for the role of the experts and the experts' findings and recommendations available for public review; and providing an action plan to respond to the experts' findings and recommendations.

More than 100 written comments were submitted during the consultation period and posted on the IFC website (www.ifc.org/ifcext/lac.nsf/Content/Uruguay_PulpMills_Consultation) as well as the transcript of the consultation meetings held in the two countries. Members of the expert panel were drawn from among a pool of technically qualified nominees by IFC following the decision by both Governments to decline the opportunity to nominate a panelist. The expert panel reviewed the feedback received, as well as all existing project related documentation and presented their findings to IFC. The independent expert panel report, referred to as the Hatfield Report, was released in April 2006 and provided

recommendations for the revision of the draft CIS in response to identified stakeholder concerns and their own professional judgment.

For the final phase of the environmental due diligence process, the IFC released an action plan in May 2006 that identified key issues to be addressed in the revised CIS. The action plan indicates that the revised CIS will be reviewed by the expert panel to verify consistency and responsiveness to the recommendations in the Hatfield Report. This review process is designed to ensure that stakeholder concerns are addressed in the final CIS. The terms of reference for the revised CIS have incorporated stakeholder concerns identified in the Hatfield Report. The final CIS will be released to the public for 30 days upon completion prior to any potential consideration of the projects by IFC's and MIGA's Board of Directors.

Following a competitive bidding process among pre-qualified environmental consulting firms, EcoMetrix Incorporated (EcoMetrix) was retained by the IFC in July 2006 to revise and finalize the draft CIS. Revisions were completed in response to the recommendations of the Hatfield Report, the published Terms of Reference, original research, stakeholder commentary and other project related documentation.

### 4.1.2 Public Consultation and Engagement

Public engagement assisted in the scoping and focusing of the contents of the draft CIS and became more comprehensive and structured upon public release of the draft in December 2005. The policy requirements relevant to these projects because they were in effect at the time IFC initially appraised the pulp mills indicate that public consultation and disclosure activities are integral components of the EIA process for projects that IFC finances. In this respect, both Botnia and ENCE carried out consultation activities in support of their EIA activities for their respective projects. Table 4.1-1 summarizes the two projects' consultation and disclosure activities between July 2002 and November 2005. The consultations listed were carried out, in part, to comply with Uruguayan environmental assessment disclosure and consultation requirements for their projects but also, according to the sponsoring companies, to promote understanding and build support for the projects among concerned and interested parties in Argentina and Uruguay.

As part of the CIS process, IFC contracted the Consensus Building Institute (CBI) – a non-profit organization specializing in facilitated dialogues, mediation and negotiation – to carry out an additional independent assessment of stakeholder perceptions and concerns about the mills and recommend strategies for possible stakeholder dialogue. The purpose of the assessment was to: better inform the IFC and other stakeholders about the range and depth of stakeholder concerns and perceptions regarding the mills; and recommend potential ways to engage stakeholders in a dialogue and a review of the draft CIS.

The stakeholder assessment reflects more than 80 interviews with a diverse range of stakeholders related to the proposed mills. CBI conducted most interviews during the final weeks of November in the two populated areas closest to the proposed plants, Fray Bentos, Uruguay, and Gualeguaychú, Argentina, and in Montevideo, Uruguay; Buenos

Aires, Argentina; and Washington, DC. CBI's team of six assessors included two from Argentina, one from Uruguay and three from the United States.

CBI sought to interview stakeholders representing the full range of opinions about the mills. CBI identified and spoke with civil society groups, non-governmental organizations (NGOs), business associations, public officials, and interested citizens such as tourism operators, local business owners, fishermen, farmers and plantation owners. CBI also spoke with IFC and representatives of Botnia and ENCE. Several stakeholders who oppose the mills declined interview requests, citing concerns that IFC had not established clear terms of engagement for stakeholder consultation.

The stakeholder assessment revealed a sharp divide between stakeholders who are optimistic about jobs and economic development stemming from the mills and stakeholders who see the projects as a fundamental threat to the environment, tourism, agriculture, fishing and their overall quality of life. CBI grouped stakeholder concerns and perceptions into the following areas:

- economic development and job opportunity;
- community quality of life;
- eucalyptus plantations and changing land use;
- effects on fishing and agriculture from pollutants; and
- appropriateness of proposed plant sites, controls and monitoring.

CBI also asked stakeholders about their perceptions of a possible joint review of the mills' impacts. Many stakeholders said a joint review of the draft CIS might offer a useful opportunity to address their concerns and issues. However, many stakeholders were skeptical, and said they would require assurances that joint review of the mills impacts would be meaningful and transparent; include broad stakeholder representation; provide opportunity for the review of all credible information; and respect sovereignty and community self-determination.

The CBI assessment notes that those stakeholders most optimistic about the mills' positive impacts and those most concerned about their negative impacts had become highly polarized and mutually distrustful. In order for the joint review to be productive, it needed to be based on explicit commitments from the concerned national and sub-national governments, IFC, the companies proposing to build the mills, and civil society stakeholders in both Uruguay and Argentina to engage in a good faith effort to resolve substantive questions about the mills impacts, and to explore the full range of siting, design, construction and operational options.

The findings of CBI's stakeholder assessment are summarized below in Table 4.1-2 and the full assessment report is attached as Annex G to this report. These findings are generally consistent with the views that have been expressed by stakeholders in earlier consultations undertaken by each of the companies as well as with representations made by public interest groups to IFC regarding project concerns subsequent to the disclosure of

the EIA documentation for both projects. Subsequent to the public disclosure of the draft CIS, CBI issued its recommendations for public engagement between IFC, the companies and stakeholders in the review of the draft CIS findings. These recommendations, along with the technical analysis of the degree and range of expected cumulative impacts, helped guide the process of further engagement.

In addition, the Office of the IFC/MIGA Compliance Advisor Ombudsman (CAO) also met with a significant number and diverse representation of stakeholders in response to a complaint received on September 23, 2005. The complaint alleged that the projects will create toxic, noxious emission incompatible with tourism and agriculture and also raised concern about the regulatory capacity to monitor and enforce environmental standards[5].

The polarization of stakeholder views regarding the pulp projects and decision by some in Argentina not to fully participate in consultations has led to allegations that the process was not thorough or adequately participatory. However, the volume and diversity of comments offered in a large number of different forums, the extensive written documentation of stakeholder concerns received, and the expert panel's review of those concerns suggests that issues of relevance are now well-known and have been subsequently addressed in the CIS.

With respect to stakeholder views and engagement, however, it is important to indicate that large numbers of Argentines , particularly those living within the community of Gualeguaychu and affiliated environmental NGOs, most notably ACAG and CEDHA, as well as the Government of Argentina remain opposed to the mills in their present location and continue to vigorously pursue this opposition via the International Court of Justice, deliberations of the World Bank Group, commercial lenders, the Organization for Economic Cooperation and Development.

### 4.1.3 Analysis of Cumulative Impacts

This study has employed a number of specialized techniques and methodologies for the analysis of cumulative impacts by discipline. Several of these are described in the annexes to this report in addition to those described herein. They include sophisticated, standardized computer modeling techniques for the analysis of air emissions and effluents to water. Other methodologies used are generally quantitative to the extent that is feasible in the given discipline and within the constraints of this particular study, while other methodologies are qualitative in nature and rely significantly, if not primarily, on the experience-derived judgments of the relevant expert(s) on the CIS technical team.

[5] Information on the activities of the CAO with respect to these projects can be found at the following web site: http://www.cao-ombudsman.org/html-english/complaint_cmb.htm.

#### *4.1.3.1 Methodology for Assessment of Air Quality*

The assessment of air quality and related impacts of pulp mill emissions primarily involved mathematical modelling of atmospheric dispersion, and the prediction of ground level ambient air quality for comparison to air quality criteria. The assessment was supported by a literature review of human health and odour effects associated with common air emissions.

Models are widely used to support the assessment of air quality effects since they can reliably calculate the change in air quality based on fundamental laws of physics, chemistry and mass conservation. They provide the only viable means to estimate change under a wide range of meteorological conditions especially when the infrastructure being evaluated has not yet been built.

Two types of models were utilized for this assessment – meteorological models and air dispersion models.

Meteorological models were used to augment the available meteorological data to provide a complete representation of the three-dimensional wind field within the general area of the mill sites. This was completed using CALMET coupled with a non-hydrostatic meso-scale weather forecast model referred to as FReSH (Radonjic, 2005). The modeling approach involved three main steps. First, weather predictions were obtained at six-hour increments from the United States National Center for Environmental Prediction (NCEP) over a coarse grid that extended over the Southern portion of South America. Second, FReSH utilized the NCEP data to generate a three-dimensional wind field at hourly intervals over a 3.3 km square grid within the general region of the proposed mill facilities. Third, the CALMET model was used to refine the predicted wind field to a 200 m square grid within a 60 by 40 km area centered on the two mill sites.

Air dispersion models were used to predict the change in ground level air quality attributed to the air emissions from the mill operations. Two air dispersion models were used for this assessment – the Industrial Source Complex Short Term version 3 (ISCST3) model and the CALPUFF model. These models are widely used and accepted, and, in the case of CALPUFF, considered state-of-the-science. Both models are approved by the United States Environmental Protection Agency (USEPA) and are available within the public domain. As a conservative measure, both models were run and used in the assessment of ambient air quality.

The analysis of ground level ambient air quality utilized the predicted hourly wind field for the 2004 period. Figure 4.1-1 provides a comparison of the predicted and measured wind roses. Based on this comparison, it is concluded that the predicted wind field provides a suitable representation of the winds near the two mill sites. The wind roses show that the dominant wind direction is from the north to northeast quadrants.

Ambient air quality results were considered at specific locations of interest (receptor locations). These locations included:

- Air Receptor 1, area immediately adjacent to the mill properties, Uruguay;
- Air Receptor 2, city of Fray Bentos, Uruguay;
- Air Receptor 3, city of Mercedes, Uruguay;
- Air Receptor 4, city of Nuevo Berlin, Uruguay;
- Air Receptor 5, beach area at Las Cañas, Uruguay;
- Air Receptor 6, beach area at Playa Ubici, Uruguay;
- Air Receptor 7, International Bridge, Uruguay;
- Air Receptor 8, city of Gualeguaychú, Argentina; and
- Air Receptor 9, beach area at Nandubaysal, Argentina.

#### *4.1.3.2 Methodology for Assessment of Water Quality*

The assessment of water quality and related impacts of pulp mill effluents on the Río Uruguay primarily involved mathematical modelling of effluent dispersion in the river to determine resulting concentrations of effluent constituents, for comparison to water quality guidelines and existing baseline concentrations. The assessment was supported by review of literature pertinent to some water quality concerns, particularly dioxins and furans, endocrine disrupting compounds, and chemicals associated with fish tainting. The assessment of sediment quality impacts was based on consideration of the potential for change in water quality, including suspended sediment loads, and on consideration of the conditions required for sediment mobilization.

Two types of mathematical models were utilized in calculating effluent dispersion and concentrations of effluent constituents in the Río Uruguay. Near-field models predict water quality changes near to the point of effluent discharge, based on the diffuser configuration and discharge characteristics, such as effluent temperature, density and release rate, as well as local river geometry, diffuser and river depth, river flow and temperature, etc. Far-field models predict water quality changes farther from the point of discharge, beyond the initial mixing zone, based on the hydrodynamics, bathymetry and shoreline geometry of the river.

Two near-field models were utilized. The CORMIX model developed by Cornell University (Akar and Jirka, 1990) was used as the primary near-field modelling tool. The VPLUME model distributed by the U.S. Environmental Protection Agency (Frick *et al.*, 2001) was used to provide a cross-check on the CORMIX model results, to ensure that the analysis was valid and conservative.

The far-field modelling was performed using the TABS-MD series of models, available from the U.S. Army Corps of Engineers. Specifically, RMA-2 and RMA-10 are two- and three-dimensional finite element hydrodynamic models. RMA-2 computes the lateral and longitudinal distribution of water surface elevation and horizontal velocity, while RMA-10 includes the vertical distribution of velocity to enable assessment of stratified waterbodies.

RMA-11 is a water quality sub-model, a three-dimensional finite element model capable of calculating the transport, dispersion and fate of water quality constituents, using the hydrodynamic results from RMA-2 or RMA-10.

The implementation of the models is described in Annex D, Section D5.1, and is briefly summarized here. Bathymetric data for the Río Uruguay were taken from published hydrographic charts. Hydrodynamic input data included river flow data at the Salto Grande dam, and water elevation data at Las Cañas. Wind data were utilized from various stations along the Río Uruguay.

The far-field hydrodynamic model was calibrated by comparing predicted and measured water elevation data for various locations along the Río Uruguay, for 05 to 25 January 1997, and adjusting the model's coefficient of roughness to maximize agreement between observed and predicted values. The calibrated model was then validated by running it for a different period (05 to 25 February 1997) in which flow conditions at the Salto Grande dam were quite different and again comparing observed and predicted water elevations. It was concluded that the hydrodynamic model accurately predicts flow dynamics along the Río Uruguay below the Salto Grande dam.

Baseline water quality conditions in the Río Uruguay were taken from Algoritmos (2006). These are average concentrations of key water quality parameters based on five water samples collected at each of ten river locations in 2005, under near average flow conditions. The locations ranged from upstream of the proposed ENCE discharge to Balneario Las Cañas.

The physical characteristics of the effluent discharges (diffuser configurations) were provided by Botnia and ENCE (Table 4.1-3). The chemical characteristics of the effluents were also provided by Botnia and ENCE. They are summarized in Table 4.1-4 as annual average and monthly maximum values, generally loadings per air dry ton (ADt) of production. These loadings were multiplied by 1,000,000 ADt/year for the Orion mill, and 500,000 ADt/year for the CMB mill, to estimate the chemical release per year.

The modelling was completed for different river flow and effluent discharge scenarios, including: typical river flow (6,230 $m^3/s$) and monthly maximum mill discharge; extreme low river flow (500 $m^3/s$) and monthly maximum mill discharge; and river flow reversal (rare) and monthly maximum mill discharge. Various wind conditions under low flow conditions were also investigated.

For each of these scenarios, water quality results were considered at specific river locations of interest (receptor locations). These locations included:

- Water Receptor 1, Río Uruguay at the Botnia and ENCE diffusers, Uruguay;
- Water Receptor 2, Río Uruguay at Yaguareté Bay, Uruguay;
- Water Receptor 3, Playa Ubici at Yaguareté Bay, Uruguay;
- Water Receptor 4, Fray Bentos drinking water intake, Uruguay;

- Water Receptor 5, beach area near Arroyo Fray Bentos, Uruguay;
- Water Receptor 6, beach area at Las Cañas, Uruguay;
- Water Receptor 7, Río de la Plata, Uruguay;
- Water Receptor 8, Río Uruguay Island Delta, Uruguay;
- Water Receptor 9, Río Negro, Uruguay;
- Water Receptor 10, Río Uruguay on the Argentina side; and
- Water Receptor 11, beach area at Nandubaysal, Argentina.

Several project options were also considered, in terms of effect on the combined mill loadings to the Río Uruguay. These included the option to treat the Fray Bentos municipal effluent within the Botnia mill effluent treatment system.

**Table 4.1-1: Disclosure and Consultation Activities for Botnia and CMB**

| Type* | Participants | Year | Date | Location | Company |
|---|---|---|---|---|---|
| A | Senate's Environmental Commission | 2002 | 15-July | Montevideo | ENCE |
| B | Forest Producers Association | 2002 | 16-July | Montevideo | ENCE |
| A | Minister for Housing, Planning, Env, DINAMA | 2002 | 17-July | Montevideo | ENCE |
| A | City Mayor and Río Negro Representatives | 2002 | 18-July | Fray Bentos | ENCE |
| D | CARU | 2002 | 19-July | Paysandú | ENCE |
| D | Departmental Councils | 2002 | 19-July | Las Cañas | ENCE |
| B | Eufores Local Staff | 2002 | 19-July | Fray Bentos | ENCE |
| E | Local Press | 2002 | 20July | Fray Bentos | ENCE |
| C | Local Environmental NGOs | 2002 | 20-July | Fray Bentos | ENCE |
| C | Trade Union Association Panels | 2002 | 22-July | Montevideo | ENCE |
| D | Technicians/academics (Pulp Seminar) | 2002 | 26-27 July | Montevideo | ENCE |
| A | DINAMA | 2002 | November | Montevideo | ENCE |
| C | Open house | 2002 | June-July | Fray Bentos | ENCE |
| D | Public Hearing | 2002 | 21-July | Fray Bentos | ENCE |
| E | Media Press Release | 2003 | 24-October | Regional | Botnia |
| E | Media Press Conference | 2003 | 30-October | Montevideo | Botnia |
| A | Argentine Environmental Authorities | 2003 | 03-November | Buenos Aires | Botnia |
| C | First Meeting with NGOs | 2003 | 04-November | Montevideo | Botnia |
| D | Informative Meeting with Río Negro | 2003 | 05-November | Fray Bentos | Botnia |
| D | Public Forum Soriano and Río Negro | 2003 | 02-December | Fray Bentos | Botnia |
| E | First Journalist Familiarization Tour | 2003 | February | | Botnia |
| D | Scientific Seminar | 2004 | March | FB and M | Botnia |
| D | Informative Meeting Mercedes | 2004 | March | Mercedes | Botnia |
| D | Informative Meeting Fray Bentos | 2004 | 01-March | Fray Bentos | Botnia |
| D | Informative Meeting Fray Bentos | 2004 | 26-March | Fray Bentos | Botnia |
| E | Press Conference Montevideo | 2004 | June-July | Montevideo | Botnia |
| E | Second Journalist Familiarization Tours | 2004 | June | Finland | Botnia |
| A | Presidents pf CARU | 2004 | June | Buenos Aires | Botnia |
| E/D | Publication of Espacio Botnia | 2004 | August | | Botnia |
| A | First Authorities Delegation (Political Parties) | 2004 | 1-8 August | Finland | Botnia |
| C | Public Hearing | 2004 | 28-29 October | Concordia, AR | Botnia |
| D | Public Hearing | 2004 | 21-December | Aromina | Botnia |

| | | | | | |
|---|---|---|---|---|---|
| E | Television Espanola | 2005 | 20-January | | ENCE |
| A | Agregados Navales | 2005 | 04-March | | ENCE |
| A | Transport Minister and commission | 2005 | 03-April | Montevideo | ENCE |
| D | Pulpwood Conference | 2005 | 14-April | Montevideo | ENCE |
| A | Canadian Ambassador and Comission | 2005 | 26-April | | ENCE |
| C | Radio Interview/Gualeguaychú | 2005 | 9-May | Gualeguaychú | |
| A | Deputies from PP Movement | 2005 | 20-May | | ENCE |
| A | Deputies from PP Paysandú/Nacional | 2005 | 03-June | | ENCE |
| A | Spanish Diplomatic Commission | 2005 | 06-June | | ENCE |
| A | Deputies Patrone and Varela | 2005 | 21-June | | ENCE |
| E | Radio and TV adds | 2005 | 18-July | | Botnia |
| A | Uruguayan Diplomats | 2005 | July | Montevideo | ENCE |
| E | Media of Montevideo | 2005 | 11-August | | ENCE |
| A | Meeting with Senator Rafael Michelini | 2005 | 12-August | | ENCE |
| D | Reps of CARU and Forest Producers Society | 2005 | 17-August | | ENCE |
| A | National Administration of Ports | 2005 | 22-August | Montevideo | ENCE |
| D | Stakeholder consultations with IFC | 2005 | 28 Aug-Sept 2 | | Botnia |
| D | Stakeholder consultations with IFC | 2005 | 28 Aug-Sept 2 | | ENCE |
| B | FEMESA Assoc of Spanish Companies in UR | 2005 | 30-Augist | Montevideo | ENCE |
| A | Comission of Environmental Deputies | 2005 | 31-August | | ENCE |
| D | Participation in the Rural Exhibition in Prado | 2005 | | Prado | ENCE |
| E | Participation on TV Program Americando | 2005 | August | | ENCE |
| A | Comission for Labor Deputies | 2005 | 09-September | | ENCE |
| A | Junta Departamental Paysandú | 2005 | 21-September | Paysandú | ENCE |
| E | Interview with BBC Journalists | 2005 | 28-September | | ENCE |
| A | Minister of Labor and Commission | 2005 | 30-September | Montevideo | ENCE |
| A | Deputies Mañana and Borsari | 2005 | 20-October | Montevideo | ENCE |
| A | President of Uruguay | 2005 | 21-October | Montevideo | ENCE |
| A | Senate's Environmental Commission | 2005 | 26-October | Montevideo | ENCE |
| A | Consulate for Spain | 2005 | 28-October | | ENCE |
| A | BID Directory | 2005 | 03-November | | ENCE |
| A | Directory of Antel | 2005 | 07-November | | ENCE |

| | | |
|---|---|---|
| *Type | A) governmental institutions | 34 |
| | B) private sector | 2 |
| | C) civil society | 37 |
| | D) tripartite | 17 |
| | E) media | 55 |
| | Total | 146 |

## Table 4.1-2: Summary of Stakeholder Assessment Findings

| Issue | Range of Perceptions and Concerns | |
|---|---|---|
| **Plant-related jobs and activity** | • Most significant source of jobs in decades for Fray Bentos<br>• Economic activity already being felt<br>• Uruguay's biggest foreign investment<br>• Chain of economic activity expected throughout region | • Job opportunities may be exaggerated<br>• Less-polluting activity could produce same benefits<br>• Small businesses might get overlooked |
| **Effects on tourism** | • Effects on tourism uncertain or minimal<br>• Fray Bentos's Las Cañas beach houses in demand from plant staff/contractors<br>• Gualeguaychú may feel little impact from plants | • Tourism in region may plummet<br>• Gualeguaychú expects loss of tourism jobs to outstrip benefits from plants<br>• Gualeguaychú sees tourism as fundamental economic driver<br>• Drop in tourism may undermine Gualeguaychú's entire economy, real estate |
| **Quality of life – Environment** | • Economic activity will improve quality of life | • Plants are direct threat to quality of life/values<br>• Key concerns: Foul odors, toxic emissions (air, water), traffic, loss of bio-diversity/habitats, landscape |
| **Quality of life - Social** | • Social services – health, education etc – will improve in Fray Bentos | • Influx of construction workers may increase prostitution, venereal disease, crime, drunk driving |
| **Eucalyptus Plantations** | • Plantations extract more value from land, especially marginal lands<br>• Creates greater chain of economic activity than other land uses | • Aggressive use of land, drains aquifers, compacts soils, increases fire dangers<br>• Provides fewer rural jobs<br>• Concentrates landownership<br>• Threatens habitats<br>• May threaten Guaraní aquifer<br>• Requires more investment in roads |
| **Effects on Fishing** | • May have little to no impact | • May contaminate river, killing fish/making them inedible<br>• River already strained with agrochemical runoff<br>• Mills located in front of spawning ground<br>• Information unclear, distances in studies incorrect<br>• Families rely on river for subsistence |
| **Effects on Agriculture** | • May have little to no impact<br>• Honey exporters expect no impact on ability to sell abroad/prices | • May impact beef, poultry, dairy, snail, rabbit and blackberry production and exports<br>• Honey producers in vicinity won't be able to export |

| Issue | Range of Perceptions and Concerns | |
|---|---|---|
| | | • Impact area may be much larger than stated |
| **Mill sites, size** | • Efficient location to take advantage of wood supply, transport<br>• Size not unprecedented; mill complex in Brazil is bigger | • Too close to populated areas<br>• Should consider moving to more remote location, Atlantic coast<br>• Impacts difficult to predict because size is unprecedented |
| **Monitoring** | • Uruguay regulators said willing to shut plants if non-compliant<br>• New national/local monitoring entities being created<br>• Governments ask United Nations for assistance | • Uruguay lacks technical capacity<br>• Political and economic pressures will reduce effectiveness<br>• May lack consistency over mills' lifetime<br>• Bi-national entity should monitor |
| **Technology** | • Mills will comply with European regulations as of 2007 | • Mills won't comply with European regulations as of 2007 |
| **Transportation/ Chemicals** | • Fray Bentos creating new emergency response teams | • Increased risk of road accidents<br>• Increased risk of chemical spills<br>• Fray Bentos lacks resources to respond to chemical/industrial emergency<br>• Chemical suppliers create new risks |
| **Views on public engagement to review mills' impacts** | • Engagement/dialogue must have pre-defined set of topics<br>• Must not be used to stage protests<br>• Must be a safe space for civil dialogue<br>• Meetings open to general public are often unproductive | • Must be accountable and transparent, with clear rules of engagement<br>• Must first receive a sign that concerns will be acknowledged and responded to<br>• Process can't be rushed<br>• Meetings should strike balance between being open to public, and being a manageable size |
| **Views on convening dialogue** | • IFC could convene process, hire neutral facilitator | • Stakeholders should identify a mutually credible convener<br>• Some initial suggestions: CAO office, Bi-National Technical Commission, Key public officials |
| **Views on quality of current information** | • Companies have provided extensive amounts of credible information<br>• Uruguay regulators have shared comprehensive information with Argentina<br>• IFC is committed to reviewing scientific material from stakeholders | • Basic data such as distances incorrect in company reports, calling into question all information<br>• Uruguay regulators haven't shared enough detail with Argentina<br>• Stakeholders lack clear language to understand impacts<br>• Cumulative Impact Study questioned because of comments from initial lead writer<br>• Opponents want an opportunity to present their scientific studies |

| Issue | Range of Perceptions and Concerns | |
|---|---|---|
| | | • A panel of experts could provide a mutually credible source of information<br>• Experiences from communities with functioning mills should be considered |

**Table 4.1-3: Physical Characteristics of the Diffusers for Botnia and ENCE**

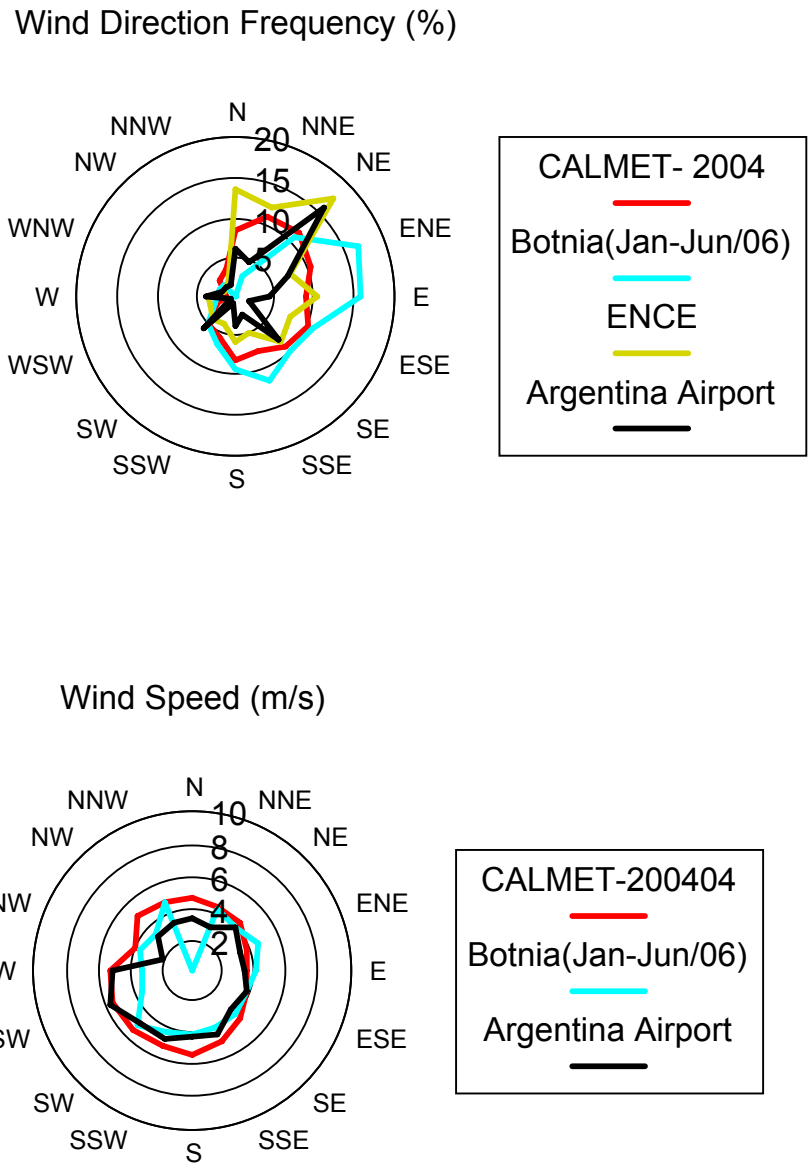
| Characteristic | Botnia | ENCE |
|---|---|---|
| Length of outfall pipe | 200 m | 200 m |
| Diffuser length | 200 m | 200 m (original)<br>100 m (recommended) |
| Orientation of diffuser | 90° to ambient flow | 90° to ambient flow |
| Number of nozzles | 80 | 80 (original)<br>40 (recommended) |
| Nozzle diameter | 0.1 m | 0.1 m |
| Nozzle vertical orientation | 90° (original)<br>0° (recommended) | 0° |
| Nozzle horizontal orientation | 0° to ambient flow | 0° to ambient flow |
| Average water depth | 13.5 m | 19.5 m |

## Table 4.1-4: Effluent Characteristics for the Botnia and ENCE Discharges

| Parameter | Units | Expected Operating Levels* | | | |
|---|---|---|---|---|---|
| | | Botnia | | ENCE | |
| | | Annual Average | Monthly Maximum | Annual Average | Monthly Maximum |
| **Aesthetic** | | | | | |
| Floating material | | absent | absent | absent | absent |
| Color | kg/ADt | 9 | 10 | 6.4 | 11 |
| **Conventional** | | | | | |
| Temperature | °C | 28 | 30 | <30 | 30 |
| TSS | kg/ADt | 0.7 | 1.3 | 0.9 | 1.6 |
| pH | | 7.5 | 6.0 to 9.0 | 6.0 to 9.0 | 6.0 to 9.0 |
| Conductivity | µS/cm | - | - | 1,200 | 2,400 |
| COD | kg/ADt | 8 | 15 | 8.7 | 19 |
| BOD | kg/ADt | 0.3 | 0.7 | 0.6 | 1.3 |
| AOX | kg/ADt | 0.08 | 0.15 | 0.10 | 0.22 |
| Oil and grease | | negligible | 0.31 | negligible | 0.35 |
| Detergents | | negligible | 0.025 | negligible | 0.09 |
| **Microbiological** | | | | | |
| Fecal coliforms | /100mL | - | - | <1,000 | - |
| **Nutrients** | | | | | |
| N total | kg/ADt | 0.15 | 0.26 | 0.17 | 0.30 |
| Nitrates ($NO_3$) | kg/ADt | 0.08 | 0.13 | 0.09 | 0.14 |
| Ammonia **(free)** | kg/ADt | 0.016 | 0.026 | 0.020 | 0.030 |
| Total Phosphorus | kg/ADt | 0.012 | 0.03 | 0.017 | 0.035 |
| **Toxins** | | | | | |
| Chlorates | kg/ADt | - | - | - | - |
| Chlorophenols | kg/ADt | 0.00175 | 0.00263 | 0.0015 | 0.0024 |
| Cyanide | kg/ADt | negligible | 0.00625 | <0.0003 | 0.006 |
| Phenolic compounds | kg/ADt | 5.5E-05 | 5.5E-06 | 0.000029 | 0.000046 |
| Plant sterols | kg/ADt | 0.004 | 0.006 | 0.005 | 0.0075 |
| Resin/fatty acids | | negligible | negligible | 0.0006 | 0.0006 |
| Sulphides | kg/ADt | 0.006 | 0.006 | 0.005 | 0.005 |
| Dioxins/furans | kg/ADt | <2.5E-10 | - | <2.9E-10 | - |
| **Metals** | | | | | |
| Arsenic | kg/ADt | 0.002 | 0.003 | 0.0003 | 0.015 |
| Cadmium | kg/ADt | 0.0002 | 0.0003 | 0.00009 | 0.0015 |
| Copper | kg/ADt | 0.004 | 0.006 | 0.000003 | 0.03 |
| Chromium | kg/ADt | 0.004 | 0.006 | 0.0009 | 0.03 |
| Mercury | kg/ADt | <0.000125 | - | - | - |
| Nickel | kg/ADt | 0.008 | 0.013 | 0.0021 | 0.06 |
| Lead | kg/ADt | 0.0013 | 0.0019 | 0.0003 | 0.0009 |
| Zinc | kg/ADt | 0.0011 | 0.0017 | 0.00009 | 0.0009 |

* Expected production is 1,000,000 ADt/year for Botnia and 500,000 ADt/year for ENCE.

**Figure 4.1-1: Wind Rose for Available Meteorological Data and Model Prediction**



## 4.2 Plantations

In December, 1987, the Uruguayan Congress approved law number 15,939 which promoted the development of new tree planting programs with support from donor countries through international financial agencies (such as the World Bank) and through government tax and subsidy programs. Regulations under the law were promulgated by the Dirección General Forestal (Uruguayan Forest Service) which is a branch of the Ministry of Animal Husbandry, Agriculture, and Fisheries.

Applications for new plantations are sent to the forestry service which reviews the proposals against a number of criteria. One of most essential of these is the soil classes within the proposed site. Only those soils classified by CONEAT (Commission Nacional de Estudio Agroeconomico de la Terra) as having a priority for tree plantations could be utilized for the conversion of land to plantations. This criterion seeks to have ensured that soils with a high capability for cultivation under row crops or high quality pasture were not converted to other uses. Generally, this resulted in the conversion of less productive lands that had predominantly been used as low-productivity pasture for cattle and sheep grazing.

At one time, many of these lands were natural grasslands and shrublands that had been converted to grazing lands through burning during a time referred to as the “Merino Period” (after the Merino Sheep). Thus, the soils of such areas had already been impacted by compaction and the natural vegetation had been largely extirpated prior to their conversion to forestry plantations.

As these plantations have developed, both round wood (whole logs) and wood chips have been exported to international markets. Uruguay is now encouraging the development of further value-added processing of these forest products and the two pulp mills intended for development in the Fray Bentos area are part of this development of the country’s industrial base.

The environmental impacts of plantation development have been addressed in the individual impact assessments prepared for these investments, in Annex B of this CIS report, and through the sustainable forest management certification process. These include potential social and environmental impacts associated with changes in land use and the ongoing operation of eucalyptus plantations. In all cases, these impacts have been found to be low to medium, and can be mitigated.

Both projects, Botnia and ENCE, have their own plantation companies (Forestal Oriental, or FOSA, and EUFORES, respectively) with significant plantation holdings. Both companies also purchase wood from other third-party plantation companies, under short or long-term contracts. It is important to note that these plantations (assuming maturity) are currently producing round wood and chips for export. With the development of these mills, this wood will instead be directed to domestic pulp production. More detailed consideration of the plantation situation is presented in Annex B of this report.

Potential cumulative impacts of the two mills with regard to plantation development and operation are described below.

### 4.2.1 Conversion of Additional Land to Plantations

During full operation, Botnia's plant will require 3.5 million $m^3$ of wood per year, and the CMB mill will need approximately 1.7 million $m^3$ per year, a total of 5.2 million $m^3$ per year for both. On the basis of average annual production rates, a total of 208,000 ha of plantation would be needed to supply this amount of wood, for these two plants. However, the area required will actually be much less during the first eight years of operation as the two mills gradually come on-line and reach maximum production. The area of net plantation ("net" area excludes areas of access roads, fire-breaks, other agricultural uses, natural areas, and log handling areas) required during this start-up period is estimated at approximately 175,000 ha.

As of the end of 2003, just over 170,000 ha of eucalyptus plantations had been developed in the three departments located within the Littoral Region[6] (Paysandú, Río Negro, and Soriano). At least 140,000 ha of this area are considered net planted. Additional plantation area has been developed since then and much of the required wood fibre will be supplied from plantations owned by FOSA and EUFORES. It is expected that the additional wood required for the mills will be sourced primarily from existing plantations owned by third party contractors. For economies of scale, the wood will mostly be sourced from an area within approximately 150 km of Fray Bentos. This includes the departments of composing the Littoral Region as well as adjacent departments such as Rivera, Tacuarembó, and Durazno.

In these six departments of Uruguay, approximately 1,500,000 ha of land have been designated as "Forest Priority Soils", on which forest plantations are encouraged. As shown in Table 4.2-1, the total area planted to eucalyptus as of the end of 2003 amounts to only about 17% of the priority soils potentially available. Table 4.2-1 also shows that more than sufficient land area had been planted to eucalyptus by the end of 2003 to supply the two mills through start-up and in full production. Although all of this wood may not be available due to other commitments, additional areas of eucalyptus plantations have been developed in these departments over the almost three years since the end of the reporting period.

As of mid-2006, the combined plantation holdings of the two companies in western Uruguay amounts to about 258,000 ha, of which about 120,000 were planted to eucalyptus. A further 40,000 ha is available on these holdings for planting. In total, the planted and available for planting lands comprise about 60% of the mill requirements for the first eight years. The companies anticipate that this wood, along with wood from third party

[6] Boletin Estadistico, Año 4-No.3, Deciembre 2004, Dirección General Forestal (http://www.mgap.gub.uy/forestal/dgf.htm).

contractors, will provide a secured supply of over 220,000 ha (net) of eucalyptus plantations from the Littoral and nearby departments. They also anticipate that another 30,000 to 40,000 ha/yr will be planted within an economical distance from the mills over the next 3 years. Although some of this wood may be available to cover short-term shortfalls, it will be utilized principally for saw logs and export.

**Table 4.2-1: Eucalyptus Plantation Land Use Characteristics in Western and Central-North Uruguay (in ha unless otherwise noted)**

| | |
|---|---|
| 1. Total land area – 6 departments | 6,865,500 |
| 2. Total area of forest priority soils | 1,516,760 |
| 3. Total net planted area, eucalyptus (approx. as of 2003) | 260,000 |
| % of land area already planted (3÷1) | 3.7 |
| % of forest priority soils planted (end of 2003) (3÷2) | 17.1 |
| 4. Total area needed during start-up 8 years | 175,000 |
| % of total area to already planted (4÷3) | 67.3 |
| 5. Planted area required by mills after start-up | 208,000 |
| % of land area already planted (5÷3) | 80.0 |

### 4.2.2 Plantation Development by Other Third Parties

As noted above, both Botnia and ENCE anticipate a reliable supply of pulpwood from their own plantations and from existing plantations owned by third party suppliers. It is unlikely that a large number of independent land owners would make a long-term investment in plantation development in this area in the future hope of supplying the mills when both Orion and CMB have their own reliable supply.

It is theoretically possible that future plantations may be developed to supply other wood products industries (sawmills, furniture manufacturers, panel producers) or industries seeking sources of local energy, but there are no incentive programs at present to promote this nor are there any known plans for such operations. However, should they proceed, it would not be the result of the pulp mills and, hence, would not be a cumulative impact of the presence of the two mills.

It is therefore unlikely that the establishment of the pulp mills will encourage significant development of plantations by other third parties, and this potential cumulative impact is not considered significant.

### 4.2.3 Additional Plantation Development in Other Areas of Uruguay

Transportation costs are the main controlling factor in wood supply, and it is generally not competitive to source wood from greater than about 150 to 200 km from the mills. There may indeed be wood available beyond the six departments noted in Section 4.2.1, especially thinnings from plantations operated to produce larger round wood, but it is less likely that these would be competitively priced, and very unlikely that landowners in those regions would establish new plantations with the intention of supplying the new pulp mills, especially when those mills are already planting areas nearby to supply their own wood.

It is therefore not likely that these pulp mills will encourage additional planting in other regions of Uruguay, and this potential cumulative impact is not considered to be significant.

### 4.2.4 Plantation Development in Natural Forests

Uruguayan law prohibits the removal of natural forests or impacts to formally designated protected areas. It was noted above that it is unlikely that the mills will induce much further planting, thus there should not be any additional pressure on natural forests as a result because plantation-derived wood supplies are adequate to meet current and future needs. Secondly, forestry plantation development is restricted under law to areas already designated as “Forest Priority Soils” which excludes areas of natural forest. Thirdly, the additional planting area available within company-owned lands will be certified under FSC, which prohibits the development of plantations in natural forests, and in fact requires the delineation of protected areas of natural forest as part of the plantation area.

It is therefore not likely that the pulp mills will encourage development of plantations in areas currently under natural forest cover, thus any potential cumulative impact is not considered to be significant.

### 4.2.5 Land Ownership

There is no evidence to suggest that plantation development will adversely impact small landholders within the region where Botnia and ENCE have their plantations. Most of the companies’ plantations were purchased from absentee landlords in a willing seller-willing buyer relationship, at prevailing market rates. The companies report that they can be very selective in their land purchases, as they have had numerous offers of land for purchase. No lands are purchased from unwilling sellers. Also, recent evidence shows that employment on the plantations is greater than in the declining cattle-raising economy, in this area. For example, many large-scale plantations, including those of FOSA and EUFORES operate agroforestry operations whereby agriculture activities such as grazing, apiaries, mushroom collection etc. may be conducted along with forestry. Additional jobs are also created in those plantations which incorporate protected areas and in which ecological restoration programs are conducted.

It is therefore unlikely that the pulp mills will play any role in driving smallholders off their lands on an involuntary basis, and this potential cumulative impact is not considered to be significant.

### 4.2.6 Soil and Water Management

Soil compaction and erosion are often cited as serious environmental impacts resulting from plantation forestry. In general, compaction impacts are highly localized (i.e., roads and handling areas) and erosion losses will be limited by the acknowledged reduction in surface runoff from plantations. Further, the sites are harvested every eight to nine years, reducing soil erosion and compaction impacts compared to agricultural areas under an annual harvesting regime. In the case of lands managed for the Botnia and ENCE mills, most are established on flat to gently rolling lands further reducing the potential for soil erosion and the loss of soil nutrients. These lands also occur in areas having an annual water deficiency of some 50 mm/year, reducing infiltration, mineral leaching, and runoff.

Based on existing information, the most serious potential impacts of the existing and planned plantations relate to water management issues – both surface water and groundwater. Surface water runoff from large plantations is known to be up to 25% less than from similar areas of grassland and grazing lands.[7] This is due, in large part to the greater take-up and evapotranspiration by trees compared to grasslands. A significant volume of this water is returned to the atmosphere and is thus available for the hydrological cycle.

Eucalyptus plantations are known to be heavy users of groundwater,[8] although the actual impact from individual trees is likely quite minimal because they are relatively shallow rooted. The exact impacts on groundwater are not well documented, however, there are several studies currently underway in Uruguay. Potential impacts to particularly significant groundwater resources, such as those associated with the Guarani aquifer western Uruguay need to be more fully evaluated.

In general, cumulative impacts to soils from eucalyptus plantations are not considered significant, especially as they will be mitigated by silvicultural techniques required to maintain productivity in the planted forest. Water management issues are more problematic and should receive greater attention.

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[7] Geary, Thomas F. “Afforestation in Uruguay: Study of a Changing Landscape,” Journal of Forestry 99, no.7 (July 1, 2001): 35-39

[8] Forest Management Certification Report, SGS Qualifor (July 31, 2003) p.29, http://64.233.187.104/search?q=cache:AkEBk0Bd0bsJ:www.qualifor.sgs.com/8365-uy-fm-eufores_ma2004.10_ad65-01_final-psummary__2_.pdf+%22Forest+Management+Certification+Report%22+Uruguay+SGS+Qualifor+&hl=en

It is recommended that the forestry companies supplying the two mills continue their participation in the on-going Uruguayan State University studies pertaining to impacts on soils, surface water, and groundwater. In addition, both EUFORES and FOSA should ensure surface and groundwater monitoring is established at all of their large-scale plantations. Further, any plantations located within the recharge area of the Guarani Aquifer should also study, monitor, and assess groundwater quality (pesticides, herbicides, and nutrients) under their plantation lands.

## 4.3 Biodiversity and Natural Habitats

Biodiversity encompasses the range of species (flora and fauna), of species' gene pools, and of landscape patterns. It can include both exotic and endemic species but healthy ecosystems are generally measured by having few or no exotic species. Eucalyptus plantations clearly consist of exotic species of trees, although some species of eucalyptus have been present in South America for over 200 years. Thus, in evaluating cumulative impacts on biodiversity due to the development of eucalyptus plantations, one must determine the nature of the impact in terms of changes from pre-existing species (and gene pools and landscape patterns) in terms of both exotic and endemic relationships.

As noted in Section 4.2 of this report, the Uruguayan forest service evaluates plantation development applications on the basis of soil capability, such that highly productive soils most suitable to intense cultivation are not being converted. Also, Uruguayan law prohibits the removal of natural forests or impacts to formally designated protected areas. As a result, the vast majority of lands converted to forest plantations have been converted from marginally productive areas, formally supporting mostly sheep and cattle grazing. Such areas may contain a greater diversity of individual species and gene pools than occur within the planted portion of eucalyptus plantations, but both areas largely contain exotic species. Hence, neither "ecosystem" can be considered "healthy" when measured by the presence of self-sustaining populations of endemic species.

Geary (2001) points out that impacts on biodiversity of the natural ecosystem as result of eucalyptus plantations are hard to specify, as the grasslands in Uruguay have been modified by human actions (such as livestock grazing) for hundreds of years:

> "Because of the small percentage of the land area in Uruguay to be converted to tree plantations, a significant impact on biodiversity might seem unlikely. Moreover, the effect on natural biodiversity could be hard to interpret as biodiversity has been modified by centuries of pastoral and agricultural uses. Exotic grasses and other exotic pastoral plants are often the common vegetation. Erosion probably has irreversibly changed the ecosystem."[9]

[9] Geary, Thomas F. "Afforestation in Uruguay: Study of a Changing Landscape," Journal of Forestry 99, no.7 (July 1, 2001): 35-39

Many large plantations in Uruguay, including those owned by EUFORES and FOSA, are managed under an agroforestry regime which often incorporates natural areas within a mix of land uses. Only about 65% or so of these plantations are directly planted to eucalyptus with remaining areas used for cattle grazing (including on areas used as fire-breaks) and other agricultural activities. EUFORES has reported that under their Forest Stewardship Council (FSC) certification, they ensure sensitive areas, including areas formally designated at regional and national levels as High Value Conservation Areas (HVCA), are protected. As part of an initial impact assessment, the company defines management plans for such areas that include, natural areas (grasslands, wetlands, palm groves, natural forests, stream corridors, etc.) which have a high biodiversity.[10] Similarly, they include forests and woodlands that provide important water resource protection functions; areas defined under international agreement (Ramsar Convention on Wetlands, Convention on Migratory Species, Convention on Biological Diversity and so on); and areas of traditional cultural interest.

Monitoring programs conducted by EUFORES in wetlands and palm groves over a 10-year period in their Santo Domingo operation (Department of Paysandú) have documented a wide list of species as well as the return of several formerly extirpated species as a result of wetland restoration programs.[11] They have documented at least 242 species including 13 amphibians, 17 reptiles, 191 birds, and 23 mammals in this area.

FOSA and its associated company, COFUSA (Compañia Forestal Oriental SA), also prepare management plans for natural areas contained within their plantation properties. These include a variety of ecosystems such as natural forests, wetlands and designated protected areas[12]. Management plans include the documentation of native species and the development of monitoring plans. The management plans require the maintenance of natural biodiversity and ecological functions of each area. Ecological monitoring in these areas includes documentation of any changes in vegetation, birds, and rare or threatened flora and fauna.

Although the direct replacement of grazing land for planted trees may result in a decrease in the biodiversity of exotic species, the operation of large multi-use forestry plantations containing other agricultural activities along with the inclusion of natural areas, clearly results in an increase in biodiversity at all levels (species, gene pools, and landscape patterns) including both exotic and endemic species.

As a result, cumulative impacts to biodiversity as the result of the conversion of grazing lands to forestry plantations are not considered to be significant.

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[10] Bentancor, A. and Delgado, S. Caracterización de los Bosques Nativos de los Establecimientos Propiedad de EUFORES S.A. EUFORES S.A., July 2005.

[11] EUFORES S.A. Informe Final Relevamiento de la Diversidad de Vertebrados Tetrapodos Establecimientos Forestales EUFORES Uruguay. Unpublished Report, EUFORES.

[12] SGS Qualifor. Evaluation of Forest Management Operations. Qualifor Program, No. AD 65, Projects 6609-UY, April 2000.

## 4.4 Air Quality Impacts

The potential effects of the air emissions from the Botnia and ENCE mills are described in the sections below. The discussion addresses specific receptor locations of interest as listed in Section 4.1.3.1. Further details are provided in Annex C, Section C5.

The assessment references air quality and air quality standards based on averaging times (e.g., 1-hour, 24-hour or annual). The length of time that a person, or some part of the environment, is exposed to pollutants is important because impacts occur from different types of exposure. A long exposure, like an annual average concentration, is important when assessing the long term health risk on people. A daily exposure (24 hour average concentration) has been used to characterize short term health and material impacts, whereas short term exposure (1-hour average concentration) can have both immediate health and material impacts. Odour is somewhat unique in that most people can sense and identify an odour within about 5 seconds and standards are set based on a 10-minute average concentration. When assessing odour impacts, the standards are converted to an equivalent 1-hour concentration so that the correct comparison can be made.

It should also be noted that as a result of the variability in the atmosphere (winds don't blow in exactly the same direction for very long), the 1-hour average concentrations (peaks) are highest and the annual average concentrations lowest.

### 4.4.1 Air Receptor 1, the Areas Adjacent to the Mill Properties

The area adjacent to the mill properties where the maximum calculated ground based concentration occurs is identified as a sensitive receptor. It represents the receptor having the absolute worst case impact. The areas adjacent to the mill where this maximum concentration is most often to occur are predominantly forest and grass lands although a few houses are located within a two kilometres of the Botnia mill.

The maximum concentration will remain in compliance with all respective air quality criteria under all operating conditions. The concentrations of substances in the atmosphere will increase slightly, but concentrations will remain less than 6% of the air quality criteria for all parameters with the exception of $NO_2$ (which is predicted to be 32% of the 1-hour standard) under normal operating conditions.

The concentration of $SO_2$ is predicted to change on an annual average basis by 0.21 $\mu g/m^3$. In comparison, the typical ambient concentration of $SO_2$ is approximately 13 $\mu g/m^3$ with a range of 5 to 30 $\mu g/m^3$. Likewise the incremental annual change of $NO_2$ and particulate matter ($PM_{10}$ and $PM_{2.5}$) are predicted to be 0.55, 0.11 and 0.08 $\mu g/m^3$, respectively, which are significantly lower than typical ambient concentrations of 15, 20 and 8 $\mu g/m^3$, respectively. These incremental changes will not be measurable.

The typical ambient air quality concentrations, used as reference points in this document, are based on monitoring in the rural United States as published by the US EPA (1997).

These typical ambient concentrations were used since ambient air quality data were not available for Uruguay or Argentina within the general area of the two mills.

On a 1-hour average basis, the concentration of $NO_2$ is predicted to change by 61 µg/m$^3$ during normal operations and by 90 µg/m$^3$ during an upset condition. In comparison, the air quality criterion for $NO_2$ is 190 µg/m$^3$, which is over two times larger than the 1-hour average concentration during an upset condition. The 1-hour average concentrations for $SO_2$ and particulate matter ($PM_{10}$ and $PM_{2.5}$) are also significantly below the ambient air quality criteria.

Since the predicted concentrations of $SO_2$, $NO_2$ and particulate matter are all below their respective air quality criteria, it is concluded that there is no potential for health effects arising from air emissions due to mill operations at this receptor.

Under normal operating conditions, no sensitive receptors are predicted to exceed the Uruguayan TRS standard. The maximum location, however, does show that, under the combined mill upset conditions, the stacks alone could reach 97% of the TRS standard and the stacks combined with the WWTP emissions would exceed the TRS standard indicating that, under one of the poor dispersion conditions, odour may be detected.

### 4.4.2 Air Receptor 2, the City of Fray Bentos

The city of Fray Bentos (population 22,600) is the closest community to the two mills and is located approximately 5 km west of the Botnia mill and approximately 11 km west of the ENCE mill. It is also the community which will receive the highest incremental change in air quality resulting from emissions from the two mills, although as discussed below, these changes will not adversely affect human health or aesthetic environment of the community.

Under normal operational conditions, the maximum 1-hour concentration of $NO_2$ is predicted to be 19 µg/m$^3$. This value is 10 times lower than the standard indicating that there will be negligible potential for health effects. During start-up and upset conditions, the 24-hour concentration of $NO_2$ is predicted to be 24 µg/m$^3$ which is 12% of the standard; however, this would only occur if both facilities were operating in the start-up mode at the same time and the meteorology favoured poor dispersion, which is extremely unlikely to occur. Therefore, it is not expected that $NO_2$ emissions from the mills will result in adverse effects in the nearby community.

As with $NO_2$, the maximum predicted 1-hour concentration of $SO_2$ is approximately 10 times lower than the standard of 690 µg/m$^3$. Additionally, the maximum predicted annual value of 0.12 µg/m$^3$ is almost 300 times lower than the annual standard indicating that there should not be any adverse health effects related to $SO_2$ emissions.

The maximum predicted concentrations of $PM_{10}$ and $PM_{2.5}$ at Fray Bentos are well below the standard of 50 and 25 µg/m$^3$, respectively, indicating that there will be no adverse health effects arising from air emissions of particulate matter from the two mills.

Likewise, the maximum predicted concentration of TRS indicates no health effect in the city of Fray Bentos. The predicted 24-hour concentration of 1.1 µg/m$^3$ is 100 times below the 24-hour WHO guideline of 150 µg/m$^3$.

The odour threshold value selected for this study for $H_2S$ is 0.7 µg/m$^3$ for odour nuisance. The concentration based upon the calculated maximum 1-hour value of $H_2S$ does not result in an exceedance of the half-hour odour threshold criteria (providing a conservative comparison). Therefore, it is not expected that there will be a short-term effect in Fray Bentos relating to emissions of $H_2S$ from the two mills during normal operations. However, during start-up and upset conditions, an exceedance of the odour nuisance threshold may occur up to a maximum of 3.6 µg/m$^3$; however, this prediction is based on the conservative assumption that an up-set condition occurred during a poor dispersion meteorological condition. This is unlikely that this will happen. However, based on operational experience at similar mills, odour may be noticeable on 4 to10 occasions per year.

To assess long-term effects related to exposure to $H_2S$, the US EPA (2003) derived a reference concentration of 2 µg/m$^3$ for annual exposure (IRIS, 2003). This means that someone may be exposed to this concentration every day for a lifetime and not experience any adverse health effect. This value far exceeds the predicted annual average $H_2S$ concentration indicating no potential for health effects arising from emissions of reduced sulphur compounds.

### 4.4.3 Air Receptor 3, the City of Mercedes

The city of Mercedes (population 45,000) is located inland from the Rio Uruguay along the Rio Negro towards the south east located approximately 30 km from the Botnia mill and approximately 22 km from the ENCE mill. The incremental change in air quality at the city of Mercedes is predicted to be lower than the incremental change at the city of Fray Bentos, and therefore it is concluded that these changes will not adversely affect human health or aesthetic environment of that community.

The change in air quality for all parameters is predicted to be far below the respective ambient air quality criteria, indicating no potential for human health effects or odour related effects. The concentration of $SO_2$ is predicted to change on an annual average basis by 0.02 µg/m$^3$ and over a 24-hour period by 0.4 µg/m$^3$, in comparison to the typical ambient concentration of $SO_2$ for rural United States of approximately 13 µg/m$^3$. Likewise the incremental change of $NO_2$ and particulate matter ($PM_{10}$ and $PM_{2.5}$) over a 24-hour period are predicted to be 1.0, 0.2 and 0.2 µg/m$^3$, respectively, which are significantly lower than the typical ambient concentrations of 15, 20 and 8 µg/m$^3$, respectively. These incremental changes will not be measurable.

These changes will be imperceptible by humans at this location.

### 4.4.4 Air Receptor 4, the City of Nuevo Berlin

The city of Nuevo Berlin is located along the shores of Rio Uruguay towards the north of the two mills a distance of approximately 24 km. The city is located towards the southern end of the wetland areas of Esteros de Farrepos e Islas del Rio Uruguay, which is Uruguay's second designated Ramsar site because of the diversity of plant and wildlife species that it

supports. The air quality predictions for the city of Nuevo Berlin provide a conservative estimate of the air quality over the wetland region.

The predicted incremental change in air quality at the city of Nuevo Berlin is comparable to the incremental change at the city of Mercedes, and therefore the same conclusion of no effect applies. The change in air quality, for all parameters, is predicted to be far below the respective ambient air quality criteria, indicating no potential for human health effects or odour related effects.

The concentration of $SO_2$ is predicted to change on an annual average basis by 0.02 µg/m$^3$ and over a 24-hour period by 0.5 µg/m$^3$, which are significantly lower than the typical ambient concentration of 13 µg/m$^3$. Likewise the incremental change of $NO_2$ and particulate matter ($PM_{10}$ and $PM_{2.5}$) over a 24-hour period are predicted to be 1.2, 0.3 and 0.2 µg/m$^3$, respectively, which are significantly lower than the typical ambient concentrations of 15, 20 and 8 µg/m$^3$, respectively. These incremental changes will not be measurable. Since the incremental change in ambient air quality is not measurable, there should be no adverse effects to the wetland area of Esteros de Farrapos e Islas del Rio Uruguay.

### 4.4.5 Air Receptor 5, the Beach Resort of Las Cañas

Las Cañas is a beach resort located along the shores of the Rio Uruguay approximately 12 km from Botnia, and 17 km from ENCE, towards the south west of the two mills. The beach attracts visitors from throughout Uruguay and Argentina, and is therefore an important resource for local tourism.

The 24-hour concentration of $SO_2$, $NO_2$, $PM_{10}$ and $PM_{2.5}$ are predicted to be 1.1, 2.6, 0.5 and 0.4 µg/m$^3$, which are significantly lower than the typical ambient air concentrations of 13, 15, 20 and 8 µg/m$^3$, respectively. These incremental changes will not be measurable. Furthermore, the concentration of all air quality parameters are predicted to be significantly lower than the ambient air quality criteria under both normal and upset operating conditions. No adverse effects to human health or the aesthetic environment are expected as a result of the combined air emissions from the two mills.

### 4.4.6 Air Receptor 6, the Beach Area of Playa Ubici

Playa Ubici is a recreational beach area located across Yaguareté Bay from the Botnia mill. The beach is a valuable resource for the city of Fray Bentos and for tourists who may visit the area. It is used for camping, swimming and other outdoor recreational activities.

The incremental change in air quality at the beach area is predicted to be comparable to that for the city of Fray Bentos. It is concluded that these changes will not adversely affect human health or the aesthetic environment of the community. It is also predicted that an exceedance of the odour nuisance threshold could occur occasionally during an upset condition. This prediction is based on the assumption that an upset condition will occur

during the worst case meteorological conditions. Typically the worst case conditions occur during the night anytime during the year.

### 4.4.7 Air Receptor 7, the International Bridge

The International Bridge provides the nearest road access connecting Uruguay, and Argentina. The change in air quality at the International Bridge is also predicted to be comparable to that at Fray Bentos, and therefore also concluded that human health and aesthetic environment are protected. It is predicted that the odour nuisance threshold will not be exceeded during normal operations, but may be noticeable on occasion during an upset and under worst case meteorological conditions. This condition occurs during the night anytime during the year.

### 4.4.8 Air Receptor 8, the City of Gualeguaychú, Argentina

The city of Gualeguaychú, Argentina (population 76,220) is the nearest community in Argentina to the mills. It is located approximately 30 km towards the north west of the two mills. The city is a thriving community located in the province of Entre Ríos, Argentina, on the bank of the Rio Gualeguaychú, a tributary of the Rio Uruguay. The city hosts an annual Carnival that is regionally well-known and attended by people from across Argentina and Uruguay.

The predicted change in air quality at the city of Gualeguaychú, for all parameters, is predicted to be far below the respective ambient air quality criteria, indicating no potential for human health effects or odour related effects, or impact on the aesthetic environment of the community.

The concentration of $SO_2$ is predicted to change on an annual average basis by 0.04 µg/m$^3$ and over a 24-hour period by 0.5 µg/m$^3$, which are 100 times lower than the typical ambient concentration of 13 µg/m$^3$. Likewise the incremental change of $NO_2$ and particulate matter ($PM_{10}$ and $PM_{2.5}$) over a 24-hour period are predicted to be 1.2, 0.3 and 0.2 µg/m$^3$, respectively, which are significantly lower than the typical ambient air concentrations of 15, 20 and 8 µg/m$^3$, respectively. These incremental changes will not be measurable.

The concentration of TRS is predicted to change by 2 µg/m$^3$ during an upset at the Botnia and ENCE mills and concurrent with the worst case meteorological condition. This concentration is significantly lower than the odour threshold of 15 µg/m$^3$.

### 4.4.9 Air Receptor 9, the Beach Area at Ñandubaysal, Argentina

A beach and camping ground is located at Ñandubaysal in Argentina across the Rio Uruguay from Fray Bentos. The site is a popular vacation and tourist destination for people from Argentina and Uruguay during the summer months and particularly during the annual

Carnival. It is located approximately 14 km from Botnia, and 19 km from ENCE, towards the north west of the two mills

The predicted change in air quality for Ñandubaysal is presented in Table C5.2-2. As presented, the 24-hour concentration of $SO_2$, $NO_2$, $PM_{10}$ and $PM_{2.5}$ are predicted to be 1.0, 2.1, 0.6 and 0.3 $\mu g/m^3$, which are significantly lower than the typical ambient air concentrations of 13, 15, 20 and 8 $\mu g/m^3$, respectively. These incremental changes will not be measurable nor perceptible. Furthermore, the concentration of all air quality parameters are predicted to be significantly lower than the ambient air quality criteria under both normal and upset operating conditions. No adverse effects to human health or the aesthetic environment, including detectable odour, are expected as a result of the air emissions from the two mills.

A white steam plume from the mill stacks may be visible on cold days, however, it will be visible only rarely during the summer.

### 4.4.10 Summary of Potential Effects on Ambient Air Quality

Table 4.4-1 provides a summary of the potential effects of mill operations on the ambient air quality. As presented, the air quality remains in compliance with ambient air quality criteria under all meteorological conditions and operating conditions at all receptor locations. It is therefore concluded that there is no potential for human health effects associated with mill emissions. However, it is possible that odour may be detected on occasion (4 to 10 times per year) within the areas adjacent to each mill and possibly within the city of Fray Bentos and at the international bridge.

## Table 4.4-1: Summary of Potential Effects of Air Emissions on Local Sensitive Receptors

| | |
|---|---|
| **Receptor 1** | **Area of adjacent to the mill properties** |
| Combustion Products ($NO_2$, $SO_2$, PM, $PM_{10}$, $PM_{2.5}$) | • Greatest potential change in ground based ambient air quality;<br>• Air quality remains in compliance with ambient air quality criteria under all meteorological conditions and operating conditions, therefore limited potential for human health effects associated with mill emissions; |
| Reduced Sulphur Compounds (Odour) | • Potential for infrequent (4 to 10 times per year) odour effects during start-up and upset conditions; |
| Volatile Organic Compounds | • Predicted ambient air concentration far below ambient air quality criteria, and therefore, emissions of VOCs from the mills are not anticipated to have a significant effect on the environment; |
| Chlorine and Chlorine Dioxide | • Predicted ambient air concentration far below ambient air quality criteria, and therefore, emissions from the chlorine dioxide generation plant are not anticipated to have a significant effect on the environment. |
| **Receptor 2** | **City of Fray Bentos** |
| Combustion Products ($NO_2$, $SO_2$, PM, $PM_{10}$, $PM_{2.5}$) | • Air quality remains well below ambient air quality criteria under all meteorological conditions and operating conditions, therefore no adverse human health effects associated with mill emissions; |
| Reduced Sulphur Compounds (Odour) | • Potential for infrequent (4 to 10 times per year) odour effects during start-up and upset conditions;<br>• Recommend TRS monitoring in Fray Bentos; |
| Volatile Organic Compounds | • No effect; |
| Chlorine and Chlorine Dioxide | • No effect; |
| **Receptor 3** | **City of Mercedes** |
| Combustion Products ($NO_2$, $SO_2$, PM, $PM_{10}$, $PM_{2.5}$) | • Immeasurable change in ambient air quality, well below any level that may cause any effect; |
| Reduced Sulphur Compounds | • Immeasurable change in ambient air quality, therefore no effect; |
| Volatile Organic Compounds | • No effect; |
| Chlorine and Chlorine Dioxide | • No effect; |
| **Receptor 4** | **City of Nuevo Berlin** |
| Combustion Products | • Immeasurable change in ambient air quality, therefore no effect; |
| Reduced Sulphur Compounds | • Immeasurable change in ambient air quality, therefore no effect; |
| Volatile Organic Compounds | • No effect; |
| Chlorine and Chlorine Dioxide | • No effect; |
| **Receptor 5** | **Beach Resort of Las Cañas** |
| Combustion Products | • Immeasurable change in ambient air quality, therefore no effect; |
| Reduced Sulphur Compounds | • Immeasurable change in ambient air quality, therefore no effect; |
| Volatile Organic Compounds | • No effect; |
| Chlorine and Chlorine Dioxide | • No effect; |

## Table 4.4-1: Summary of Potential Effects of Air Emissions (cont'd)

| | |
|---|---|
| **Receptor 6** | **Beach Area of Playa Ubici** |
| Combustion Products ($NO_2$, $SO_2$, PM, $PM_{10}$, $PM_{2.5}$) | • Air quality remains well below ambient air quality criteria under all meteorological conditions and operating conditions, therefore no adverse human health effects associated with mill emissions; |
| Reduced Sulphur Compounds (Odour) | • Potential for infrequent (4 to 10 times per year) odour effects during start-up and upset conditions;<br>• Recommend TRS monitoring in Fray Bentos; |
| Volatile Organic Compounds | • Predicted ambient air concentration far below ambient air quality criteria, and therefore, emissions of VOCs from the mills are not anticipated to have a significant effect on the environment; |
| Chlorine and Chlorine Dioxide | • Predicted ambient air concentration far below ambient air quality criteria, and therefore, emissions from the chlorine dioxide generation mill are not anticipated to have a significant effect on the environment. |
| **Receptor 7** | **International Bridge** |
| Combustion Products ($NO_2$, $SO_2$, PM, $PM_{10}$, $PM_{2.5}$) | • Air quality remains well below ambient air quality criteria under all meteorological conditions and operating conditions, therefore no adverse human health effects associated with mill emissions; |
| Reduced Sulphur Compounds (Odour) | • Potential for infrequent (4 to 10 times per year) odour effects during start-up and upset conditions;<br>• Recommend TRS monitoring at the International Bridge; |
| Volatile Organic Compounds | • Predicted ambient air concentration far below ambient air quality criteria, and therefore, emissions of VOCs from the mills are not anticipated to have a significant effect on the environment; |
| Chlorine and Chlorine Dioxide | • Predicted ambient air concentration far below ambient air quality criteria, and therefore, emissions from the chlorine dioxide generation mill are not anticipated to have a significant effect on the environment. |
| **Receptor 8** | **City of Gualeguaychú, Argentina** |
| Combustion Products | • Immeasurable change in ambient air quality, therefore no effect; |
| Reduced Sulphur Compounds | • Immeasurable change in ambient air quality, therefore no effect; |
| Volatile Organic Compounds | • No effect; |
| Chlorine and Chlorine Dioxide | • No effect; |
| **Receptor 9** | **Beach Area at Ñandubaysal, Argentina** |
| Combustion Products | • Immeasurable change in ambient air quality, therefore no effect; |
| Reduced Sulphur Compounds | • Immeasurable change in ambient air quality, therefore no effect; |
| Volatile Organic Compounds | • No effect; |
| Chlorine and Chlorine Dioxide | • No effect; |

# 4.5 Noise

There is a potential for noise impacts related to the construction and operation of the proposed pulp mill developments in Fray Bentos. ENCE also evaluated potentially elevated noise levels resulting from plant decommissioning and as a result of their plantation operations.

The World Bank/International Finance Corporation guidelines for ambient noise state that noise abatement measures should be implemented that will limit noise increases to no more than 3 dB(A) (decibels) above background levels or maximum allowable levels as shown in Table 4.5-1.

**Table 4.5-1: World Bank/IFC Ambient Noise Guidelines[13]**

| Receptor | Maximum Allowable (hourly) in dB(A) | |
|---|---|---|
| | Daytime 07:00 – 22:00 | Nighttime 22:00 – 07:00 |
| Residential Institutional Educational | 55 | 45 |
| Industrial Commercial | 70 | 70 |

ENCE recognizes these guidelines but referenced the Chilean standard (Normativa D.S. 146/97) as the standard to be used. In general, the maximum allowable noise levels are comparable in the two systems with the same ranges for similar receptors. Further, the Chilean standard requires noise levels to not increase by more than 10 dB(A) above baseline levels in rural zones. The IFC guideline is to be measured at the project property boundary whereas ENCE described a 1.5 km "area of influence". However, they do not specify if the limits apply throughout this area or at the outer edge. The Botnia EIA does not reference any international standards but refers to the regulations promulgated by the Department of Río Negro. Their EIA notes a municipal regulation of a maximum of 65 dB(A) during the day but does not indicate whether this level is subject to the type of adjacent land uses nor where it should be measured.

## 4.5.1 ENCE

The EIA document prepared by ENCE notes that noise impacts associated with all phases and operations are reversible and generally of low magnitude. Construction and

[13] International Finance Corporation. Environmental, Health and Safety Guidelines for the Wood Products Industry. Pertaining to Operational Policy on Environmental Assessment (OP 4.01), July 1, 1998.

decommissioning noise impacts are considered short-term whereas operational phase impacts are long-term and plantation noise impacts are long-term but intermittent.

The highest noise levels are anticipated to occur during the plant construction phase due to the presence of many workers along with the movement of vehicles and heavy equipment. Close range noise levels (at 5 m) are predicted to range from 65.5 dB(A) for a hopper wagon to 81.5 dB(A) for large earth movers. They estimate a worse case condition of 84.9 dB(A) at any one time at close range, given the mix of vehicles and machines. The EIA (Chapter 4) provides a graph showing the fall-off in noise level with distance from the source. The methodology used to prepare the graph is not provided. The data indicate that from a maximum of over 80 dB(A) at source, noise levels would rapidly fall-off with distance, reaching a level of 45 dB(A) at about 500 m from the source. It is likely this would exceed the IFC guideline at least in some locations around the property boundary (for non-industrial and commercial receptors), however, the location of the proposed mill on an island would minimize impacts to human receptors.

Maximum noise levels within plantation areas is estimated in the EIA as being in the order of 75 dB(A) due primarily to harvesting and handling machines. These levels would be confined to areas adjacent to the trees but, given the location of outer portions of the plantations relative to the property boundary, it is quite likely that the IFC standard for residential receptors would be temporarily exceeded for some adjacent properties and landowners.

Mitigation measures proposed by ENCE to reduce the impact of elevated noise levels include the use of speed limits and signs to control vehicular traffic on-site and the planting of a vegetated border around the perimeter of the plant. No information is provided regarding the timing of the vegetation planting with regard to the construction phase nor are any data provided on the likely effectiveness of such measures in reducing noise levels.

### 4.5.2 Botnia

The Botnia EIA primarily focuses on the construction and operational phases of the physical plant in Fray Bentos. They provide a range of potential noise levels from typical construction equipment at a distance of 15 m. These levels range between 72 and 97 dB(A), with short-term escalation up to 105 dB(A) for pneumatic equipment. Overall, they note that noise emissions can exceed 100 dB(A) at 15 m during the construction phase. However, the EIA asserts that the levels at the property boundary will comfortably meet the municipal standard of 65 dB(A). Given that the surrounding land uses are residential and recreational, these noise levels would not meet the IFC guidelines during certain periods of the construction phase. Mitigation measures employed during the construction phase are noted as providing the workers with ear protection devices, as required in Botnia's health and safety policies.

Operational phase noise levels will be similar to those during construction, with individual machines and process plants ranging from 85 to 103 dB(A). The EIA calculates the

attenuation rate between nearby receptors (including, the property boundary, the international bridge, and the Argentine coast) and each of the noted plant processes/machinery. The attenuation calculation is noted to follow the methodological standard defined in by ISO 9613. The results indicate that all receptors, from all sources will experience noise levels below the maximum IFC standard for residential and recreational receptors (45 dB(A)).

Overall they note that although noise levels associated with the construction and operation of the plant will be detectable outside the property boundary, the levels will not exceed the regulations promulgated by the Department of Río Negro. The most significant impact to human receptors will be those related to the movement of vehicles servicing the plant. Mitigation measures include the use of ear protection equipment by workers and notification of the local population when exceptionally loud noise will be anticipated during the construction phase.

### 4.5.3 Summary of Potential Noise Effects

The data provided by Botnia and ENCE indicate that there may be exceedences of the IFC standards for noise impacts during the construction phase. Some exceedences may also occur in areas adjacent to plantations. The construction phase impact will be short to medium term and reversible. The plantation impact will be long-term but intermittent. The exact extent of the impacts has not been fully addressed in the EIAs and each company should undertake detailed monitoring of noise levels adjacent to plantations and the mills. In addition, they should prepare contingency plans to protect particularly sensitive receptors, such as recreational and residential areas, in the event of regular exceedences of IFC guidelines. These contingencies could include sound proofing and deflecting devices including vegetation planting and the construction of noise walls.

Noise impacts are short term and reversible, and are not considered to be a significant cumulative impact.

## 4.6 Water Quality Impacts

The potential for effects on the water quality and aquatic resources of the Río Uruguay arising from the treated effluent discharges from the two proposed mills is described in detail in Annex D, Section D6. It is summarized here, with an overview of effluent dispersion and dilution patterns under different river conditions, and a synopsis of potential effects at specific receptor locations of interest as listed in Section 4.1.3.2.

### 4.6.1 Effluent Exposure in the Río Uruguay

The mathematical models described in Section 4.1.3.1 were used to estimate the patterns of effluent dispersion from the two proposed mills under three river flow conditions: typical flow (6,230 $m^3/s$), extreme low flow (500 $m^3/s$) and flow reversal during extreme low flow (a

rare, short-term event). For all three scenarios, the effluent discharge rates were 0.83 $m^3$/s and 0.55 $m^3$/s, respectively, for the Botnia and ENCE mills.

Under typical flow conditions in the river, the combined effluent flow of 1.38 $m^3$/s is approximately 0.02% of the average river flow. The effluent is rapidly mixed and diluted at each point of discharge, due to the high river flow and the action of the diffuser. The concentration of effluent in the river is reduced to less than 1% (100:1 dilution) within a few metres of the diffuser (Figure 4.6-1). Based on experience in monitoring aquatic effects around paper mills in Canada (Environment Canada, 2003), environmental effects are not anticipated beyond the 100:1 dilution envelope. Trace levels of effluent would extend further downstream, reaching 1,000:1 dilution in the vicinity of Yaguareté Bay. Environment Canada defines areas beyond 1,000:1 dilution as reference areas, and considers them representative of background conditions.

Under extreme low flow conditions in the river (500 $m^3$/s), the combined effluent flow of 1.38 $m^3$/s is approximately 0.28% of the river flow. This low flow in the river has a recurrence interval in the range of 5 to 20 years. In this case, the 100:1 dilution envelope extends approximately 35 m downstream from each diffuser and 200 m along the length of the diffuser (Figure 4.6-2). The small size of this exposure area minimizes any potential for effects on fish, since fish usually range over much larger areas. In its environmental effects monitoring program for paper mills, Environment Canada (2005) has determined that a survey for effects on fishes is not required when 100:1 dilution is achieved with 250 m of the mill discharge. Trace levels of effluent would extend further downstream, reaching 200:1 dilution in the vicinity of Fray Bentos.

During a rare flow reversal condition, with low flow, the effluent plumes may extend upriver, again reaching 100:1 dilution within approximately 35 m of the discharge (Figure 4.6-3). Trace levels of effluent would extend further upstream, to a maximum extent of 7 km above the ENCE mill, at 1,000:1 dilution. The reverse flow condition would not last for more than a few hours. During this time, trace levels of effluent could extend across the Río Uruguay into Argentina waters at a 700:1 dilution level.

### 4.6.2 Potential for Effects at Receptor Locations

The effluent dilution factors for specific receptor locations of interest are shown in Table 4.6-1, based on modelling results for conductivity, which is a conservative tracer of mill effluent. The results are shown for three different river flow conditions: average flow, extreme low flow and flow reversal during extreme low flow.

The receptor locations are individually discussed in the following paragraphs, with reference to particular effluent constituents and potential effects.

#### *4.6.2.1 Water Receptor 1,* Río *Uruguay at the Botnia and ENCE Diffusers*

The treated effluents from the Botnia and ENCE mills will be discharged to the Río Uruguay through diffuser structures located 200 m offshore from the river bank in 13.5 m and 19 m of water, respectively. Under the most extreme condition (low river flow), the 100:1 effluent dilution envelope will extend approximately 35 m downstream from each diffuser. Typically, this exposure envelope will extend only a few metres downstream.

The greatest potential effect within these relatively small areas is of an aesthetic nature. There is a slight risk that the discharge for the Botnia mill may be visually detected under extreme low flow conditions by an observer standing on the International Bridge. The close proximity of the Botnia mill to the International Bridge provides a clear view of the diffuser area, whereas the ENCE mill is too far away to view the diffuser area from the bridge. The proximity of the Botnia diffuser to the bridge may enable visual detection of the slight change in color of the wastewater relative to the ambient river water and the possible slight disturbance of the surface flow pattern due to the turbulence from the diffuser nozzles. This visual detection of the plume could be objectionable to the public as it may be perceived as an environmental risk, although such detection does not pose any real risk to either public safety or to the environment. These subtle differences are not likely detectable from a boat.

The water quality within this extremely small exposure area will not pose a risk to humans or aquatic life. The water quality may exceed one or more of the surface water quality standards of DINAMA and CARU during periods of extreme low flow, although this potential is provided for within the regulatory standards (referred to as a mixing zone). The areas of potential exceedance are relatively small and are confined to areas within the main channel on the Uruguayan side of the river away from sensitive habitat, valued recreational areas and drinking water supplies. They therefore do not pose a direct risk to the valued components of the ecosystem.

Fish may be attracted to these areas because of warmer temperatures and higher velocity immediately at the diffusers. However, the size of this area of exposure is so small relative to the home range for most fish species that the potential for effects on fish is considered minimal. Experience at pulp mills in Canada shows that fish health responses are non-measurable within such small exposure areas.

Beyond the edge of the mixing zone, the water quality of the Río Uruguay will be in compliance with all surface water quality standards with the exception of those water quality parameters in exceedance under existing conditions. As described in Section 3.2.2, the baseline concentration of phosphorus and several metals exceed the surface water quality standards throughout the Río Uruguay under existing conditions. The discharge of untreated municipal and industrial wastewaters, agricultural fertilizers and other agricultural runoffs all contribute to this existing condition.

Sediments within the immediate vicinity of the diffusers (extending 35 m from the diffuser) may be enriched with nutrients (organic material, nitrogen, phosphorus) as is commonly

found near pulp mill diffusers, and this enrichment may cause a change in the benthic macroinvertebrate community. However, given the extremely small size of the exposure area and high mobility of sediments at moderate and high flows in the main channel, the extent of enrichment is expected to be limited and perhaps transient.

#### *4.6.2.2 Water Receptor 2, Río Uruguay at Yaguareté Bay*

The Yaguareté Bay is a shallow embayment located approximately 1.5 km downstream from the Botnia mill. It has been identified as a potentially sensitive aquatic environment since it provides important habitat for various species of fish.

With water depth less than 2 m, it comprises a particularly extensive littoral zone, similar to those existing in other embayments both up and downriver. In general, this littoral zone tends to be more productive than the profundal zone of a river and, as such, tends to be used as a feeding area for many fish species, particularly benthivorous species such as catfish and carp. In addition, juvenile fishes of many species feed in these areas due to the high bottom productivity and low density of predatory fishes. Both carp and catfishes tend to use shallow embayments for spawning purposes, and this likely occurs in Yaguareté Bay, as in other shallow embayments up and down the river.

Water velocity is lower in Yaguareté Bay as compared to the main channel, and as such, sedimentation may occur more readily in the embayment than further offshore. At the same time, the embayment is regularly flushed during high flow periods and due to wind/wave action, as evidenced by the lack of sedimentary features (e.g., islands). An investigation of the potential influence of the port development (Botnia, 2006) estimated a potential change in the sedimentation rate from 0.13 m/a under present conditions to 0.19 m/a with the development of the port. However, these estimates of sedimentation are unrealistically high considering they would cause the embayment to fill within 10 to 15 years under present conditions. Calculations (Yalin, 1992; Dean and Dalrymple, 1984) show that currents of 0.25 m/s and waves of 0.5 m can mobilize silt size sediment in 2 m of water, and therefore these other factors are expected to prevent accumulation of sediment within the embayment.

Suspended sediment discharged from the two mills will not affect the net sedimentation rate within Yaguareté Bay since the potential change in concentration of suspended solids is exceedingly low. The change in total suspended solids concentration within the embayment is estimated to range from 0.0 mg/L under average flow to 0.5 mg/L under extreme low flow conditions within the Río Uruguay. In comparison, the baseline concentration of total suspended solids is approximately 14 mg/L and can range from 2 to 58 mg/L (CARU, 1993). Thus, it is expected that suspended solids will not measurably change in or near Yaguareté Bay as a result of mill operations, and accordingly, net sedimentation in the bay is not expected to change.

Nutrification is a potential issue for Yaguareté Bay under existing conditions, since algal blooms can occur in the embayment during the summer months. Baseline concentrations of

total nitrogen and total phosphorus range from 0.19 to 1.1 mg/L and 0.04 to 0.24 mg/L, respectively (CARU, 1993; Algoritmos, 2006) in comparison to surface water quality standards for total phosphorus of 0.025 mg/L. (A surface water quality standard does not exist for total nitrogen). The discharge from the two mills will not change the concentrations of total nitrogen and total phosphorus in or near Yaguareté Bay under average flow conditions, and will not measurably change the concentrations under extreme low flow conditions (increments 0.04 and 0.001 mg/L). Nutrient levels in sediments are unlikely to be measurably changed as a result.

The concentration of chlorinated organics will also remain unchanged in or near Yaguareté Bay as a result of mill operations. Chlorophenolics are the main chlorinated constituents in the mill effluents. Baseline levels of chlorophenolics in the waters of Yaguareté Bay range from approximately 0.0001 mg/L (Tana, 2005, 2006) to 0.0014 mg/L (Algoritmos, 2006). They will not change under average flow conditions and may change marginally by 0.0003 mg/L under extreme low flow conditions. While chlorophenolics may partition to sediments and benthic invertebrates, with minimal changes in water quality and sedimentation in the bay, the levels in sediments and biota are not expected to be measurably changed.

A conservative estimate of the dioxin and furan concentrations in the Botnia and ENCE mill effluents is less than 10 pg/L TEQ (note 1 pg/L is equivalent to $10^{-9}$ mg/L). Based on this conservative estimate, the TEQ concentration within Yaguareté Bay may change by less than 0.035 pg/L TEQ under extreme low flows, as compared to baseline levels as high as 0.46 pg/L TEQ in the Río Uruguay (Tana, 2005, 2006). This small increment would not measurably change the baseline water quality for dioxins and furans within Yaguareté Bay. Furthermore, the concentration of the most toxic congener (2,3,7,8-TCDD) is expected to be non-detectable (at the 0.5 pg/L level) within the effluent, and therefore water in Yaguareté Bay will be significantly less than the water quality guideline of 0.005 pq/L defined by the U.S. EPA (2002) for protection of fish consumption. Consequently, the concentrations of dioxins and furans in fish tissue are not expected to be measurably changed as a result of releases from the mill.

The baseline concentrations of dioxins and furans in fish tissue are in the 0.1 to 0.3 pg TEQ/g FW[14] range (Tana, 2005, 2006). These values are 13 to 200 times lower than the TEQ levels at which fish consumption advisories would begin. Thus, there is a considerable margin of safety at present with respect to dioxins and furans, and this will continue to be the case when the mills are operating.

While adverse effects from chlorinated organics in Yaguareté Bay are not anticipated, monitoring of chlorophenolics and dioxins and furans in the sediments and biota of the bay is recommended to confirm that there is no measurable increase in the levels of these substances. A proposed monitoring program is outlined in Section 5.1.4.

[14] FW refers to fresh weight

Phytosterols in Botnia mill effluent are expected to be 0.020 to 0.160 mg/L. In ENCE mill effluent, they are expected to be less than 0.170 mg/L. The phytosterols will be diluted at least 300:1 in Yaguareté Bay under the worst case condition, resulting in a potential change in concentration of less than 0.001 mg/L. This increment is below the baseline range for the Río Uruguay of less than 0.001 to 0.022 mg/L (Tana, 2005, 2006). It is also below the threshold level of 0.010 mg/L for β-sitosterol induction of estrogenic effects in fishes, and well below the levels that have been associated with reproductive effects in wild fishes (Munkittrick *et al.*, 1998; McMaster *et al.*, 2003; Golder, 2006). It is therefore concluded that effects are very unlikely to be observed in fishes in the vicinity of Yaguareté Bay.

Similarly, fish tainting is very unlikely to be detected in the area as a result of mill operations. Even with older bleached kraft mill technologies, fish tainting has not been associated with effluent concentrations below about 25:1 to 50:1 dilution (Kovacs, 1986). In comparison, the effluent concentrations in Yaguareté Bay are estimated to be significantly lower at the 300:1 level or better. Tainting related to mill effluents is generally not observed today (Environment Canada, 2003) and is never observed in the vicinity of modern mills with good secondary treatment.

#### *4.6.2.3 Water Receptor 3, Playa Ubici at the Downstream Edge of Yaguareté Bay*

Playa Ubici is a recreational beach area located along the downstream edge of Yaguareté Bay approximately 1,500 m from the Botnia discharge. The beach is a valuable resource for the city of Fray Bentos and for tourists who may visit the area. It is used for camping, swimming and other outdoor recreational activities.

Under existing conditions, the water quality along the waterfront of Playa Ubici is in compliance with the surface water quality standards of DINAMA and CARU for all listed parameters with the exception of total phosphorus and possibly bacteria. These two water quality parameters are generally of greatest interest from the perspective of recreational water contact. Phosphorus is of interest as it promotes growth of algae which can affect the aesthetic quality of the water and beach front, and certain species can pose a health risk to humans and aquatic life. Bacteria serve as an indicator of the possible presence of pathogens associated with fecal contamination which pose a risk to human health.

Mill operations will have no effect on the quality of this valued resource. The contribution of phosphorus from mill operations is predicted to be immeasurably small (0.003 mg/L under extreme low flows) in comparison to background of 0.130 mg/L (Algoritmos, 2006). Likewise, the contribution of mill operations to bacteria levels will also be immeasurably small relative to the recreational standard of 200 F.C./100 mL. As a result, algal biomass and pathogens associated with fecal material will remain unchanged.

#### *4.6.2.4 Water Receptor 4, Fray Bentos Drinking Water Intake*

The water intake for the community of Fray Bentos is located approximately 5 km downstream from the Botnia site, and about 70 m into the Río Uruguay. The water supplier

(OSE) withdraws approximately 0.05 $m^3$/s and distributes treated water to approximately 22,600 people. The treatment includes flocculation (by alum addition), sedimentation, filtration, disinfection with chlorine and pH adjustment. The chlorine residual in the finished drinking water is typically about 0.8 mg/L.

Primary water quality indicators for potability of water relate to the colour, taste, smell and coliform bacteria count. The first three are aesthetic issues. The latter is not a health concern per se, but serves as an indicator that microbial disease organisms may be present. Water quality associated with chlorinated organic compounds, such as dioxins, furans and chlorophenols, are also of interest from a human health perspective. Nitrites and nitrates are also of interest from a human health perspective. WHO guidelines for nitrite and nitrate in drinking water are 3 and 50 mg/L, respectively.

Baseline OSE data for 2000 to 2003 indicate nitrite concentrations of less than 0.01 mg/L and nitrate concentrations of less than 11 mg/L in the river water supply. Botnia (2004) presents data for nitrate at this location in the 1 to 2 mg/L range. Recent data for this general area in 2005 and 2006 indicate values may be as high as 5.9 mg/L. Nitrates in mill effluents (3 to 10 mg/L) are expected to be below levels of drinking water concern at the point of discharge, and 1,500 times below WHO guidelines at the Fray Bentos water supply.

Adsorbable organic halide (AOX), often used as a surrogate for chlorinated organic compounds, is in the 0.002 to 0.007 mg/L range at the water intake location (SEINCO, 2003). Botnia (2004) data for this location are in the 0.007 to 0.008 mg/L range, and recent data for this general area indicate values may be as high as 0.012 mg/L. AOX in mill effluents is expected to be diluted to the 0.003 to 0.043 mg/L range at the intake location under the average and extreme low flow conditions, respectively. The higher value would suggest that a new source of chlorinated organics may be present; however, at most, a small fraction of the AOX might be in the form of toxic chlorinated organics. In the case of modern ECF mill effluents, chlorophenolics might comprise up to about 1 or 2% of AOX.

It should be noted that AOX may be formed as part of the drinking water treatment process through chlorination, particularly when there are high levels of organic substances in the raw water. Chemical oxygen demand (COD) is a general indicator of organic substances. The baseline COD concentration at the intake ranges from 1 to 2 mg/L reported by Botnia (December, 2003) and to 20 mg/L reported by GTAN (2006). The incremental contribution from the mill operations is predicted to range from 0.3 to 4.1 mg/L for the average and extreme low flow conditions, respectively. Thus, there is limited potential for organics from the mills to increase the production of AOX within the water supply facility.

Since AOX levels of 0.050 to 0.100 mg/L in drinking water are not considered problematic (Grimvall *et al.*, 1994; McCubbin, 2001; Norrstrom and Karlsson, 2006), and since the mill projects on the Río Uruguay are likely to make a small change in AOX levels (up to about 0.05 mg/L during low flow), there is little likelihood of mill effects on the Fray Bentos water supply related to chlorinated organics.

Most modern North American mills report "non-detect" for TCDD in final effluent (at detection limits up to 10 pg/L) and roughly half report occasional detection of TCDF (which may represent river baseline conditions). McCubbin (2001) notes that there has never been proven damage to water users in North America due to TCDD/TCDF in mill effluents, despite the fact that until the 1990s, all mills discharged much greater amounts of TCDD/TCDF than do modern ECF kraft mills.

Consideration of chlorophenols in mill effluents would support the expectation of no adverse effects on the drinking water supply from chlorinated organics. With expected effluent concentrations of approximately 0.070 mg/L and worst case dilution, the concentration in the river near the discharge will be less than 0.0007 mg/L. This is within the baseline range of up to 0.0014 mg/L (Algoritmos, 2006). It is also well below the Health Canada guideline of 0.005 mg/L for 2,4,6-trichlorophenol, the most toxic of the listed chlorophenolics.

#### *4.6.2.5 Water Receptor 5, Beach Area near Arroyo Fray Bentos*

The beach area near Arroyo Fray Bentos is a valued resource for the city of Fray Bentos and is used for swimming and other outdoor recreational activities.

The beach is located downstream from the municipal wastewater discharge for the city of Fray Bentos. It is reported that this beach area experiences elevated levels of phosphorus and fecal coliform bacteria as a result of its close proximity to the municipal discharge. The average contribution of this discharge to phosphorus and bacteria is predicted to be 0.01 mg/L and 70 FC/100 mL. Higher concentrations are expected during periods of heavy rainfall. Elevated phosphorus concentrations contribute to the growth of algae which can impact the aesthetic quality of the beach area, and elevated bacteria levels can pose a health risk to the public.

Botnia is considering the option of treating the municipal wastewater for Fray Bentos at the wastewater treatment system for the mill. This will effectively eliminate this significant source of phosphorus and bacteria to this beach area thereby improving the overall quality of the resource. This is considered a significant benefit that should be considered further by DINAMA, the city of Fray Bentos, Botnia and other stakeholders.

#### *4.6.2.6 Water Receptor 6, Beach Area at Las Cañas*

Las Cañas is a beach resort community located further downstream along the shores of the Río Uruguay. The beach attracts visitors from throughout Uruguay and Argentina, and is therefore an important resource for local tourism.

The beach is also located downstream from the municipal discharge for the city of Fray Bentos. The contribution of phosphorus and bacteria along the shores from this discharge is predicted to be 0.005 mg/L and 30 F.C./100 mL, on average, and potentially considerably higher during heavy rainfall. The treatment of the Fray Bentos discharge by the Botnia mill will eliminate this source of wastewater to Las Cañas and is therefore considered a benefit.

The mill discharges are sufficiently far upstream that the water quality at Las Cañas will remain unchanged as a result of mill operations.

#### *4.6.2.7 Water Receptor 7, Río de la Plata*

The Río de la Plata is an estuary formed by the combination of the Río Uruguay and the Río Paraná. It extends approximately 290 km from the rivers' confluence to the Atlantic Ocean. Where the rivers join, it is 48 km wide, and it runs to the southeast increasing to 220 km wide where it opens on the Atlantic Ocean. It forms part of the border between Argentina and Uruguay, with the major ports and capital cities of Buenos Aires in the southwest and Montevideo in the northeast.

The basin drained by the main tributaries of the Río de la Plata (the Uruguay and Paraná, and the Paraná tributary, the Paraguay) covers approximately one fifth of South America, including areas in southeastern Bolivia, southern and central Brazil, the entire nation of Paraguay, most of Uruguay and northern Argentina. The average flow from this massive drainage area is approximately 24,000 $m^3/s$, in comparison to the average flow of the Río Uruguay of approximately 6,200 $m^3/s$.

Given the magnitude of flow within the Río de la Plata, the wastewater discharge from the two mills will have no effect on water quality. All resources within the Río de la Plata will therefore be unaffected by the mill operations.

#### *4.6.2.8 Water Receptor 8, Esteros de Farrapos e Islas del Río Uruguay*

Esteros de Farrapos e Islas del Río Uruguay is Uruguay's second designated Ramsar site. In 2004, it was added to the List of Wetlands of International Importance and incorporated into the National Protected Area System. Located along the Río Uruguay between Neuvo Berlin and San Javier, the site consists of alluvial areas on the river's eastern bank as well as 24 islands that are periodically flooded during periods of high flow. The site is a representative wetland of the transition zone between the humid temperate and the subtropical areas. The site supports a high diversity of birds and serves as an important wildlife refuge and corridor.

This area will not be exposed to wastewaters from the mill operations. During most flow conditions, the downstream direction of flow carries the wastewaters from the two mills away from this area thereby preventing all risk of exposure. During rare occasions when the flow reverses direction and travels upstream, the wastewaters move upstream at trace levels, although the dilution is expected to be greater than 1,000:1 at a point 7 km upriver from ENCE, well below the Island Delta area, and the plume would extend this far only for a few hours. Therefore, there is virtually no potential for mill effluents to impact the Island Delta area.

#### *4.6.2.9 Water Receptor 9, Río Negro*

The Papelera Mercedes is a neutral sodium sulphite chemical (NSSC) and Kraft mill located along the Río Negro in the community of Mercedes. This mill does not have any form of chemical recovery or wastewater treatment, and all cooling and process waters are discharged directly to the Río Negro where it then flows to the Río Uruguay.

Botnia is considering the possibility of transporting the weak black liquor from their pulp washing plant to the evaporation plant at the Botnia mill, requiring approximately 3 to 4 trucks daily. This option presents significant environmental and social benefits that warrant further consideration by DINAMA, the Mercedes mill, Botnia and other stakeholders.

#### *4.6.2.10 Water Receptor 10, Río Uruguay on the Argentina Side*

As with Uruguay, Argentina values the Río Uruguay as a resource for drinking water, irrigation water, recreation, and habitat for valued aquatic species. Protection of this resource is a priority of the people of Argentina and their Government. As such, the Government of Argentina, together with the Government of Uruguay, established CARU as the agency responsible for the oversight of the protection and monitoring of water quality within the Río Uruguay. CARU has developed water quality standards that the mills must comply with. These standards are approved by the Governments of Argentina and Uruguay and are considered by these Governments as acceptable and adequately protective of the aquatic environment of the Río Uruguay.

The mill operations will comply with the water quality standards provided by CARU.

The wastewaters from the mill operation will remain on the Uruguayan side of the river and will not cross over to the Argentina side beyond trace levels. Under average and extreme low flows, the dilution of mill wastewaters in Argentina waters will exceed 1,000:1 and therefore are considered the same as background from the perspective of water quality and aquatic resource protection. During rare flow reversals the dilution may reduce below 1,000:1; however, the contribution of mill effluents to water quality within Argentina waters will remain extremely small and well within the standards provided by CARU.

Fish and other aquatic animals move throughout the Río Uruguay and may reside in water along both Uruguay and Argentina sides of the river. The aquatic resources within Yaguareté Bay are not expected to be adversely affected by mill operations (Section 4.6.2.2), and therefore fish species that move between Yaguareté Bay and Argentina are also considered to be protected from the perspective of the mill operations. It is worth noting that many of the valued fish species of the region spend early life stages in Argentina waters along the Río Paraná.

#### *4.6.2.11 Water Receptor 11, Beach Area at Ñandubaysal, Argentina*

A beach and campground is located at Ñandubaysal in Argentina across the Río Uruguay from Fray Bentos. The site is a popular vacation and tourist destination for people from Argentina and Uruguay during the summer months and particularly during the annual Carnival.

The existing water quality at the beach area is within the standards for both CARU and DINAMA with the exception of phosphorus, several metals and possibly bacteria. These elevated levels reflect a general concern throughout the Río Uruguay associated with the discharge of untreated municipal and industrial wastewaters and agricultural runoff. Given its close proximity, the quality of water at Ñandubaysal is likely most influenced by the water quality of the Río Gualeguaychú.

Dispersion modeling shows that wastewaters discharged along the Uruguayan side of the river tend to remain along the shoreline and do not disperse across the river, particularly within such a short distance from the source. Studies conducted by CARU reach the same conclusion. The calculated dilution at the beach area at Ñandubaysal exceeds 1,000:1 under both average and low flow conditions (Table 4.6-1), and therefore is considered to be unaffected by mill operations.

On rare occasions the flow of the river may reverse direction and during these rare occasions the model predicts movement of trace levels of wastewater across the Río Uruguay towards Ñandubaysal. A dilution of approximately 700:1 is sufficient to reduce the concentration of wastewater to non-measurable levels. AOX may be a possible exception since it can be detected at trace levels. However, the predicted contribution from mill operations of 0.007 mg/L is within the range of observed background levels and is not considered problematic for drinking water or protection of aquatic life.

### 4.6.3 Summary of Potential Effects on the Aquatic Environment

Table 4.6-2 provides a summary of the potential effects on the aquatic environment associated with the mill operations. As presented, potential effects are limited to the area within the immediate vicinity of each diffuser where the effluent initially mixes with the ambient water. Beyond this small area, the water quality standards are achieved with the exception of those parameters which exceed the standards under present conditions due to the discharge of untreated municipal wastewater and agricultural runoff. Options under consideration for treatment of the municipal wastewater for the city of Fray Bentos and treatment of the industrial wastewater for Papelera Mercedes could result in significant improvements to the water quality downstream of Fray Bentos and within the Río Negro.

## Table 4.6-1: Effluent Exposure at Receptor Locations for Various Flow Conditions

| Receptor | Average Flow (6,230 $m^3/s$) | | Extreme Low Flow (500 $m^3/s$) | | Flow Reversal during Low Flow (700 $m^3/s$) | |
|---|---|---|---|---|---|---|
| | Conductivity (µS/cm) | Dilution | Conductivity (µS/cm) | Dilution | Conductivity (µS/cm) | Dilution |
| **Conductivity of Effluents** | 4,000 | - | 4,000 | - | 4,000 | - |
| **Conductivity of Ambient River** | 100 | - | 100 | - | 100 | - |
| **Uruguay** | | | | | | |
| 1. At each discharge | - | - | 140 | 100:1 | 140 | 100:1 |
| 2. Yaguareté Bay | 100 | >1,000:1 | 103 | >1,000:1 | 108 | 516:1 |
| 3. Playa Ubici | 102 | >1,000:1 | 116 | 246:1 | 105 | 757:1 |
| 4. Fray Bentos water intake | 102 | >1,000:1 | 124 | 164:1 | 105 | 784:1 |
| 5. Beach area at Arroyo Fray Bentos | 101 | >1,000:1 | 118 | 220:1 | 102 | >1,000:1 |
| 6. Beach area at Las Cañas | 101 | >1,000:1 | 116 | 247:1 | 101 | >1,000:1 |
| 7. Rio de la Plata | 100 | >1,000:1 | 101 | >1,000:1 | 100 | >1,000:1 |
| 8. Rio Uruguay Island Delta | 100 | >1,000:1 | 100 | >1,000:1 | 103 | >1,000:1 |
| 9. Rio Negro | N/A | N/A | N/A | N/A | N/A | N/A |
| **Argentina** | | | | | | |
| 10. Rio Uruguay in Argentina | 100 | >1,000:1 | 103 | >1,000:1 | 104 | 895:1 |
| 11. Beach area at Ñandubaysal | 100 | >1,000:1 | 100 | >1,000:1 | 106 | 693:1 |

## Table 4.6-2: Summary of Potential Effects on the Aquatic Environment

| | |
|---|---|
| **Receptor 1** | **Vicinity of Botnia and ENCE Discharges** |
| Water quality | • Exposure Area extending approximately 35 m from each diffuser and 200 m along each diffuser.<br>• Possible exceedance of surface water quality objectives within this exposure area during extreme low flow conditions.<br>• Potential for aesthetic effect associated with visual detection of the effluent plume within a very small area at each diffuser during extreme low flow conditions. |
| Sediment quality | • Possible enrichment of sediments (e.g., organic material and nutrients) within the small exposure area at each diffuser. |
| Fish community | • Possible fish attraction to the diffusers due to warmer temperature and higher velocity.<br>• Minimal potential health effects on fish, since exposure area is small relative to the home range for most fish species. |
| Aquatic invertebrate community | • Possible change in benthic macroinvertebrate community within the exposure area at each diffuser due to sediment enrichment. |
| **Receptor 2** | **Yaguareté Bay** |
| Water quality | • Water quality in compliance with DINAMA surface water quality standards (with the exception of phosphorus which exceeds the standard under background condition due to discharge of untreated municipal wastewater and agriculture runoff).<br>• Trace levels of wastewater from mill operations will not adversely affect water quality. |
| Sediment quality | • Potential for sedimentation due to the lower water velocities within the embayment but limited change expected due to mill operations.<br>• Monitoring of sediment quality recommended to confirm conclusion of no adverse effect. |
| Fish community | • Trace levels of wastewater from mill operations will not adversely affect the health of fish communities within Yaguareté Bay.<br>• Monitoring of selected fish species recommended to confirm conclusion of no adverse effect. |
| Aquatic invertebrate community | • Trace levels of wastewater from mill operations will not adversely affect the invertebrate communities within Yaguareté Bay.<br>• Monitoring of benthic macroinvertebrate community recommended to confirm conclusion of no adverse effect. |

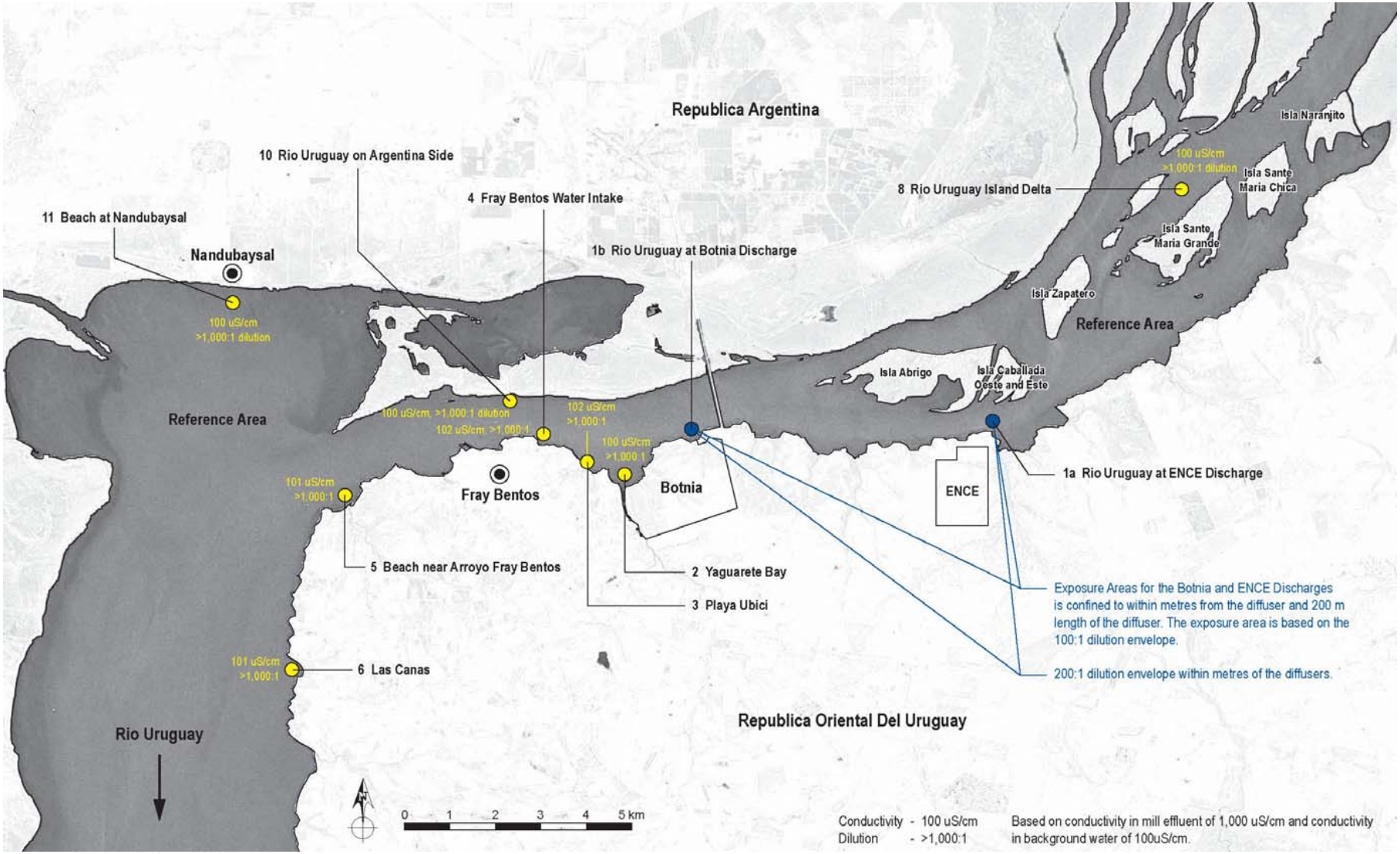
## Table 4.6-2: Summary of Potential Effects on the Aquatic Environment (cont'd)

| | |
|---|---|
| **Receptor 3** | **Playa Ubici** |
| Water quality | • Water quality in compliance with DINAMA surface water quality standards (with the exception of phosphorus and possibly bacteria which exceed the standard under background condition due to discharge of untreated municipal wastewater and agriculture runoff).<br>• Trace levels of wastewater from mill operations will not adversely affect water quality. |
| Sediment quality | • Sediment quality unaffected within beach area. |
| Fish community | • Fish community unaffected within beach area. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected within beach area. |
| **Receptor 4** | **Fray Bentos Drinking Water Supply** |
| Water quality | • Water quality in compliance with DINAMA surface water quality standards for Class 1 waters (with the exception of phosphorus, ammonia and possibly bacteria which exceed the standard under background condition due to discharge of untreated municipal wastewater and agriculture runoff).<br>• Trace levels of wastewater from mill operations will not adversely affect water quality. |
| Sediment quality | • Not applicable |
| Fish community | • Not applicable |
| Aquatic invertebrate community | • Not applicable |
| **Receptor 5** | **Beach Area near Arroyo Fray Bentos** |
| Water quality | • Water quality in compliance with DINAMA surface water quality standards (with the exception of phosphorus and possibly bacteria which exceed the standard under background condition due to discharge of untreated municipal wastewater and agriculture runoff).<br>• Trace levels of wastewater from mill operations will not adversely affect water quality.<br>• Option to treat the municipal wastewater for the city of Fray Bentos at the Botnia mill will improve water quality within the beach area. |
| Sediment quality | • Sediment quality unaffected within beach area. |
| Fish community | • Fish community unaffected within beach area. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected within beach area. |
| **Receptor 6** | **Beach Area near Las Cañas** |
| Water quality | • Potential for improved water quality if municipal wastewater for the city of Fray Bentos is treated at the Botnia mill. |
| Sediment quality | • Sediment quality unaffected within beach area. |
| Fish community | • Fish community unaffected within beach area. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected within beach area. |

## Table 4.6-2: Summary of Potential Effects on the Aquatic Environment (cont'd)

| | |
|---|---|
| **Receptor 7** | **Rio de la Plata** |
| Water quality | • Water quality unaffected. |
| Sediment quality | • Sediment quality unaffected. |
| Fish community | • Fish community unaffected. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected. |
| **Receptor 8** | **Esteros de Farrapos e Islas del Rio Uruguay** |
| Water quality | • Water quality unaffected. |
| Sediment quality | • Sediment quality unaffected. |
| Fish community | • Fish community unaffected. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected. |
| **Receptor 9** | **Rio Negro** |
| Water quality | • Potential improvement in water quality in Rio Negro if untreated wastewater from Papelera Mercedes is treated at Botnia mill. |
| Sediment quality | • Potential improvement in sediment quality in Rio Negro if untreated wastewater from Papelera Mercedes is treated at Botnia mill. |
| Fish community | • Reduced risk to fish community in Rio Negro if untreated wastewater from Papelera Mercedes is treated at Botnia mill. |
| Aquatic invertebrate community | • Reduced risk to invertebrate community in Rio Negro if untreated wastewater from Papelera Mercedes is treated at Botnia mill. |
| **Receptor 10** | **Rio Uruguay along the Argentina Side** |
| Water quality | • Water quality unaffected. |
| Sediment quality | • Sediment quality unaffected. |
| Fish community | • Fish community unaffected. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected. |
| **Receptor 11** | **Beach Area at Ñandubaysal, Argentina** |
| Water quality | • Water quality unaffected. |
| Sediment quality | • Sediment quality unaffected. |
| Fish community | • Fish community unaffected. |
| Aquatic invertebrate community | • Aquatic invertebrate community unaffected. |

## Figure 4.6-1: Effluent Exposure under Typical Flow Conditions



## Figure 4.6-2: Effluent Exposure under Extreme Low Flow Conditions

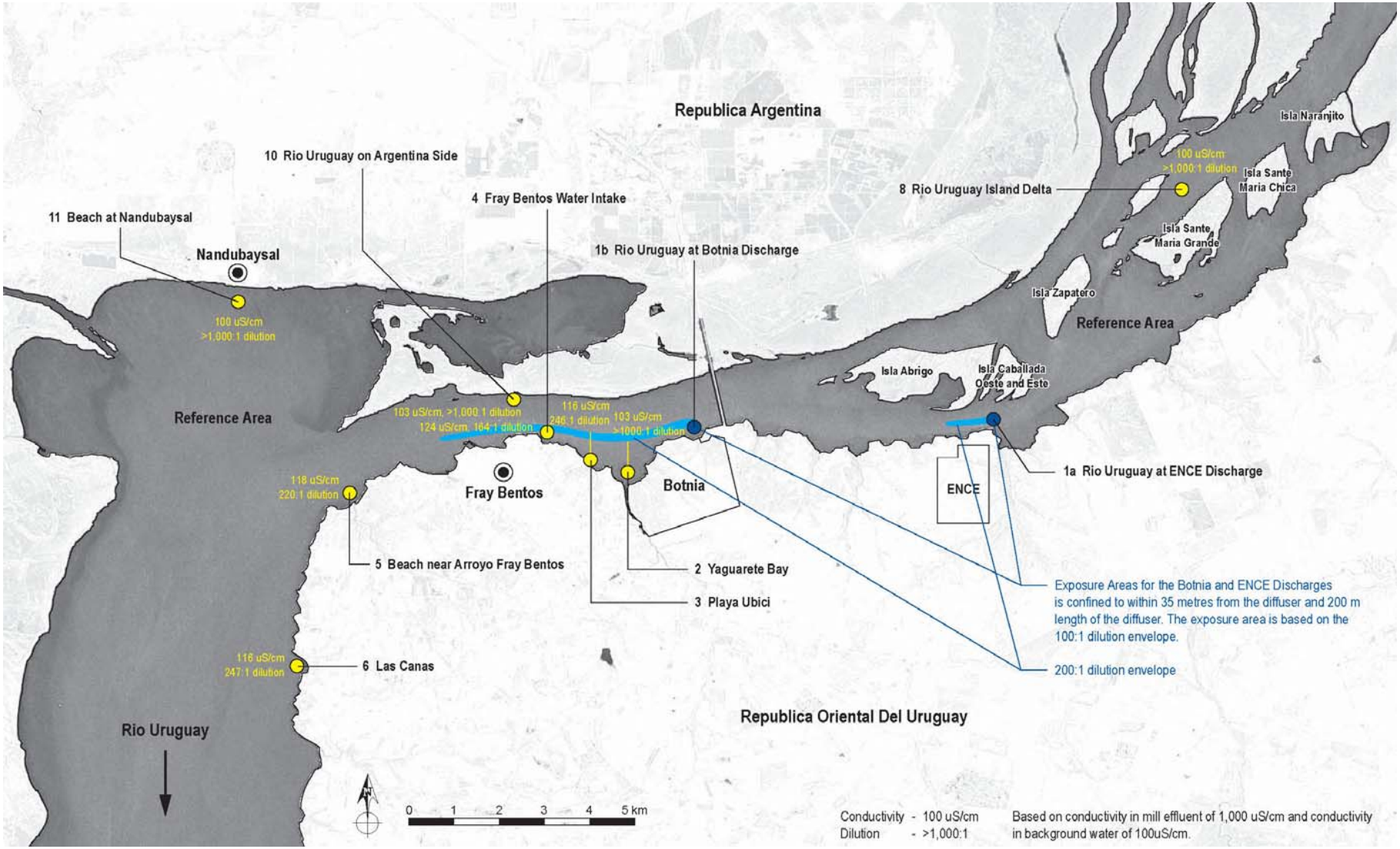
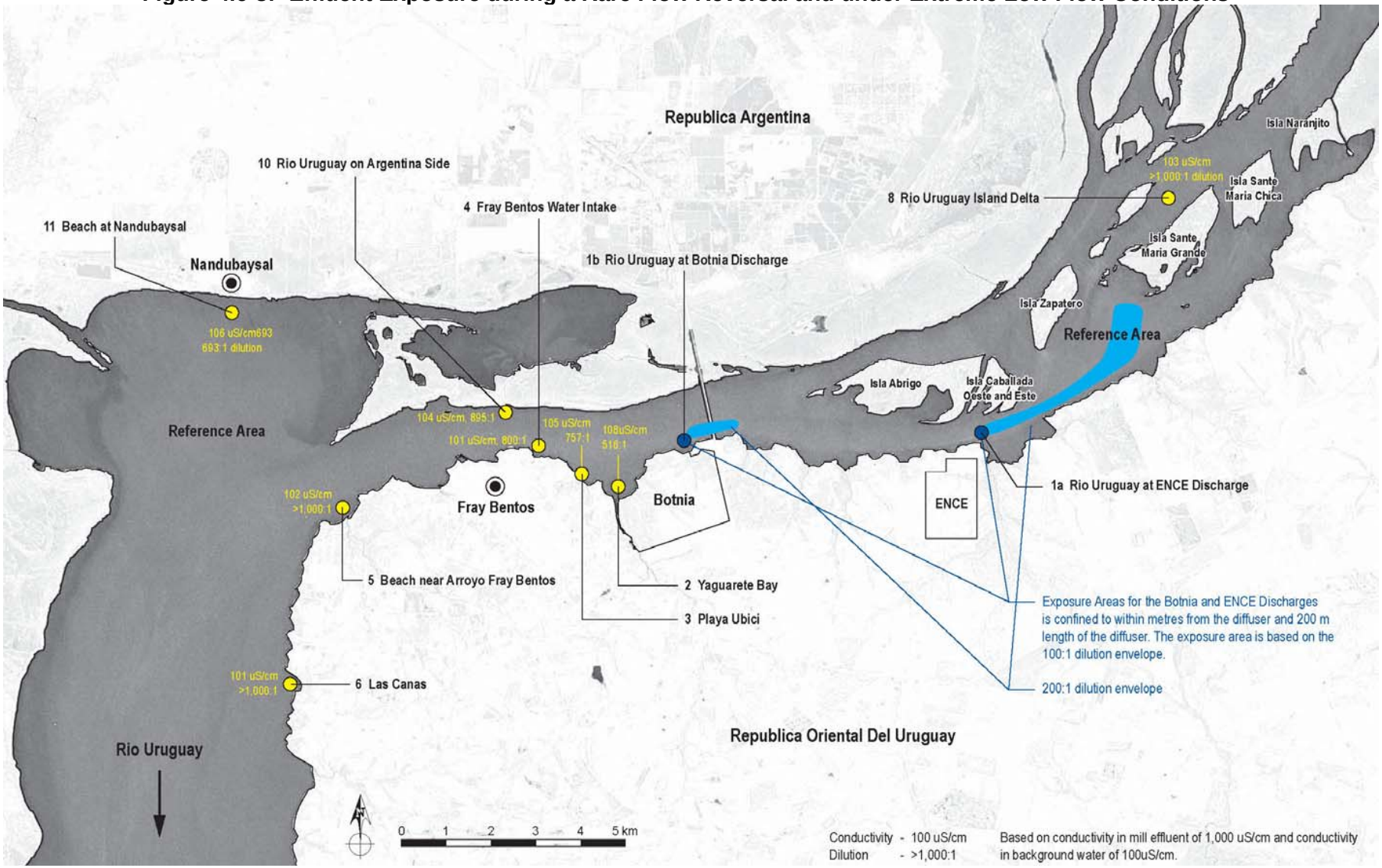


**Figure 4.6-3: Effluent Exposure during a Rare Flow Reversal and under Extreme Low Flow Conditions**



## 4.7 Solid Waste

Best available techniques for solid waste management involve minimizing the generation of solid waste by recovering, recycling and reusing waste materials wherever practicable. These actions as well as innovative waste minimization techniques that will be adopted by the mills are described in Annex A. In this section, the types of solid waste, the design of the landfills, and hazardous waste handling techniques will be discussed.

Solid wastes generated by Kraft pulp mill operations generally consist of the following:

- Wood Preparation Waste – bark, sand, grit and other debris associated with wood handling and preparation.
- Raw Water Treatment Sludge – mixed organic and inorganic materials resulting from the chemical treatment and filtration of water for use in the production process.
- Green Liquor Dregs, Grit and Lime Mud – primarily inorganic solids generated from the chemical recovery process. They consist of impurities from the wood or chemicals used in production that must be removed to prevent build up of inert materials and non-process chemicals.
- Effluent Treatment Sludge – generated from the primary and secondary treatment of effluent. Primary sludge is a combination of non-recoverable fiber from the pulp mill and inorganic materials (mostly lime mud and $CaCO_3$) which settles in the primary clarifier. Secondary sludge is mostly excess organic biomass from biological wastewater treatment.
- Ash/Sands – generated from combustion of wood residues and sludges and usually include solids recovered by air pollution control systems.
- Municipal Solid Waste – generated from non-production processes such as offices, kitchens and building materials from construction and workshop areas.
- Hazardous waste – pulp mills generate an assortment of hazardous wastes in small quantities, including oily rags, spill collection wastes (chemicals and fuel) and used containers.

A summary of the quantities of waste projected to be generated and the proposed management methods for the Botnia and ENCE mills is presented in Table 4.7-1. A schematic diagram of waste management practices in the proposed pulp mills is presented in Figure 4.7-1. The location of each project's landfill is presented in Figure 4.7-2.

**Table 4.7-1: Solid Waste Generation and Management Summary**

| | | Botnia | | | ENCE | |
|---|---|---|---|---|---|---|
| **SOLID WASTE** | | **QUANTITY** | **MANAGEMENT/DISPOSAL** | | **QUANTITY** | **MANAGEMENT/DISPOSAL** |
| | | Tons/year | | | Tons/year | |
| | | | | | | |
| Domestic | | 3,500 | Municipal Landfill | | 2,000 | Municipal Landfill |
| Sludge | | | | | | |
| - Raw Water Treatment Sludge | | 9,000 | Industrial Landfill/Future Recycle | | 1,000 | Effluent Treatment/Bark Boiler |
| - Fiber Sludge (Primary) | | 6,000 | Plantations/Compost | | 1,200 | Bark Boiler |
| - Biological Sludge (Secondary) | | 6,000 | Recovery Boiler | | 6,000 | Recovery Boiler |
| Chemical Recovery Process | | | | | | |
| - Green Liquor Dregs | | 30,000 | Industrial Landfill/Future Recycle | | 10,000 | Industrial Landfill |
| - Grits | | 6,000 | Industrial Landfill/Future Recycle | | 1,000 | Industrial Landfill |
| - Lime Mud | | 4,000 | Industrial Landfill/Future Recycle | | 1,000 | Industrial Landfill |
| Other | | | | | | |
| - Ash from Bark Boiler | | - | - | | 6,500 | Industrial Landfill |
| - Wood Preparation Waste | | 8,000 | Plantations/Compost | | 4,000 | Bark Boiler |
| - Sand, Stones etc from Wood Handling | | - | - | | 2,000 | Industrial Landfill |
| - Rejects from sand traps | | 1,000 | Plantations/Compost | | - | - |
| | | | | | | |
| Total Solid Waste | | 73,500 | | | 34,700 | |
| | | | | | | |
| Total to Boilers | | 6,000 | | | 12,200 | |
| Total to Plantations/Compost | | 15,000 | | | - | |
| Total to Industrial Landfill | | 49,000 | | | 20,500 | |
| | | | | | | |
| Hazardous Waste | | 100-150 | Off-site Disposal Facility per Approved Plan | | 80-100 | Off-site Disposal Facility per Approved Plan |

**Figure 4.7-1: Schematic Diagram of Waste Management in Pulp Mills**

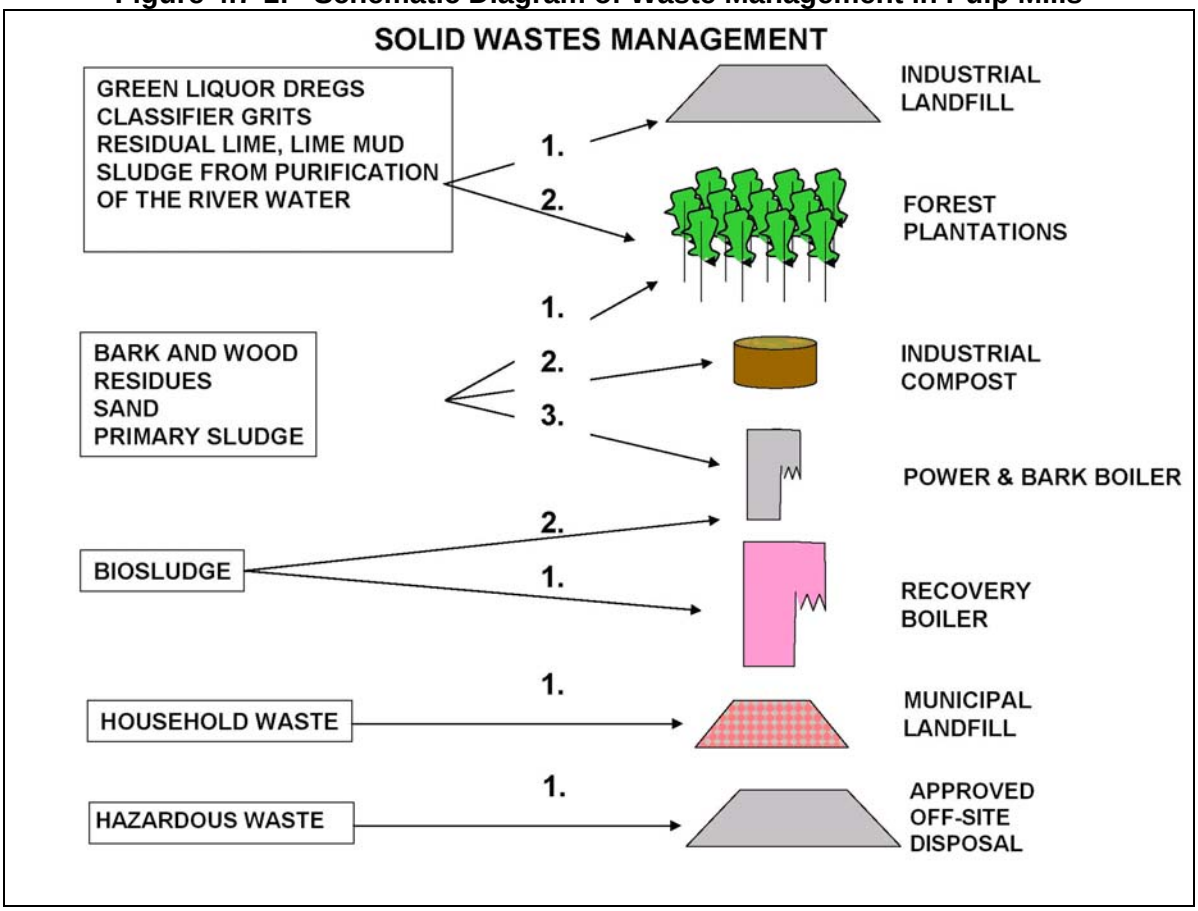
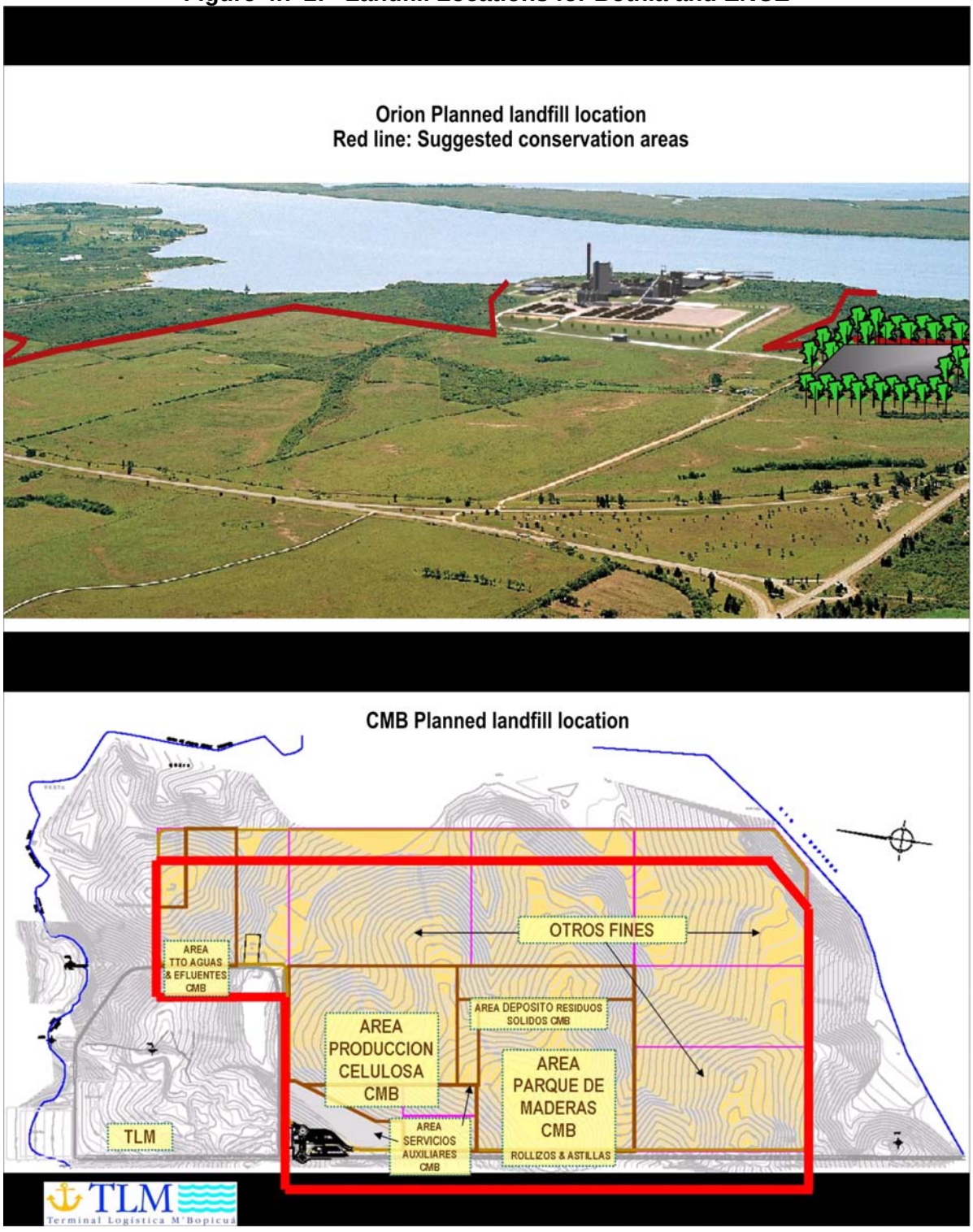


**Figure 4.7-2: Landfill Locations for Botnia and ENCE**



### 4.7.1 Landfill Development

Both projects propose to construct on-site landfills for disposal of non-hazardous solid waste. The preliminary basis of design is as follows in Table 4.7-2.

**Table 4.7-2: Landfill Design Characteristics of the Botnia and ENCE Pulp Mills**

| Item | Botnia | ENCE |
|---|---|---|
| Shape | 3 trapezoids | 8 cells initially, 12 cells if expansion required (layout 6 x 2) |
| Length (m) | 400 to 600 | 750 |
| Width (m) | 200 to 210 | 190 |
| Thickness (m) | 8 to 14 | 8 |
| Surface area ($m^2$) | 110,000 | 93,250 |
| Volume ($m^3$) | 930,000 | 560,000 |
| Estimated Capacity[1] (years) | 19 | 30 |

[1] Landfill capacity will depend on the quantity of waste that is recyclable. Waste diversion programs are expected to extend the life of the landfills.

In general, both landfill designs will consist of: a low permeability soil or geocomposite bentonite liner over the compacted subgrade; an impermeable geomembrane (plastic) liner; and a leachate collection system consisting of high permeability material and perforated plastic piping.

Both landfills will be located on their respective plant sites. This will minimize off-site truck traffic, provide for adequate landfill security and control, and allow collected leachate to be readily transferred to effluent treatment facilities. After the landfills have reached their final grade, they will be covered with a low permeability barrier and soil suitable for revegetation.

In general, organic waste will go to the bark boiler (ENCE), plantations or compost (Botnia). Therefore, the waste in the industrial landfills will be primarily inorganic. The only potential organic waste going to an industrial landfill is the sludge from Botnia's river water treatment system. However, the organic content of the raw water treatment sludge is relatively small compared to the amount of inorganic waste going to the industrial landfill. In addition, the alkaline lime mud, grits and dregs are expected to inhibit biological gas generation. If required, passive landfill gas venting systems can be installed to allow decomposition gases to vent to the atmosphere and avoid potential subsurface migration. Alternatively, these gases could be collected for combustion.

The Botnia landfill will comprise three excavation areas, with three cells per excavation area. The capacity of 19 years for the Botnia landfill is a conservative estimate based on 49,000 $m^3$ of solid waste being disposed per year (density of 1 ton/$m^3$ assumed). Botnia expects that part or all of the waste streams going to the landfill at the beginning of the project will later be sent to the plantations to recycle elements as nutrients for the growth of trees. In this way, the lifespan of the landfill will be extended. If required, there is additional space on the property to expand the landfill.

The estimated capacity of 30 years for the ENCE landfill is based on the construction of eight cells and 16,700 $m^3$ of solid waste being disposed per year (densities between 1.1 to 1.3 ton/$m^3$ assumed for the various waste streams). The modular design of the landfill enables expansion of the landfill if required. If waste diversion programs (e.g., composting) are successful, then the expansion will not be necessary. If additional space is needed to extend the life of the landfill, four additional cells could be constructed. This would create enough space in the landfill to receive residual wastes for a period of operation greater than 40 years.

### 4.7.2 Potential Impacts of Non-Hazardous Materials

Landfill installations may produce a number of impacts if they are not properly designed and operated, particularly in relation to leachate contamination. However, both landfill designs are consistent with state-of-the-art practice for these types of non-hazardous waste landfills. The landfills are designed to minimize potential environmental impacts to groundwater or adjacent surface waters.

Both companies will ensure that their facilities are located in areas with suitable geology and soils, and include careful construction techniques and monitoring of the placement of the low permeability soil and geomembrane layer, to avoid potential leachate releases to the environment. The leachate collection systems will divert leachate to their effluent treatment plants. The groundwater monitoring systems will consist of a network of upgradient and downgradient wells to monitor potential impacts and implement corrective actions as appropriate. Each load of waste will be inspected, weighed and recorded to verify waste generation rates and determine if corrective measures are required.

### 4.7.3 Hazardous Waste Generation

Hazardous wastes generated at the facilities will consist of a variety of materials including but not limited to small quantities of used oils, solvents, detergents/cleaning compounds, certain building and maintenance chemicals, fluorescent light bulbs, and laboratory wastes. Botnia has estimated that 100 to 150 tons of hazardous materials will be generated on an annual basis. For ENCE, an estimated 80 to 100 tons per year of hazardous waste will be generated.

Both projects will transport these wastes to an appropriate off-site hazardous waste management facility. However, at this time, only limited facilities exist in Uruguay for the management of these types of materials. Botnia has indicated that they would export these materials using appropriate containment to a suitable facility in another country if necessary. Ultimately, the location and management plan for these materials must be submitted and approved by DINAMA. While the quantities of hazardous wastes generated by these facilities is not large compared to other industries, these projects could be used as a basis for Uruguay to develop appropriate management, transport and disposal guidelines, and future in-country facilities.

### 4.7.4 Potential Impacts of Hazardous Materials

Hazardous materials may produce soil and water contamination if they are not properly handled. Both companies will have to develop adequate plans for the off-site government approved disposal of hazardous wastes. Given that the production of hazardous waste is relatively small and their characteristics are relatively benign, these wastes will be stored in proper containers before being sent to a government-approved disposal site.

### 4.7.5 Cumulative Impacts

There are no cumulative impacts associated with the management and disposal of solid wastes given that there are no waste sites in this area currently. Solid waste transport and the activities around each landfill are restricted to the plant site. Landfill design and construction are secure in terms of avoiding possible leakages of leachate to the soil or rainfall drainage to the surface waters. No impacts on aquifers, including the Guarani Aquifer, are expected.

No cumulative impacts are expected from the management and disposal of hazardous wastes. Hazardous materials are relatively small in quantity and can be readily handled in basic containment facilities using standard international procedures. These two pulp plants are the first large industrial operations of their type in the country, and their development could stimulate third parties, including the responsible government agencies, as well as the project proponents to start formal planning for this type of broader waste management issue on a regional, national or bi-national basis.

## 4.8 Social and Economic Aspects

Founded in 1859, the history of Fray Bentos is intertwined with the development of a meat processing plant by the British. The plant, Anglo del Uruguay (Anglo), was originally the called the Liebig Extract of Meat Company and opened in 1866. It was ranked among the largest industrial complexes in South America and played a major role in the development of Uruguay's cattle sector. In 1873 it started to produce "Fray Bentos Corned Beef", a label that quickly became well known in Western Europe. As a result of the economic success of the processed meat in the European market, Fray Bentos became a major centre for

innovations in Uruguay. For example, in 1869 the first hydraulic pump in Uruguay was installed at the meat processing plant. In 1873 the first steam-powered plough arrived and, in 1883 for the first time in the history of the country, electric power was used at the facility. In 1924 the plant was bought by the Vestey group of England and renamed to Anglo.

Fray Bentos experienced a boom to its economy and at its peak the plant employed 5,000 people. As Anglo grew, the infrastructure to support it also grew including the development of a hospital, school, and worker housing. Another legacy of the Anglo 'boom' days is the municipal golf course located between the core urban area and the meat processing site. The golf course supports a club house, two outdoor tennis courts, a squash court and a grounds-keeper cottage.

Due to declining markets and new manufacturing advances in Europe, Anglo ceased its operations in 1971. The Uruguayan government continued to operate the processing plant until its closure in 1979.

Predominately a single-industry town, the closure of the meat processing plant was devastating for the community of Fray Bentos. As conveyed during interviews, it was not unusual for two or even three generations of a family to be employed at Anglo. Closure of the plant left many families without an income; consequently, the community entered into a 'bust' scenario with a reliance on government pensions, out- migration of workers and youth, degradation of infrastructure, and little economic investment in Fray Bentos.

The community of Fray Bentos is very proud of Anglo and their meat processing past. The plant has been converted into a museum depicting the history of the industry. Other support services available include a restaurant and artisan-souvenir shop. The grounds make up part of the public parklands along the Uruguay River where horses and cows are permitted to graze freely.

This history of foreign investment in the community and single-industry reliance has shaped the development and attitudes of Fray Bentos in the last forty years. Interviews with local government and with sociologist professors/professionals provided anecdotal information on the history of Fray Bentos. All referred to Fray Bentos as a community "waiting for something" or an "expectant community". Several attempts were made over the years to attract foreign investment in an attempt to reopen the meat processing plant, or to utilize the property in some sort of tourism capacity. Both attempts failed, leaving the community disappointed. When Botnia and ENCE announced their plans, the community initially reacted with cautious optimism.

### 4.8.1 Economic Impacts

There is expected to be a significant increase in local employment opportunities – both direct and indirect – during the construction of the two plants and their subsequent operation. As a result, there is likely to be an influx of job seekers into the department of

Río Negro. The socio-economic impacts of the two projects have been considered from the perspective of direct and indirect effects on the regional and national economy as well as on social services and quality of life in the vicinity of the two plants. Finally, the impact of the projects on populations who depend on natural resources for their livelihoods has also been considered.

It is expected that there will be no economic impact to Argentina, due to the Government of Argentina and its citizens' refusal to support employment and wood sales to the pulp mills on the Argentine side of Río Uruguay.

The consultants engaged by Botnia and CMB to examine the macroeconomic impacts of the pulp mills used different methodologies, prices and time periods.[15] The resulting cumulative impacts include some adjustments to reconcile these approaches. The economic impacts discussed below describe three types of effects:

- **Direct Impacts** – activities of the construction sector in building the pulp mills and carrying out all related work;
- **Indirect Impacts** – activities of all other sectors directly related to building the plants and carrying out all related work and providing services to the mills and its employees (e.g., manufacturing, energy, construction, transport, food, lodging, etc.).
- **Induced Impacts** – activities induced by increases in consumption and investment as a result of the construction of the plants (i.e., the multiplier effect of direct or indirect earnings on wider economy).

A detailed evaluation of these impacts during both the construction and operation phases of both plants as well as a description of the methodology used in estimating these values are presented in Annex E - III.

The cumulative impacts of the two projects on the national and regional economy and on employment, as illustrated in Table 4.8-1, are likely to be significant in terms of economic performance, employment, balance of trade and tax revenue.

[15]HCG Environment Consultants , "Socio-Economic Study of the Impacts of the Botnia Pulp Mill Project" (Spanish version May 2004, English translation June 2004); Tea, Deloitte, Touche, "Economic Impact Study of the M'Bopicuá Pulp Mill (CMB)," (November 2003); Tea, Deloitte, Touche, "Update of the Economic Impact Study of the M'Bopicuá Pulp Mill (CMB)" (January 2005); ENCE, "Feasibility Study, M'Bopicuá Pulp Mill Project" (2004); *Handbook of Input-Output Table Compilation and Analysis* (New York: United Nations, 1999).

**Table 4.8-1: Cumulative Economic and Employment Impact for the Botnia and ENCE Pulp Mills[16]**

| Impact | Region | Construction Phase (2005-2007) | Operational Phase (Typical Year) |
|---|---|---|---|
| Economic (USD Millions) | Uruguay | 417 (3.2% of 2004 GDP) | 331 (2.5% of 2004 GDP) |
| | Río Negro | 206 (112% of 2003 GDP) | 223 (121% of 2003 GDP) |
| | Soriano | 33 (14% of 2003 GDP) | 13 (6% of 2003 GDP) |
| | Paysandú | 41 (13% of 2003 GDP) | 23 (7% of 2003 GDP) |
| Employment (Person-Years) | Uruguay | 18,699 (1.4% of 2004 Total) | 12,593 (0.9% of 2004 Total) |
| | Río Negro | 11,196 (109% of labor force) | 4,773 (47% of labor force) |
| | Soriano | 1,337 (6% of labor force) | 1,108 (5% of labor force) |
| | Paysandú | 2,421 (8% of labor force) | 2,048 (7% of labor force) |
| Balance of Trade (USD Millions) | Uruguay | - 1,100 (Similar to "normal" annual average) | +244 (Approx. 22% of "normal" trade deficit) |
| | Uruguay | +83 (2% of 2004 revenues) | +39 (1% of 2004 revenues) |
| | Río Negro | -1.8 (19% of 2004 revenues) | +0.9 (10% of 2004 revenues) |

**Economic Performance** – The economic impact of the two projects will be equivalent in value to about 3.2% of Uruguay's 2004 Gross domestic product (GDP) over the full three years of the construction phase, and about 2.5% of 2004 GDP in each year of full capacity production (approximately 40 years for each plant). The impact on the country's Gross National Product (GNP) is estimated to be 2.8% for the entire three year construction period and 1.5% for the years in which the plants are operating at full capacity. The Department of Río Negro is expected to experience significant impacts, with GDP increasing by an equivalent amount to that in 2003 for the construction phase and for each year of full capacity production during the operational phase. The economic impacts for the neighboring departments of Soriano and Paysandú will still be significant, though of lesser magnitude compared to Río Negro.

The direct, indirect or induced economic impact of the pulp mills on the Argentine border of Río Uruguay was not evaluated.

**Employment** – For Uruguay, the employment impacts will also be significant, accounting for an increase in the equivalent of 1.4% of the 2004 national labor force over the three years of the construction phase and equivalent to slightly less than 1% of the 2004 national labor force during each year of full capacity production. As Table 4.8-1 above indicates, the Department of Río Negro is expected to have a significant increase in employment, being equivalent to about 109% of its 2004 labor force over the construction period and 47% of the labor force during each year of full capacity production. The mills are expected to

[16] Summary of economic impact analysis from Annex E-III.

attract labour force entry for those of working age and for those outside the local labour market. Such prospects of increased employment in the department will encourage migration from other parts of the country and day commuters from neighboring departments. The employment impact on Soriano and Paysandú, while not as large as that for Río Negro, will be important as both of these departments have a significant amount of unemployment (16.9 % and 16.2%, respectively). Table 4.8-2 illustrates the estimated employment that will be generated by the construction and operations phases of the two projects. Estimates of employment generated by each company during the construction phase show peak values that occur during the four-year construction period (2005 to 2009). Estimates for employment generated during the operation phase are for one year of full operation.

The mills have an outsourcing of services policy that will be implemented throughout the construction and operation phases as long as it is economically viable and that such suppliers comply with the required international standards of quality. Uruguay does not have the capacity to offer all services required, thus the mills will need to outsource services to other countries. Although Argentina could offer outsourcing services, their refusal to permit construction of the pulp mills makes such services uncertain.

**Table 4.8-2: Estimated Employment Generated during the Construction and Operations Phases of both Pulp Mills**

| | Construction Phase | | | Operations Phase | | |
|---|---|---|---|---|---|---|
| | Botnia | ENCE | Total[1] | Botnia | ENCE | Total |
| Direct | 4,200 | 5,050 | 9,250 | 300 | 300 | 600 |
| Indirect | 5,710 | 6,866 | 12,576 | 3,976 | 2,094 | 6,070 |
| Induced | 2,512 | 3,020 | 5,532 | 3,879 | 2,043 | 5,922 |
| Total | 12,422 | 14,936 | 27,358 | 8,155 | 4,437 | 12,592 |

[1] The total number of workers required for both projects. Some individuals may be expected to work on both projects.

In July 2006, Botnia was employing 2,458 workers for construction, of which 51.5% came from Río Negro, 21% from the Departments of Soriano and Paysandú, and nearly 25% from other Uruguayan departments. Specialized workers from Brazil and Finland accounted for 2.5% of the employees.

Indirect jobs are evident in the beekeeping sector where the effect of increased forested areas extends harvest season (from December-July) resulting in honey production typically not seen during the eucalyptus flowering season. Honey production has been reported to increase by nearly 30%. Although 2005 was an exceptionally dry season, eucalyptus honey accounted for 45% of the revenues.

Landowners are often encouraged by the additional income generated by leasing land for beehives that is in close proximity to the forests. The contribution of cattle-raising in the forested areas is estimated to create 1 job for every 1,000 hectares of forest.

**Balance of Trade** – During the construction phase there will be a negative effect on the trade balance. This effect will be approximately equivalent to the annual deficit registered during the "normal" years prior to the onset of the Argentine fiscal crisis in 2001-2002 at which time imports fell drastically. However, during the years of full capacity production of the pulp mills, about 22% of the "normal" trade deficit will be offset by the positive trade flow generated by sales of pulp, the less negative trade flows of reduced overseas log sales, and the imported inputs for the pulp mills.

**Revenues** – Central Government revenues should total the equivalent of about 2% of 2004 revenues for the construction phase. For each year of full capacity production, the pulp mills should contribute slightly less than the equivalent of 1% of 2004 revenues. Incremental expenditures incurred to support the establishment of the pulp mills by the departmental government of Río Negro total about US $1.8 million, equivalent to about 19% of 2004 revenues. When the pulp mills are at full production it is estimated that the Government of Río Negro will collect approximately US $916,000 annually as additional revenue, equivalent to about 10% of 2004 revenues.

### Summary

The construction of the pulp mills in Río Negro will have a positive economic impact in Uruguay, especially in Río Negro, Soriano and Paysandú. There will be an increase in employment during both the construction and operation phases. During the operation phase, most employment opportunities will be generated through indirect and induced employment. Under current circumstances the mills will have a negligible economic impact in Argentina.

## 4.8.2 Potential Impacts of Labour Influx

The direct social impact in the construction phase of the pulp mill projects will be the influx of persons, primarily to Fray Bentos and its environs, attracted by the opportunities for employment. The actual scope of this influx is difficult to predict for a number of reasons, including the following:

- The extent to which the employed, underemployed or unemployed population living within commuting distance of the proposed projects – including both Uruguayan and Argentine population centers – will seek and obtain employment during construction is unknown;
- The extent to which non-local construction workers will migrate to the area in search of employment is unknown and is, in part, dependent on employment

opportunities with the pulp mill construction as well as other construction employment in the greater region;

- The capacity of contractors to provide for, and manage their own labor force will vary from contractor to contractor; and
- The extent to which the sequence of construction at both plant sites overlaps so that construction workers complete tasks at one site and move to the next depends on a wide variety of factors including project financing and manufacturing equipment delivery.

Each project is expected to require 4,000 or more workers during peak construction. Botnia is currently under construction and will hit its peak construction worker period in December 2006, whereas ENCE estimates a start-up date for their construction of mid-February 2007. ENCE anticipates it will reach its peak construction period in June 2008. Thus, as the construction at Botnia winds down, the construction activity at ENCE will gear up. As shown in Figure 2.8-2, the labor requirements for both projects combined will be less than the peak values for the Botnia and ENCE projects individually.

The increase in population during the three to four years required to construct both plants will be heavily weighted towards men, and in particular younger men. Both companies have discussed with community officials ways to mitigate and manage potential impacts from the influx of workers. Concerns related to the influx of workers include increased incidents of drunk driving, increased incidents of drunken public behaviours, increased incidents of sexually transmitted diseases, and pregnancies.

To help manage the number of workers coming to Fray Bentos in search of employment with one or both of the mills, transportation is provided from communities within commuting distance. This will encourage employees to remain in their home communities and not relocate to Fray Bentos.

Anecdotal evidence suggests that the influx of workers will not be long-lived. The experience of large construction projects in Uruguay such as the Salto Dam and the San Martin International Bridge indicates that the migrant workforce disperses from the construction zone, perhaps to other projects in the region, back to their homes or, to some extent integrate into the local population.

Botnia's July 2006 monitoring report indicated that the participation rate for the 20 to 29 age group has increased in Fray Bentos 40% over baseline. An increase in the number of women working was also reported. Nonetheless, an analysis of the regional social profile, especially of the economically active population, indicates that there is an insufficient working age population to meet the labor requirements of plant construction in Fray Bentos and other population centers in the departments of Soriano, Río Negro and Paysandú. Despite the availability of workers, given the negative climate toward the mills in Gualeguaychú, it is not anticipated that workers for the construction phase will originate

from there. In addition to the strong peer and social pressure to not seek employment at the mills, daily crossing of the International border and transportation may also prohibit workers from Gualeguaychú in seeking employment.

To meet the construction requirements both skilled and unskilled workers will be recruited from throughout the region, including Brazil. As a result, there will be increased demand on social services to cope with the increase in population, particularly in the areas of housing, health, public safety, education, transport, as well as recreation and cultural activities. The major impact will be on the social services provided in the city of Fray Bentos. The specific impacts will depend on the numbers of local and commuting workers relative to non-local residents that that will occupy the positions created during the three to four years of the construction phase. There will also be associated impacts of population increases associated with ancillary economic activities that develop as the economy of the area grows.

**Employment Training** – Training of the local workforce for skilled and semi-skilled jobs will be an important means of regulating and managing the impacts of migrant workers. To maximize local employment generation, both companies have established agreements with the Ministry of Labour and Social Security and the National Employment Board to establish skills training courses to qualified trainees. A welding school was developed with Botnia's support in Fray Bentos, and programs and shops to support welding at high schools within the Uruguay area of influence have been implemented. However, the level of qualification of local workers and trainees as well as the desire for employment will limit the numbers of applicants for jobs during both the construction and operation phases of the projects. The timing and scope of construction schedules will demand additional labour from throughout the region.

**Housing** – The arrival of non-resident migrant workers will result in a substantial increase in the demand for housing, with the present available supply being quickly occupied and with an overflow into Mercedes and other communities within a daily commuting distance of the plants. Trends already being experienced in Fray Bentos include the increased cost of rental properties, an increase in the number of rental properties available compared to baseline, and an increase in the number of home renovations undertaken to accommodate rental units (Botnia 2006).

To address these impacts, Botnia, in coordination with the Land Management Unit of the Municipality of Río Negro, is constructing low cost housing to accommodate workers unaccompanied by families as well as suitable housing for its higher-level employees. The Land Management Unit of the Municipality of Río Negro is coordinating with the National Directory of Land Use (DINOT), to plan for the expansion of urban areas, taking advantage of those areas, primarily in Fray Bentos, already having basic services and infrastructure. The housing development projects were planned to integrate into existing neighbourhoods. Once the construction phase is complete, and workers return to their home communities,

During plant operations, there will likely be a reduction in overall housing demand and a corresponding reduction in the cost of renting. However, for more expensive properties there could be an increase in demand owing to demand by high level operational administrators, technicians and skilled labour involved in the operation of the plants and of new enterprises supplying the pulp plants.

**Public Health, Safety and Security** – There will be an increase in demand for health services at all levels, particularly in Fray Bentos and its vicinity. Private health care will be needed for the workers in the plants, their families, and for those employed in related activities. An increase in public health services will be required for those who cannot afford private health care; for example for families of workers with low levels of remuneration, itinerant workers and others who might not be able to join the labour market and who have limited financial means.

Both Botnia and ENCE employ health specialists on their staff and have management plans to handle health risks and to prevent industrial accidents. Botnia has an agreement with the Ministry of Public Health (MSP) for 24 hour coverage inside its plants. ENCE has a system to attend emergencies within its construction site. The MSP is working out a strategy to attend to the increased demand for health care, including additional emergency facilities at the Fray Bentos Hospital, together with equipment to permit rapid diagnosis of serious multiple injuries and arrangements with neighbouring departments for rapid movement of patients. The MSP is putting into effect public health awareness and education campaigns to prevent and monitor any possible adverse health effects during the construction and operation phases of the plants including HIV/AIDS and sexually transmitted disease. Private health cooperatives in the various regional centers are planning a system of mutual cooperation.

Mitigation measures for the operational phase include sustaining and adapting those measures proposed for the construction phase so that they address the necessities of plant operations, e.g., issues of health, preventing industrial accidents, and sustaining the safe and effective movement of people and freight by road.

Both companies have developed plans for coordination with local police to restrict and manage the influx of job-seekers and maintain public order during the construction phase of their plants. Similar arrangements have been made with the Fray Bentos fire brigade to enhance responsiveness to fires and other emergencies.

**Education** – There will be an increase in the demand for public and private education facilities; the former mostly for the children of construction workers and the itinerant population; the latter for children of technical and management personnel. The amount of educational support required will depend on the characteristics of the incoming population and whether they are accompanied by their families.

Both companies have made arrangements with private educational institutions to provide schooling for the children of plant workers. The demand for private education in the area of influence will not fall with the reduction in employment, but rather is more likely to rise with the influx of more highly educated personnel involved in the operational phase of the plants. This demand will cover pre-school, primary and secondary levels.

**Quality of Life** – There will likely be changes in the quality of life for the population in the projects' area of influence, and most notably in Fray Bentos and in the surrounding area. The pace of life will increase with the influx of outsiders into the area, there will be an increase in traffic, with its attendant increase in noise, and an increase in tourist and commercial activities. There will be greater demand for and supply of cultural and recreation events and activities. With the increasing population, it can be expected that there will be a rise in incidents of anti-social behaviour and in crime.

The Department of Río Negro is working on a plan to satisfy the demand for increased recreational and cultural activities, taking advantage of local facilities and professionals in the fields of music, theatre and cinema. There is also a plan to reinforce the local police and for the elaboration of a plan to improve the security of the citizenry through the prevention of increases in the crime rate and acts against property and persons. The companies are implanting strategies for communicating with the public through workshops and talks, enabling the residents of the area to ask questions or articulate their worries with regard to noise or other subjects related to the construction of the plants.

With the influx of population associated with both direct and indirect employment related to the pulp mill projects, there will likely be a temporary increase in the cost of goods and services. This increase will affect local residents living on fixed incomes or below the poverty line. However, local wages are expected to increase for the working population. These inflationary pressures are expected to be short-lived as the impact of the construction "boom" on the local economy passes and prices for goods and services fall.H

### 4.8.3 Impacts on Natural Resource-Based Livelihoods

Tourism, agriculture, fishing and apiculture are the principal natural resource-based activities in the area of the pulp mills. By far, tourism is the most significant and the sector is described in Section 4.9.

The area of influence is predominately engaged in some form of agricultural activity. Activities include growing and selling cash crops (including citrus), meat and milk production, and grazing of livestock. Approximately ¾ of the land use in both Uruguay and Gualeguaychú is dedicated to agricultural activities. Raising cattle for meat and milk production tends to be the main activity in the area of influence; however, wheat, oats, sunflower, rice, and soya bean are the main crops harvested.

A net benefit will result during the construction and, to a lesser extent, the operation phase, due to increased demand for agricultural products (milk, meat, vegetables, honey, fruit etc).

This increase in demand will benefit both the shop/market owners primarily in Fray Bentos and farmers within the area of influence.

The active river fishing population is estimated at 126 persons in the Uruguayan area of project influence and another 50 persons on the Argentine side of the Río Uruguay. There appears to be an active sport-fishing enterprise on the local waters as well. Like beekeeping, fishing is for many a part-time activity although there are a number of subsistence fishermen who work the waters of the Río Gualeguaychú and Río Uruguay. These numbers may double during the harvest season (April/May) during which fish catches using both active and passive techniques (e.g., weirs, nets and lines) range between 250 kg and 300 kg per day. Most of the fish catch is sold on the local market but some is sold to commercial buyers from outside the area, including Brazil.

The analysis discussed in Annex D on the potential impacts during construction and operation of the mills on water and fishery resources indicates that wastewater discharges will be treated to levels that will have no impact on aquatic life, and will be rapidly diluted to undetectable levels in the river. As a result, the type, abundance and health of the fish within the Río Uruguay in the vicinity of the discharge is not expected to change.

A limited amount of nutrient enrichment of the sediments may be experienced within the immediate vicinity of the diffuser (extending the length of the diffuser and for several tens of metres outward). Within this very small area, the benthic community may change somewhat but only in terms of species type not necessarily abundance. This means that the fish food may change slightly in this extremely small area.

CARU and DINAMA both identified that the fisheries resource is impacted by other activities, such as the Salto Grande dam, and industrial activities in the Río Parana. The Salto Grande dam restricts migratory access to the headwater streams where many species of fish spawn. CARU further identified that the spawning and nursery areas are mainly on the Río Parana. The Río Uruguay at Fray Bentos is mainly a feeding ground for adult fish. This means that any impact identified through monitoring will only be measuring impacts on fish originating from the Río Parana.

There are an estimated 1,904 beekeepers in the Soriano, Río Negro and Paysandú departments and another 700 in the area surrounding Gualeguaychú. A number of beekeepers are organized into cooperatives, which facilitate the marketing and sale of honey. The production of honey is generally complementary to other agricultural activities, including plantation forestry, and is for the majority a part-time activity. Eucalyptus trees flower in July, thus extending the honey collection season by four months. The Paysandú honey cooperative (CALAPIS) indicated that eucalyptus plantations have helped to stabilize the annual production of honey due to the longer collection season.

Honey is exported to European markets by both Uruguay and Argentina. The production of honey in Gualeguaychú is reported to generate US $4 million annually in export earnings.

Because of the process controls planned for pulp manufacturing at both plants, air emissions from the plants will be well below concentrations, which are known to have any effect on physiology or behavior of the bees, and as a result there should be no measurable impact on the area's apiculture. Also, there are no known cases where these transient and low levels odors have been picked up and accumulated in the honey.

## 4.9 Tourism

Tourism is well established in and around the area of the pulp mills. In Uruguay, the riverside beach at Las Cañas in the Department of Río Negro, and hot springs to the north of the Department of Paysandú attracted more than 80,000 visitors in 2004 during the peak summer months of January to March. Sports activities and cultural tourism in both Fray Bentos and Mercedes also attract many visitors but they are significantly less popular than the above areas.

Approximately 80% of the tourists visiting Río Negro, Soriano and Paysandú departments originate in Argentina according to the Directorate of Tourism of the IMRN, particularly from the federal capital and the greater Buenos Aires area. The majority of tourists make their main destination Las Cañas on the Río Uruguay to enjoy sunbathing and water sports. This destination is visited mostly in the summer, but it is also popular during Argentina's national holidays, and long weekends.

The number of jobs directly associated to tourism is difficult to estimate, as insufficient information is available on the number of people employed directly as a result of tourism activities. The Río Negro Director of Tourism suggests that in the commerce, hotel, restaurant and transport sectors, about 150 full time jobs would be attributable to tourism and that during January and February an additional 600 jobs, most of which are related to activities in Las Cañas, are created to serve the heavy influx of visitors during the summer months.

The direct contribution of tourism to the economy of Río Negro, both in terms of the commerce, hotel and restaurant sector; and of the total GDP, for the years 2000-2003, is provided in Table 4.9-1.

**Table 4.9-1: Contribution of Tourism in Fray Bentos/Las Cañas to Gross Departmental Domestic Product (GDDP) 2000 to 2003 in US$ Millions**

| | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|
| Expenditure- International Visitors | 22.9 | 20.9 | 9.5 | 8.6 |
| **Expenditure- Uruguayan visitors** | **7.6** | **7.0** | **3.2** | **2.9** |
| Total Visitor Expenditure | 30.5 | 27.9 | 12.7 | 11.5 |
| GDDP Commerce, Hotels & Restaurants (CHR) | 33.7 | 30.3 | 18.5 | 16.6 |
| Gross Departmental Product | 256.2 | 256.7 | 185.7 | 184.0 |
| Tourism Value Added CHR Sector | 16.9 | 15.2 | 7.0 | 5.7 |
| **Tourism value added GDDP** | **18.9** | **17.3** | **7.9** | **7.1** |
| **Visitor value added as % of CHR Value Added** | **36.4** | **36.3** | **27.5** | **25.0** |
| **Visitor value added as % of GDDP** | **3.0** | **2.7** | **1.7** | **1.6** |

Source: Smith, Peter. Tourism Assessment of Gualeguaychú in the Province of Entre Ríos, Argentina and Fray Bentos in the Department of Río Negro, Uruguay. April, 2006

Gualeguaychú in Argentina is also an important center of tourist activity, particularly in the summer months of January, February and the first half of March. The main tourist attraction is the Carnival (in 2005 164,376 adult tickets were reported to have been sold), which supports approximately 1,500 families (Secretariat of Tourism of the Municipality). The majority of tourists originate from within Argentina (Buenos Aires area) and neighbouring countries such as Paraguay and Chili.

Table 4.9-2 summarizes the expenditure per visit and per day. The devastating effect of the River Plate Crisis of 2002 on Carnival revenues can be seen, when revenues in real terms in 2002 were only one third of the revenue of the previous year.

**Table 4.9-2: Expenditures by Carnival Visitors – 2000 to 2005**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|
| Expenditure per visitor (US$) | 118.33 | 113.15 | 47.46 | 36.64 | 57.74 | 59.73 |
| Daily expenditure per visitor (US$) | 43.65 | 56.81 | 17.81 | 15.72 | 19.59 | 18.49 |
| Total Expenditure (US$ millions) | 16.625 | 13.160 | 4.344 | 4.608 | 7.775 | 9.206 |

Source: Smith, Peter. Tourism Assessment of Gualeguaychú in the Province of Entre Ríos, Argentina and Fray Bentos in the Department of Río Negro, Uruguay. April, 2006

The Carnival complements the water sports and camping activities of weekend visitors and vacationers who largely originate in the Buenos Aires area. There are 12 beach camping grounds in the Gualeguaychú department. The majority of these are on the Gualeguaychú River, but the most popular and largest area is Ñandubaysal on the Río Uruguay. During

its peak season approximately 350 people work at the beach resort and it is visited by 160,000 tourists annually.

In recent years, the Municipality of Gualeguaychú has begun to explore opportunities to increase and maintain tourist visits year-round, including further investment in thermal spas, an automobile race track, a convention center, a thematic casino (during Carnival), nautical clubs, and protected natural areas.

There are several ways in which any industrial establishment (such as a pulp mill) could potentially affect the tourism sector in its area. These include:

- pollution of air and water during regular operation and during accidents, which negatively affects the environment within which tourist activities take place;
- effects of associated industrial facilities and activities (e.g., road, river and port traffic), which may be negative;
- visual effects, which distract from enjoyment of other tourist activities;
- negative press resulting from controversy associated with an industrial establishment that discourages tourist visits;
- direct positive impacts through actions of the industry to support development and operation of tourism and recreation infrastructure, sites or events, as part of its corporate role in the community; and
- indirect positive impacts of the presence of the industry, which contributes to general economic development in the area and may lead to an increase in the number and quality of facilities such as restaurants and accommodation, which also serve tourists.

These potential impacts have been considered in the EIAs for the two pulp mills, particularly for Botnia's mill which is closest to Fray Bentos and within view of the main beach area of Ñandubaysal on the Argentine side of the Río Uruguay. These are reviewed below, with particular attention to the existence of any cumulative impacts of the two plants.

### 4.9.1 Direct Pollution Impacts

Computer modeling of air emissions, carried out for the individual EIAs and for this cumulative impacts study, indicates that there will be no significant impacts on air quality in the region. Odour is the main air quality parameter of concern with regard to tourism. However, both plants have included advanced technology to capture and eliminate these odours[17], and therefore odour, even at the plant boundary, will usually be below accepted

[17] Atmospheric emissions treatment systems, including incineration of Total Reduced Sulfur, electrostatic precipitation for dust abatement and stack scrubbers to control $SO_2$ and Volatile Organic Compounds will be installed at both plants.

odour thresholds (i.e., the level at which most people would be able to detect an odour) under normal operating conditions. However, during the initial commissioning periods of both plants, it is expected that there will be some detectable odour in the vicinity of the plants, the city of Fray Bentos and at the international bridge. This will occur over the first 3 to 4 months of plant operation. Once the plants are in full operational mode, there will also be both regular and unplanned startups and shutdowns of all or parts of the process, and these events also may result in some odors being released. These will usually be restricted to the vicinity of the mill but may occasionally extend out to the city of Fray Bentos and at the international bridge. These odour events are expected to be infrequent and of very short duration. Odour is predicted to be below detection limits in Gualeguaychú and Ñandubaysal, which are the focal areas for tourism in Argentina. There should therefore be no significant impact on tourism in these areas from odour, cumulative or otherwise (see Annex C for further details on the air quality study).

In terms of air quality, and specifically odour, the combined emissions of both mills will rarely exceed ambient air quality standards. Visitors crossing the International Bridge may detect a sulphur (rotten eggs) smell less than 0.5% of the time. The worst-case scenario is that concentrations will exceed the standard (15 ug/$m^3$) for no more than 27 hours/year in Fray Bentos and 44 hours/year at the International Bridge. Exceedences are not anticipated in locations such as Las Cañas, Mercedes, Gualeguaychú and Ñandubaysal, thus visitors to the beach area will not smell offensive odours originating from the mills at any time.

Wastewater from the two plants is treated to levels at which it poses no direct threat to aquatic life or recreational use of the river, and it is further diluted to undetectable levels within a short distance of the point of discharge. More detailed computer modeling, performed for this cumulative impact study, confirms the rapid dilution of the treated waste to undetectable levels, and this is true when both outfalls are considered together as well as separately.

Botnia has proposed providing treatment for the Fray Bentos municipal sewage effluent in its wastewater treatment plant. This would result in more complete treatment of municipal wastes, along with eliminating the present downstream discharge that currently impacts water quality in the Las Cañas area. If this proposal is implemented, Fray Bentos would benefit from an enhanced public service and improved water quality downstream of the town, thus improving the water quality of the Las Cañas area.

The event of a serious industrial accident at either or both plants during operation is highly unlikely as appropriate measures have been taken to prevent spills of chemical products, fires, contaminating emissions, etc. Because the plants are designed with the most advanced technologies, they do not include storage of large quantities of hazardous chemicals that would be a threat to the environment if there were an industrial accident. The worst case scenario for an industrial accident at the pulp mill would be an explosion of the recovery boiler. Its harmful consequences would be limited, like any boiler accident, to

within a few dozen meters of the boiler – in other words, within the project site – and would result in an immediate shutdown of the plant until the recovery boiler could be rebuilt.

### 4.9.2 Associated Impacts

Related facilities and activities of the plants were also reviewed for their potential cumulative impacts on tourism. Truck transport (mostly of logs) in the plantation areas and on the national highways leading to both plants is expected to increase approximately 30%. This increase in truck traffic is still within the capacity of the highway infrastructure (Botnia, 2006). This will result in some cumulative impacts of traffic congestion at some intersections, and to the extent that this happens in the Fray Bentos area it may have some impact on tourist traffic in this area. This cumulative impact is considered to be low and relatively localized.

Barge traffic on the river will increase somewhat from present volumes with the operations of the plants. Currently roundwood and wood chips are shipped down river. Roundwood and chip exports will be replaced by pulp and returning vessels will transport chemicals and other raw materials used in the pulping process. This change is not predicted to have any cumulative impact on tourism.

The increase in forest plantation area is discussed further in Section 4.2 of this report. This is not expected to have any negative impact on tourism, and in the longer term may increase the attractiveness of the area as habitat diversity increases and the nature reserves established by the two projects become recognized tourist sites.

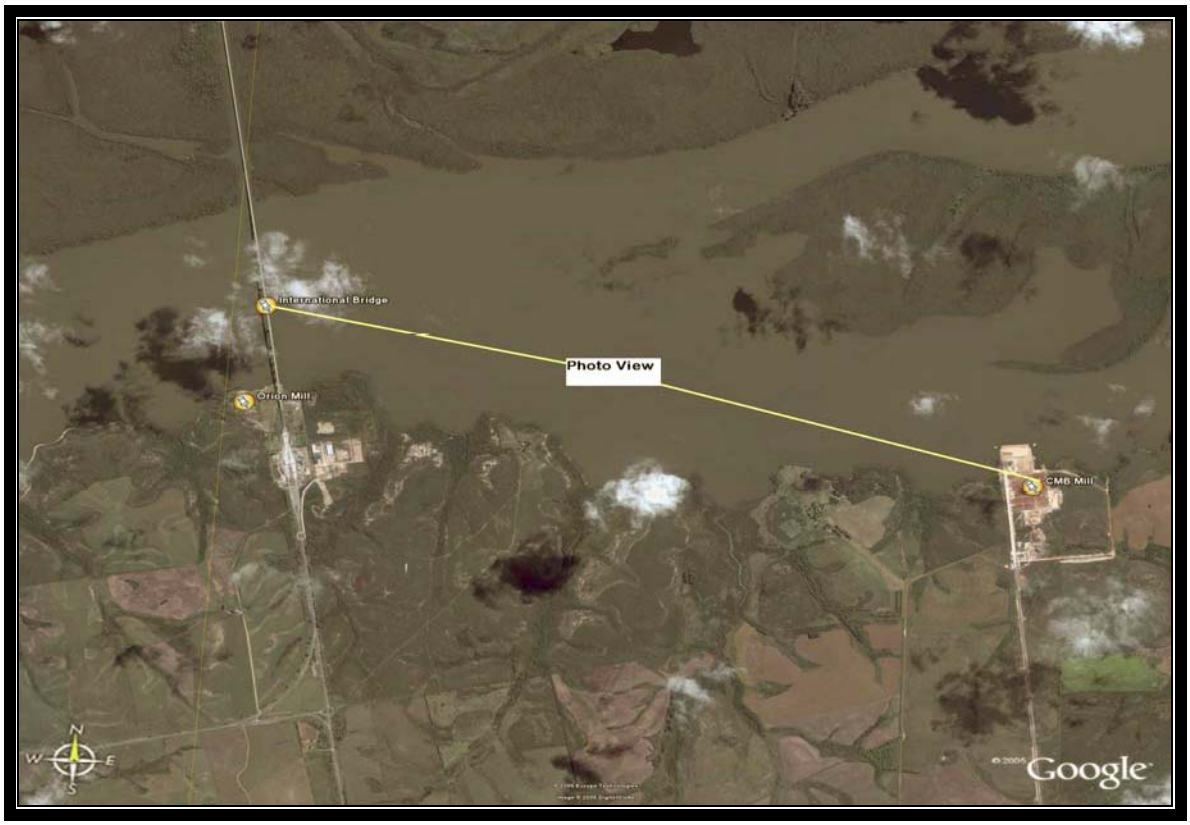
### 4.9.3 Visual Impacts

The Botnia plant will be a visible new feature in the landscape, especially for tourists crossing the international bridge en route to Las Cañas and other tourist destinations in Uruguay. The ENCE plant will also be visible from the bridge, but further away and less of a visual presence. The change to the landscape is a permanent impact; however, the public's response to these new industrial features is subjective and may potentially change over time as the public becomes accustomed to the new landscape. It is unlikely, that the sight of the plants will discourage tourists from continuing on to Fray Bentos, Las Cañas or other locations in the region.

Figures 4.9-1 to 4.9-2 show the view from approximately half-way across and, at the highest point, of the International Bridge.

**Figure 4.9-1: View from High Point of the International Bridge Looking Towards the BOTNIA Mill**

**Figure 4.9-2: View from High Point of the International Bridge Looking Towards the ENCE Mill**



In Gualeguaychú, the Botnia mill is the closest and most visual mill site, located 13 km across and upriver from the beach resort of Ñandubaysal. Although it is new to the landscape, its visible physical presence is far enough away as to be unlikely to cause loss of enjoyment of the beach area for all but the most sensitive users from a visual standpoint. During peak season, January and February, at Ñandubaysal, the river is used for water sports (jet skis, sailing, board sailing, boating, etc). Due to the heavy use of the river for water sports, the Botnia mill will be less noticeable due to these activities on the river; however, the visual impact of the mill will be heightened for those out boating on the river. There is no visible plume from the stacks in modern pulp mills, except for a white steam plume in cold, humid weather.

At night, looking across the river, lights from the Botnia mill will be visible at the beach. Due to the distance and the mills proximity to other existing light sources, namely the International Bridge and the community of Fray Bentos, the impact of lights to people strolling along the Ñandubaysal beach is considered low and is not anticipated to impact significantly on their experience.

Case studies in British Columbia, Canada have shown that tourism can co-exist with pulp mills, as tourism exists at practically all pulp mill towns. The mills have odour control systems that comply with Canadian regulations, but are neither as complete, nor as well backed-up as those proposed for the Fray Bentos mills. In one case study at Prince George, the mills use the ASB effluent treatment process, which is well known to release substantially more malodorous gasses than the AST process, proposed by ENCE and Botnia. At a second mill site in Kamloops, an ECF bleaching process is used with odour control systems; however, these environmental protection systems are neither as advanced, nor as efficient as those proposed for the Fray Bentos mills. In both Prince George and Kamloops, tourism is dependent on outdoor activities such as hiking, canoeing or fishing.

### Adverse Social Climate

The beginning of the construction works generated an increased feeling of vulnerability and distress concerning the potential negative effects of the mills for the residents of Gualeguaychú. During this period, the conflict between Argentina and Uruguay escalated generating a negative impact. Posters, banners, pins and scarves sprang up in public places in Gualeguaychú and residents blockaded the International Bridge between Argentina and Uruguay for during the 2006 summer months. These actions from opposition to the installation of the mills on the part of the citizens of Gualeguaychú could reduce the possibility for continued increases in the number of Argentine tourists visiting Uruguay. In addition, sustained opposition and the associated negative information campaign may harm tourism in both Uruguay and Entre Ríos, including Gualeguaychu.

### 4.9.4 Indirect Positive Impacts

Through their presence in the area, the pulp mills will indirectly lead to further economic development. According to the Economic Impact Assessment (Annex E, III) it is estimated that the combined economic impact from operating the plants at full output will be about US $331 million per year. Of this, over 50 per cent will be direct impact of plant production and indirect and induced impacts should account for about 30 and 20 per cent, respectively. To put this in perspective the GDP in 2004 is estimated to be about US $13.2 billion. The economic impact from the operational phase of the mills would therefore represent about 2.5 per cent of 2004 GDP.

Botnia's July 2006 monitoring report has already documented positive indirect economic impacts including an improved investment climate. Within Fray Bentos new businesses have opened such as Avis-Rent-A-Car, and the Great Montevideo Store, Hotel Fray Bentos is under extensive renovations as a result of approximately $1.25 million dollar investment, and two new truck repair shops have opened.

Other economic development can be expected in support services and facilities such as restaurants, hotels, and related facilities which also serve tourists and further contribute to making the area a more attractive tourist destination.

### 4.9.5 Mitigation

Mitigation measures for cumulative impacts during the operational phase include management of air emissions and water discharges, and emergency preparedness and response, which both companies have already included in their respective action plans. A sustained public consultation and communication campaign will also be necessary to dispel unsubstantiated fears and concerns from the public. This is particularly important to protect the tourism industry.

To provide support to this important sector, the Directorate of Tourism of the Department of Río Negro is looking at ways to expand the availability of tourist sites in the area, for example by promoting a 'forest route' that includes a visit to eucalyptus plantations and the pulp mills.

There is little that can be done to mitigate the visual intrusion of the stacks at the mills. The properties can be landscaped to decrease the overall view of the sites and care should be given to the placement and direction of lighting, as proper shielding of lights can help make the plants less intrusive.

## 4.10 Transportation

The transportation network in western Uruguay will be affected by the construction and operation of the Botnia and ENCE pulp mills (see Figure 4.10-1). The two most important flows of traffic will be wood and other supplies delivered to the mills, and pulp exported from

the mills. In addition, there will be transport of personnel to and from the mills, and transport of domestic and hazardous waste to appropriate landfills. This section is based on the transportation study (see Annex F) from the draft CIS prepared by PCI Americas and Malcolm Pirnie.

The main modes of transport will be truck, barge or ship for wood and other supplies, and barge or ship for pulp. If the rail system is upgraded, transport of wood and pulp by rail will be an alternative form of transport. Pulp produced by the Botnia mill will be transported by barge to Nueva Palmira for trans-shipment. Because of operating depth restrictions at ENCE's M'Bopicuá port, transport of pulp by truck or barge to other loading points would be required. Currently, the procedure for wood chip exports from the M'Bopicuá port is to load the ocean-going vessels approximately 50%, and top-off in Montevideo where ENCE has built an additional wood chipping plant.

### 4.10.1 Cumulative Impacts on the Río Uruguay

Table 4.10-1 presents the estimated increase in river traffic expected as a result of pulp mill operations. This projected increase represents only an additional 34% in traffic volume (i.e., around 650 vessels per year) over current rates because the wood chip cargo currently being barged downstream from Terminal Logistica M'Bopicuá (TLM) and Fray Bentos to Nueva Palmira and Montevideo will be replaced by pulp.

To export its pulp production, the Botnia mill will require 333 barges per year, each carrying 3,000 tons per barge, or an average of one round trip barge voyage per day increase to current traffic levels of 5.3 barges per day. Botnia estimates another 150 barge trips per year will be required to deliver chemicals and raw materials to the plant.

The ENCE mill will maintain ocean-going vessels from the M'Bopicuá port for export of pulp. Currently, these 50,000 ton capacity vessels are being used for export of wood chips to Nueva Palmira and into the Río de la Plata. ENCE plans to partially load vessels at M'Bopicuá and top-off in Montevideo. This process will not generate a significant amount of additional large ship traffic in the river from M'Bopicuá to Nueva Palmira. The balance of ENCE pulp would have to be moved from ENCE to Montevideo, by barge, truck or rail (if the rail system is renovated and upgraded). If 3,000 ton barges are used, ENCE would require 83 barges per year.

ENCE may utilize large vessels returning for pulp loading to deliver these supplies but a conservative estimate of 70 additional barges per year has been made for the purpose of river traffic projections.

Thus, the operations of the two mills could result in a maximum of 650 additional barge trips per year on the Río Uruguay up to M'Bopicuá. This level of traffic would add an additional 1.8 barge trips per day to the existing 5.3 trips per day.

The above analysis suggests that the increase in river traffic when compared to current traffic in 2004 will not be significant because the pulp export traffic will replace the current logs and wood chip volumes being exported or moved in river transport. Therefore, the incremental increase will be less than the total volume of ships and barges required for the export of the pulp produced. Similar to the road traffic analysis, if the two pulp mills were not built (the "no project" alternative) then the logs and wood chip exports in the near future would continue increasing, also requiring more ships and barge traffic to occur in the river.

### 4.10.2 Cumulative Impact on Road Network

The road network in the project area of influence will be affected during both the construction and operation of the mills. Based on the estimated project timelines between the start of 2007 and mid-2009, the construction activities of both plants overlap and cumulative impacts on the road network during construction could occur. However, since the construction for the Botnia mill will be winding down as construction for the ENCE mill would be gearing up, the cumulative impacts may not be as dramatic as first expected. The impacts during the construction period that will be greatest in the immediate vicinity of each mill include: potential increase in road accidents, an increase in vehicular emissions, and increased demands for road maintenance. Both companies are developing management plans for road transportation in collaboration with the administration of the department of Río Negro.

The approximate cumulative impact of truck traffic on the local road network resulting from the operation of both the Botnia and ENCE mills is summarized in Table 4.10-2. At full capacity of 1.0 million tons per year of pulp production, the Botnia mill will require 3.5 million $m^3$ of pulpwood per year.[18] The estimated annual average daily traffic (AADT) for the delivery of round wood to the Botnia mill is approximately 512, based on 256 daily return trips by truck on an annual basis between the mill and the surrounding forest plantations. The ENCE mill at full capacity will consume 1.7 million $m^3$ per year requiring approximately 137 return trips by truck per day, or an AADT of 274.

These numbers imply a significant increase in truck traffic particularly on Highway 2 between the access road to the ENCE mill and the junction with the international bridge (see Figure 4.10-1). There is a potential for congestion in this area, particularly at intersections. Even in the absence of the pulp mill projects, there is still expected to be increased traffic in the area due to potential increases in transport of wood as well as other agricultural commodities. With the Botnia mill in place, wood transport to the port of Fray Bentos will be replaced by transport to the mill, and this will result in a significant decrease in truck traffic in the city itself. According to the transportation study attached as Annex F, the AADT for pulpwood trucks required for operation of the two mills will be 580 on the segment of Route 24 south of Paysandú to the intersection of Route 2. For the segment of

[18] The number of trucks required will vary depending on the species mix for a mill. ENCE uses a higher percentage of *E. globulus globulus* and bark is left on, resulting in less volume per truck.

Route 2 between Mercedes and the intersection of Route 24, the AADT is 206, based on estimated truck traffic for supplying wood to the Botnia and ENCE mills.

These numbers indicate that truck traffic will significantly increase on the road network of western Uruguay that serves the two mills. This increase will be particularly evident on Route 2 between the junction of Route 24 and the access road to M'Bopicúa and the ENCE mill, where there is potential for major traffic congestion. Even in the absence of the two mills, existing truck traffic volumes are expected to double, at least on Route 24, with the continued growth of round wood and agricultural commodity exports via M'Bopicúa, Fray Bentos port and Nueva Palmira. The existing round wood transport to the port of Fray Bentos will be largely diverted directly to the mill site and, thus, bypass the city.

In addition to the potential for traffic congestion which will require traffic control and engineering solutions, the assessment of potential cumulative impacts of increased traffic as well as possible mitigating measures, include:

- Safety: The increase in truck traffic will require measures to control risks to pedestrians, including school children living in communities that are typically located along rural roads in Uruguay. Driver training and dispatch controls can be utilized to maintain road safety.

- Accidents: The current and projected traffic volumes are relatively low because the transport network serves an area of low population density. Impact of the increase in truck traffic and traffic congestion will be minimized with dispatch systems that keep the trucks adequately spaced and also control speeds.

- Air Pollution: The forecast traffic volumes are relatively low for two-lane roads, but with controlled spacing and continuously moving traffic any increase in air pollution should be minimal.

- Increase in Road Maintenance: The increase in truck traffic on the area's road network will require more frequent maintenance resulting in increased costs to the affected department governments. Compensation methods to increase maintenance funding could be developed to charge users for the increased costs, by installing tolls with appropriate rates for log haulers.

## Figure 4.10-1: Transport Network Map

**Table 4.10-1: Current and Projected Increase of Vessels on Río Uruguay**

| Vessel Type | Traffic in 2004 | Projected Traffic Increase |
|---|---|---|
| Ocean going vessels navigating Río Uruguay | 240 per year | No significant increase |
| Barges | 1,925 per year | |
| Barges importing raw materials to pulp mills | - | 220 per year |
| Barges exporting pulp to Nueva Palmira & Montevideo | - | 420 per year |

**Table 4.10-2: Cumulative Impact of Pulp Mill Operations on Local Road Network (daily truck traffic)**

| Segment of Highway | Current Traffic | Estimated Traffic for Botnia Mill | Estimated Traffic for ENCE Mill | Estimated Traffic for Both Mills |
|---|---|---|---|---|
| Route 24 from Paysandú to Junction of Route 2 | 98 | 420 | 160 | 580 |
| Route 2 from Mercedes to Junction of Route 24 | 245 | 92 | 114 | 206 |
| Total | 343 | 512 | 274 | 786 |

## 4.11 Energy

### 4.11.1 Energy Production and Use at the Mills

Most of the wood by-products that are not converted to marketable pulp fiber are burned in the pulp mills to produce energy. The burning of black liquor[19] in recovery boilers at both mills will produce steam and electricity and enable the recovery of cooking chemicals. A biomass boiler at the ENCE mill will produce energy by burning bark and wood waste from

[19] Black liquor is a mixture of dissolved organic substances (lignin) and chemicals (for cooking wood chips).

wood preparation and primary sludge from the effluent treatment system. Energy issues related to the comparison of mill technology with BAT are discussed in Annex A.

Both mills will be connected to the national electricity grid (150 kV and 30 kV lines) and are expected to produce surplus power. The estimated surplus of power to be sold to the national grid is 15 MW for Botnia and 31 MW for ENCE under normal operation. Electricity from the national grid will be used during start-up of production, regular maintenance and unplanned shutdowns (about 15 days per year). Fuel oil will be required for the boilers (for start-up, shutdown and unbalanced conditions), the lime kiln, the incinerator of odourous gases, and for emergency power.

Analysis of environmental permit applications by DINAMA considers the mills and chemical plants as typical industrial installations, with the Kemira plant being part of the Botnia mill, and there is no reason to modify this approach. However, when examining the combined impact of the mill projects, it is useful to consider the beneficial impact on the overall electric power balance of Uruguay.

Any energy balance must be based on a defined boundary. In the pulp industry, it is normal practice to consider the mill fence, and ignore electricity consumed to supply chemicals to the mills. In this case, production of chemicals for the mills within the boundary is included in the assessment.

The Botnia mill is expected to produce approximately 47 MW of excess power, of which the Kemira chemicals plant requires 12 MW to produce chemicals for Botnia's mill (net surplus of 35 MW). The ENCE mill is expected to produce a surplus of around 31 MW. The manufacture of chemicals to supply the ENCE mill will consume around 6 MW, therefore the net export for ENCE will be approximately 25 MW.

The Kemira plant will require approximately 45 MW to operate at full capacity if chemicals are produced to supply other mills. This is most likely to occur if other Kraft mills in the region convert from using chlorine bleach to ECF bleaching. By using electrical energy from the Botnia mill, Kemira will avoid drawing an equivalent amount from the national electrical grid. Any export of chemicals from the Kemira plant beyond Fray Bentos to existing mills will be based on power generated from biomass and may replace fossil fuel generated electricity elsewhere. Analysis of the environmental benefits of this versus possible future energy consumption is beyond the scope of this CIS.

Based on Botnia's expected surplus of 35 MW and ENCE's expected surplus of 25 MW, a total of 60 MW could be sold to the grid when both mills are in operation. The 60 MW power surplus for the mills is equivalent to around 500 GWh of energy to the national grid per year. This would represent around 5% of electricity generation in Uruguay.

### 4.11.2 Electricity Production and Demand in Uruguay

Uruguay's annual electricity generation is approximately 9,000 GWh based on data from 2000 to 2005. Uruguay's hydroelectric plants are able to meet most of the country's electricity demand. On average, 83% of Uruguay's electricity was generated by hydroelectric plants over the 2000 to 2005 period. Since power production from the hydroelectric plants fluctuates due to weather conditions (i.e., lack of rain), the country relies on imported electricity from Argentina and Brazil, and thermal power plants (oil and diesel) to meet demand during shortfalls. Hydroelectric generation is reaching full capacity, therefore Uruguay has been seeking to diversify its energy supply (e.g., wind power, natural gas) to meet increasing demand in the future.

In June 1997, Uruguay changed its electricity laws to allow independent power producers to generate power. An association of independent power generators was established recently. The electricity sold by the pulp mills to the national grid can be called green power because it is produced using biomass[20] which is a renewable resource. Since carbon dioxide is captured through photosynthesis, the use of biomass to produce energy is considered carbon neutral (i.e., no net increase in carbon dioxide emissions to the atmosphere).

### 4.11.3 Potential Impact of Selling Electricity to the National Grid

The power sold by the mills to the national electricity grid can be considered to have a positive impact if it offsets environmental impacts associated with production of electricity by thermal power plants. Like most systems in the world, low-cost energy sources such as hydro power are used to the maximum in Uruguay, and the shortfall is made up with oil or other fossil fuel generation. Thus, any input of "green" power from the pulp mills will result in an equivalent reduction of fossil fuel use somewhere, whether in Uruguay, Brazil or Argentina. If there is actually more hydro power available than the total demand, which is conceivable for short periods, the hydro dams will store water for future use, or hydro power can be sold to Brazil or Argentina and offset fossil fuel use there.

An approximate comparison can be made of the estimated fuel oil consumption for processes at the Botnia mill relative to the electrical energy surplus that may be supplied to the national grid and is presented in Table 4.11-1.

To estimate the amount of fuel oil required to produce the amount of electricity sold to the electricity grid, an efficiency of 27.5% was assumed. This is typical for such installations. Efficiency is the amount of power produced per amount of fuel burned. This means that the amount of energy produced as electricity would be equal to 27.5% of the energy contained in the fossil fuel feed. Based on the calculations shown in Table 4.11-1, the amount of

[20] Biomass is organic matter (e.g., wood material, vegetation, agricultural waste) used as fuel.

surplus energy that may be sold to the national electricity grid is equivalent to more than the amount of energy consumed as fuel oil at the Botnia mill.

The fact that the energy needs of the mills are supplied primarily by black liquor and wood waste is an advantage compared to other industries that are not based on renewable energy sources. The estimated emissions associated with the production of 500 GWh of electricity are shown in Table 4.11-2. The potential emissions from thermal power plants corresponding to the surplus electricity from the pulp mills are based on the National Greenhouse Gas Inventory for 2002 (Inventario Nacional de Emisiones Netas de Gases de Efecto Invernadero, INGEI).

### 4.11.4 Potential Impact of Collecting and Burning Wood Waste from the Surrounding Area

A biomass boiler at the ENCE mill will burn bark and wood waste (fines) from wood preparation and primary sludge from the effluent treatment system. Wood waste from other sources, such as sawmills, may also be collected and burned in the biomass boiler at the ENCE mill. The bubbling fluidized bed boiler, equipped with electrostatic precipitators to be used at the ENCE mill would discharge a trivial amount of atmospheric pollutants relative to burning equivalent quantities of wood waste in the older incinerators in common use in sawmills.

The collection and burning of wood waste to generate electricity would therefore virtually eliminate the environmental impacts associated with incineration of wood waste in low-technology burners or decomposition of wood waste in landfills. However, the impacts cannot be quantified in this report because the suppliers of wood waste and their practices regarding wood waste have not been analyzed at this time.

The supply of wood waste from outside sources will depend on transportation costs, distance to potential suppliers, and wood waste prices at the moment of purchase. In Uruguay, there are around 200 sawmills. Within a radius of 200 km of Fray Bentos, there are six sawmills. In general, wood waste from small sawmills is burned for domestic heating, wood drying, and brick-making, or simply left to decompose at disposal sites. Some larger sawmills sell some of their wood waste as chips for pulp production in Uruguay or export them to Argentina and Europe. The magnitude of the positive impact of burning wood waste from outside the ENCE site will depend on the supply of wood waste for the ENCE mill and the way that the wood waste was previously managed.

**Table 4.11-1: Comparison of Fuel Oil Consumption and Electricity Surplus for the Botnia Mill**

| Mill Process | Type of Fossil Fuel | Fossil Fuel Consumption (ton/year) | Conversion Factor (ton of oil equivalent/ton) | Fossil Fuel Consumption (ton of oil equivalent/year) |
|---|---|---|---|---|
| Odourous gas incinerator | light fuel oil | 1,200 | 0.9056 | 1,100 |
| Recovery boiler | heavy fuel oil | 20,000 | 0.9590 | 19,200 |
| Lime kiln | heavy fuel oil | 37,000 | 0.9590 | 35,500 |
| | | | **Total** | **55,800** |
| | Energy to Grid (GWh/year) | Conversion Factor (ton of oil equivalent/GWh) | Fossil Fuel Equivalent (ton of oil equivalent/year) | Fossil Fuel Consumption to Produce Electricity[1] (ton of oil equivalent/year) |
| Electricity surplus (35 MW) | 294 | 260 | 76,440 | **278,000** |

[1] An efficiency of 27.5% was assumed for electricity generation using fossil fuels.

**Table 4.11-2: Estimate of Potential Offset of Emissions from Thermal Power Plants for Electricity Generation of 500 GWh**

| Parameter | Estimated Emissions from Thermal Power Plants for Electricity Generation of 500 GWh (tons per year) |
|---|---|
| Carbon dioxide ($CO_2$) | 495,107 |
| Methane ($CH_4$) | 20 |
| Nitrous oxide ($N_2O$) | 5 |
| Nitrogen oxides ($NO_x$) | 1,308 |
| Carbon monoxide (CO) | 99 |
| Non-methane volatile organic compounds (NMVOCs) | 33 |
| Sulfur dioxide ($SO_2$) | 7,354 |

[1] Emission rates were calculated using the estimated emissions for 2002 (INGEI 2002) reported as part of Uruguay's commitment to the United Nations Framework Convention on Climate Change (Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente, Direccion Nacional de Medio Ambiente, Unidad de Cambio Climatico, Mayo 2004).
[2] An efficiency of 27.5% was assumed for electricity generation using fossil fuels.

## 4.12 Regional Developmental Impacts

The proposed pulp mills will continue the development of the forestry sector in the region as planned and supported at least since the mid-1980s. Multi-lateral donors assisted with studies and financing; the government of Uruguay agreed to pro-actively pursue such a development pathway in an environmentally and socially acceptable manner. Construction and operation of the proposed pulp mills will bring increased value-added benefits (both direct and indirect) to the local, regional and national economies rather than exporting them to overseas jurisdictions.

### 4.12.1 Community Development

ENCE and Botnia have made significant and ongoing commitments to programs and activities that will result in community development benefits to their local and regional communities. Each company has developed Social and Environmental Action Plans that describe in detail this commitment. Overall, the cumulative impact of these programs are expected to be positive and bring long term benefits to the local and regional communities.

The Department of Río Negro, together with twelve major businesses in the Fray Bentos area (including ENCE and Botnia) has already formed a development agency with the

objective of creating strategic projects to address the regional development implications of the projects on the surrounding area. Partnerships have already formed with education facilities and new programs are in place to assist with the education and training of local and regional residents so that they may benefit from the opportunities created by the mill development. Welding programs have been set up at local high schools, traffic safety programs, computer education programs, and business skills are a few of the programs already implemented.

Providing additional opportunities for employment will encourage youth to remain in their community rather than to migrate to Montevideo or other large urban area in search for employment.

Community services and infrastructure will also be improved and expanded such as health care facilities, recreation facilities (e.g., golf course), municipal sewage treatment and housing.

### 4.12.2 Quality of Life

There will be changes in the quality of life for the population in the area of influence, most notably in Fray Bentos and in the surrounding area. The pace of life will increase with the influx of outsiders into the area, there will be an increase in traffic, noise, tourism and commercial activities. As Fray Bentos continues to develop, new opportunities will be created, making the city more attractive to youth and young adults. The out-migration of youth should decrease as these new opportunities develop.

Perhaps most noticeably will be the increased overall affluence experienced by many in Fray Bentos and the region. Increased affluence creates new choices related to improved living conditions, purchasing power, education and health care.

There will be a greater demand for, and supply of, cultural and recreational events and activities. These activities will be induced by market forces and regulated by the local institutions. For example, the increase in accommodation rentals will potentially lead to an overall increase in the cost of living in the city of Fray Bentos and in neighbouring localities.

There will be a tendency towards greater social stratification in the city of Fray Bentos with the influx of operational personnel for the mills and other related industries in the higher social and educational categories. The long-term presence of both mills will result in an overall more prosperous economy that attracts other forms of investment. The community will benefit from improved health care, education opportunities, and infrastructure. Investment in recreation and cultural activities will also be experienced during the operations phase, two indicators that contribute to an improved quality of life.

Actions planned or already implemented by ENCE and Botnia to deal with these quality of life issues include communicating with the public through:

- The use of a dedicated telephone number during construction for residents to use to ask questions, or express concerns;
- Botnia will publish a large circulation magazine in which it presents and analysis different topics related to its plants and activities in Uruguay and Finland; and
- ENCE, jointly with the Faculty of Social Sciences of the University of the Republic, has conducted a number of public seminars with the members of the local civil society of Fray Bentos to explain the characteristics and implications of the construction works.

Negative impacts to the quality of life include an expectation of an increase in crime, sexually-transmitted diseases, and anti-social behaviour with an increasing population (Section 4.8).

## 4.13 Organizational Capacity

The success of social and environmental management activities depends critically on the capacity of the responsible organizations to implement their programs effectively. Sufficient human resources with the requisite skills to carry out their tasks are important elements for success. Ancillary and supporting resources are also required at appropriate levels and times for programs to be carried out effectively.

### 4.13.1 Corporate

The EIA documentation for the pulp mill projects outlines each project's commitments to social and environmental action plans to manage anticipated impacts from the projects. Overall, both companies have committed to programs that will pro-actively manage impacts within a social and environmental management system adequate to the task. These programs are described in Section 5.0 of this report.

### 4.13.2 Governmental

The issue of the Government of Uruguay's capacity to provide the in-country regulatory oversight of the pulp mill projects has been raised by some interested parties.

DINAMA is Uruguay's environmental authority. It is part of the Ministry of Housing, Territorial Arrangement and Environment (MVOTMA). DINAMA is responsible for formulating, executing, monitoring and evaluating the "National Plan of Environmental Protection". It is also responsible for proposing and implementing the National Policy of Environmental Protection, aiming towards sustainable development for the country.

MVOTMA also houses Comision Tecnica de Asesoramiento de Medio Ambiente (COTAMA). COTAMA is an inter-institutional and multi-sector entity that provides advisory and coordination guidance on environmental issues. Its membership includes

representatives from many ministries, government institutions, and NGOs. COTAMA was responsible for the formulation of the National Law of Environmental Protection.

DINAMA's responsibilities and duties include the following:

- Formulate, execute, supervise and evaluate plans to (i) to measure and evaluate the quality of environmental resources (water, air, etc), and (ii) prevent the negative environmental impact of human activities;
- Evaluate control plans of public and private entities that will impact on the quality of the environmental resources; and
- Formulate and coordinate actions with public and departmental entities for the protection of the environment.

DINAMA's licensing process and requirements are described in Section 1.4 of this report. DINAMA's organizational structure includes five departments: (i) Assessment of Environmental Quality, (ii) Assessment of Environmental Impact, (iii) Environmental Control, (iv) Protected Natural Areas, and (v) Administrative.

### 4.13.3 International

**Comisión Administradora del Rio Uruguay (CARU)**

CARU was commissioned under the Rio Uruguay Statute that was endorsed by Argentina and Uruguay on February 26, 1975. It is a bi-national commission responsible to administrate affairs pertaining to the Rio Uruguay including those dealing with water uses and water quality. One of the most important responsibilities of CARU has been the adoption of water quality standards[21] that both governments are committed to regulate. Requirements related to environmental monitoring have also been prepared and CARU has responsibilities to undertake joint monitoring.

Although CARU has been active in the administration of these responsibilities, the recent animosity between the two countries pertaining to the proposed pulp mills in Fray Bentos has undermined the ability of the commission to fulfill its mandate. In the meantime, the Government of Uruguay has decided to proceed unilaterally with regard to regulation and monitoring in connection with the Botnia and ENCE applications. CARU's function in monitoring water quality is a critical function and should be restored as soon as possible to help protect the overall quality of the river.

[21] CARA. Digest on the Uses of the Uruguay River. Administrative Commission of the Uruguay River, Paysandú, 1984.

**United Nations Environment Program (UNEP)**

UNEP is not formally involved in the environmental regulation or monitoring of effects pertaining to the pulp mills, however, it was previously invited to contribute to monitoring activities by the Ministers of Environment of Uruguay and Argentina. To date, there are no planned or committed activities on behalf of UNEP in this matter.

### 4.13.4 Other Interested Parties

A number of other organizations and groups, including NGOs and other civil society representatives, have expressed interest in these projects in various ways. Overall, many parties are expected to have a role in developing the plans for the management and monitoring of the projects' effects. Such capacity is expected to benefit the local and regional social and biophysical environs and to assist in optimizing the projects' effects, including their cumulative impacts.

# 5.0 CUMULATIVE IMPACT MANAGEMENT

The assessment of environmental impacts involves the determination of the type, magnitude, and duration of potential effects on the social and ecological environments in areas affected by the developments. Once these effects are elaborated, it is necessary to determine what actions should be undertaken to mitigate their impact, if necessary and how the success of the mitigation actions will be measured. Monitoring programs are designed as part of the assessment process in order to implement the requirements of regulatory authorities as well as to measure predicted impacts and provide sufficient information to manage or further mitigate the impacts.

Once the specific activities associated with the development are elaborated, potential impacts identified and monitoring programs designed, the proponents must pull together the relevant information into comprehensive and action-oriented environmental and social management plans. These plans should cover all activities pertaining to all phases and operations of the development. Where the development has important consequences on the surrounding communities, these plans should also be integrated with well constructed and complete public communication and consultation procedures and programs.

The results of environmental and social monitoring studies and the implementation of emergency response measures potentially affecting the public must be communicated to the public in a clear and responsible manner. Public disclosure by all actors pertaining to the construction and operation of the mills must be transparent, rapid, inclusive, responsive, and, above all, unambiguous.

This chapter of the CIS addresses the key components and processes required for the development of environmental and social management planning, as required by DINAMA as part of the licensing process for the two proposed mills.

## 5.1 Environmental and Social Monitoring

Monitoring programs are an essential component of EIA and generally respond to two requirements. The first requirement is monitor parameters such as those related to air and water emissions that are required by regulatory authorities (in this case DINAMA) to ensure that plant processes meet their design specifications with regard to applicable standards and guidelines. The second monitoring requirement responds specifically to potential impacts and is designed to define the magnitude or nature of the problem as well as provide input for additional mitigation, if needed.

Section 4.0 of this CIS document reviewed and summarized potential cumulative effects associated with the construction and operation of the Botnia and ENCE proposed pulp mills. The two companies had previously undertaken an evaluation of specific impacts of their facilities and operations for which they developed mitigation strategies and specific monitoring programs. These programs are elaborated in their respective EIA documents

and are briefly summarized here. The CIS evaluation presented in this document also identified a number of monitoring activities designed to address specific cumulative impacts defined in this CIS.

### 5.1.1 Plantations

In general, most of the impacts resulting from the operation of existing plantations and the development any new plantations were considered minor and manageable. All of the company-owned plantations and most of those owned by third party contractors are certified under the Forest Stewardship Council sustainable forest management program which requires measurements and audits of social and environmental components. However, individual and cumulative impacts of potential significance relate to water management issues – both surface water and groundwater.

The CIS document (Annex B, Subsections 4.2 and 4.3) recommended that the forestry companies supplying the two mills continue their participation in on-going Uruguayan State University studies pertaining to impacts on soils, surface water, and groundwater. In addition, both EUFORES and FOSA should ensure surface and groundwater monitoring is established at all of their large-scale plantations. Any plantations located within the recharge area of the Guarani Aquifer should also study, monitor and assess groundwater quality (pesticides, herbicides, and nutrients) under their plantation lands.

### 5.1.2 Noise

The data provided by Botnia and ENCE indicate that there may be exceedences of the IFC standards for noise impacts at least during the construction phase (Subsection 4.5). Some exceedences may also occur in areas adjacent to plantations. The construction phase impact will be short- to medium-term and reversible. The plantation impact will be long-term but intermittent. The exact extent of the impacts has not been fully addressed in the EIAs and each company should undertake detailed monitoring of noise levels adjacent to plantations and the mills. In addition, they should prepare contingency plans to protect particularly sensitive receptors, such as recreational and residential areas, in the event of regular exceedences of IFC guidelines. These contingencies could include sound proofing and deflecting devices including vegetation planting and the construction of noise walls.

### 5.1.3 Air Quality

The maximum concentration of all air quality parameters occurs within the areas immediately adjacent to the mill properties. The CIS assessment (Subsection 4.4) indicated that air quality in these areas will remain in compliance with all respective air quality criteria under all operating conditions. The concentrations of substances in the atmosphere will increase slightly, but concentrations will remain less than 6% of the air quality criteria for all parameters with the exception of $NO_2$ (which is predicted to be 32% of the 1-hour standard) under normal operating conditions. Beyond this limited area and at the neighboring communities in Uruguay and Argentina, the potential change in air quality

for virtually all substances will be immeasurable. The only exception to this is the potential for infrequent occurrences (4 to 10 times per year) of detectable odour in the city of Fray Bentos and at the international bridge.

Both companies proposed to undertake monitoring of reduced sulphur compounds (TRS), but they did not specify pertinent receptors. It is thus recommended that monitoring of TRS be undertaken in Fray Bentos and at the international bridge.

### 5.1.4 Water Quality

The cumulative assessment of water quality in the Río Uruguay indicates that no water quality standards or guidelines will be exceeded as a result of the discharge of effluents from the two mills. However, chemical and biological monitoring in the river, in conjunction with mill effluent monitoring, is recommended to demonstrate the lack of adverse impact.

Recommendations for chemical monitoring of mill effluent are detailed in Annex A. In addition, toxicity testing of effluent is recommended, including both acute and chronic testing (Annex D, Section D7.1). If non-toxic results are consistently obtained, the need for such testing should be reviewed.

A plume delineation study is recommended, to be completed when the mills are operating normally (Annex D, Section D7.2). This will confirm the complete simulations of plume dispersion in the Río Uruguay.

Water and sediment quality monitoring programs are recommended, including upstream reference and downstream plume exposure locations (Annex D, Section D7.3). Water quality would be monitored bimonthly, for a comprehensive suite of chemical parameters. Sediment quality would be monitored every two to three years, for total organic carbon (TOC), grain size, pH, nitrogen, phosphorus, adsorbable organic halides (AOX), extractable organic halides (EOX), total phenolics, chlorophenolics, and dioxins and furans. This program will track any sediment nutrification effects, as well as any accumulation of toxic contaminants of concern.

Monitoring of benthic invertebrate community composition is recommended, concurrent with the sediment quality monitoring program. In addition, a selected benthic invertebrate (clam or mussel) would be collected for analysis of tissues for bioaccumulative substances, including chlorophenols, resin and fatty acids, phytosterols, and dioxins and furans.

A fish health survey similar to that conducted at many Canadian mills was deemed not to be a useful monitoring tool in this instance, because of the small size of the predicted effluent plume, consistent with Canadian regulations. Similarly, chemical monitoring of fish tissues was considered not to be needed. However, a conceptual fish monitoring program was developed (Annex D, Section D7.3), as a contingency measure, should a program be required in the future.

### 5.1.5 Compliance Monitoring Requirements

A monitoring and recording system is an essential element of BAT. In August 2006, DINAMA issued a preliminary compliance monitoring plan for the pulp mills in Fray Bentos requiring three levels of monitoring:

1. monitoring to be undertaken by the pulp mills for process control and environmental performance purposes, and which agrees with the Monitoring and Follow-up Plan to be presented to and approved by DINAMA;

2. monitoring that can be undertaken by the follow-up commissions established in the respective Initial Environmental Authorizations (AAP); and

3. monitoring to be undertaken through DINAMA with the objectives of industrial control and evaluation of the environmental quality. It is at this level that DINAMA defines the parameters to be monitored, location of sampling stations, frequency of sampling, responsible operators, and the analytic techniques and procedures.

Follow-up activities, as overseen by DINAMA, comprise two elements: the quantification of the parameters that characterize industrial emissions and environmental and ecosystemic quality (monitoring); and the audit of Management Plan implementation.

The Environmental Impact Assessments (EIA) submitted with the AAPs by each pulp mill contains a monitoring plan for environmental media in the impacted area. Additional monitoring requirements will be included in specific authorizations issued by the Ministry of Housing, Land Use Planning, and Environment (MVOTMA). A central part of the approval for both the AAPs and the Environmental Management Plan (PGA) for the Botnia and ENCE plants is the requirement of comprehensive monitoring of environmental impacts in different environmental media, including in the Río Uruguay. Both companies are required to engage in extensive monitoring prior to operations of the plants to establish a baseline condition of the Río Uruguay. Monitoring should include superficial water (including sediments, fish and benthic fauna), air, soil and groundwater, terrestrial biota, noise and social aspects.

The AAPs of both Botnia and ENCE set forth parameters with which their monitoring plans must comply and DINAMA has indicated that the monitoring requirements may be modified. Indeed, pursuant to the AAO procedure, DINAMA will review each plant's monitoring plans every three years and if necessary, will require additional monitoring to ensure the avoidance of negative environmental impacts. The monitoring data collected for the construction and operation PGAs will be submitted to and evaluated by DINAMA. If unacceptable impacts are observed, DINAMA will take appropriate action.

Neither of the two mill proponents has yet submitted their compliance monitoring program which is to be approved before being awarded the remaining PGAs and AAOs, even though

they have produced preliminary versions of these plans and engaged in discussions with DINAMA to that respect. These preliminary plans for end-of-pipe and end-of-stack monitoring include parameters to be monitored, frequency, and point of measurement, and primary responsible.

The requirements for compliance monitoring are critical to ensure that the mills are well operated at all times. Establishing the compliance monitoring requirements is a task that DINAMA and the two proposed mills are addressing incrementally and carefully. The permit requirements have not been established at the time of this CIS writing and thus the compliance monitoring requirements cannot be explicitly stated. However, there are certain important principles that should be considered in establishing these compliance monitoring requirements:

1. DINAMA has indicated that they will establish loading-based requirements in addition to concentration-based requirements. Concentration-based requirements, while required by Decree 253/79, restrict the mills' ability to decrease flow and achieve energy efficiency, especially with regards to effluent contaminants such as metals. The loading-based requirements should be considered the most pertinent and should include a more conventional time-averaging requirement, e.g. 24 hours.

2. Because DINAMA is responsible for requiring 4-hour maximum concentration values, continuous monitoring techniques should be used wherever possible for the effluent, including inferential techniques.

3. The variability in mill effluent discharge that needs to be accounted for between long term average discharge and various time maxima, e.g. 4-hours, daily or monthly maxima, is unique to each mill and depends on a number of complex factors. The variability that is considered in setting the loading-based permit requirements should be evaluated based on actual effluent data once production has stabilized.

4. Effluent flow limits should not be specified in permits and likewise, flow reduction targets should not be explicit in the Authorizations for Industrial Wastewater Discharge (ADI) and AAOs. Flow reduction is unlikely to result in measurable reduced environmental impacts, and it is essential that the mills have flexibility to target productivity factors such as production increase, energy efficiency, etc. without limitations from unduly low water usage requirements.

5. Air limit requirements should be specified on a source basis and not on a stack basis, e.g. for the recovery boiler, lime kiln, etc. in order that the data can be used to verify BAT.

6. DINAMA should not set specific in-process requirements unless the operating mills are proven to be out of compliance or to have an impact and that this can be clearly attributed to suboptimal in-process practices.

7. An allowance should be attributed in the permits during start-up and shutdown of certain major equipment items, e.g. boilers, and during an initial operating period for the mills.

8. DINAMA will include a requirement for AAO renewal every three years. It is recommended that in addition to this a re-permitting exercise be required should a production increase threshold be surpassed.

### 5.1.6 Solid Waste

The solid waste assessment (Subsection 4.7) indicated that groundwater monitoring will take place in association with their proposed solid waste landfills along with the monitoring of waste type and amount going into the landfills. The companies will not generate significant amounts of hazardous waste but the quantities generated will be taken to approved facilities. It is recommended here that the companies should also monitor the type and amount of such waste generated as well as ensure that an appropriate waste transportation tracking procedure is implemented.

### 5.1.7 Social and Economic

Economic and employment impacts (Annex E, Subsections 4.8 and 4.9) associated with the construction and operation of the two mills are considered to be significant and positive to the economy, particularly in Fray Bentos and the Department of Río Negro. However, the increase in demand for local services and changes in quality of life in these areas may have a negative impact. Overall, tourism may be negatively impacted due to visual changes and the potential for increased pollution such as odor problems associated with the operation of the mills.

Monitoring programs for air quality and water quality already planned by the companies will assist in future assessments of social impact mitigation. In addition, Botnia has commenced a detailed social monitoring program based on a number of indicators. The social and economic CIS assessment recommends that both companies co-operate in undertaking their monitoring programs. The CIS document (Annex E) provides specific monitoring program recommendations pertaining to indicators, sub-indicators, locations, and frequency. The indicators include housing, policing, health care, education, employment, tourism, fishery resources, farm resources, and beekeeping. Generally, most of the monitoring is recommended for Fray Bentos, Río Negro and Paysandú on a quarterly, semi-annual, or annual basis.

### 5.1.8 Transportation

Transportation impacts (Annex F, Subsection 4.10) resulting from the construction and operation of the mills as well as from the shipment of logs from plantations to the mills are considered negative due to increased traffic and congestion. Increased river traffic to export the pulp will be more or less offset by the decreased river traffic due to elimination of former pulp log and woodchip exports. No monitoring programs are identified for this sector.

### 5.1.9 Energy

The cumulative impacts pertaining to the energy requirements of the mills are considered overall to be positive. This is based on the displacement of fuel oil with biomass from providing surplus electricity to the national grid. Also, the use of wood waste for energy generation may reduce negative impacts related to the disposal of these materials. No monitoring programs are recommended for this sector.

### 5.1.10 Regional Development

The companies and local communities are working together to develop social and environmental action plans that will increase local and regional development opportunities as well as community programs and activities. These should result in net benefits related to education, training, employment opportunities, and improvements to community infrastructures relating to health care, recreation, and utilities. Alternatively, quality of life will be impacted both positively (increased wealth and services) and negatively (increased population, congestion, and demand for services). The companies are planning to institute a number of community communication actions to respond to problems as they may arise. No specific monitoring programs are proposed for this sector although the program recommended for social and economic impacts will respond to negative impacts pertaining to community services.

## 5.2 Environmental, Social and Corporate Management Planning

Detailed environmental management plans are designed to cover all phases and activities of the development. These plans are critical to ensuring that the results of the initial impact assessments are properly implemented and followed through with. They include specific actions to be taken with regard to on-going monitoring and responses to unplanned but predictable events; responsibilities and chain-of-command within the company; contact procedures (both in-plant and community, as required); staff actions to be taken (including both technical response and health and safety measures); reporting requirements; and follow-up. It is essential that such plans be kept up-to-date as procedures, staff, and contact numbers change. Further, they must be implemented via company policies which include staff orientation, education, and training (including simulations of events).

Botnia and ENCE have prepared a wide range of documentation pertaining to their internal management processes. These include corporate social and environmental policies, organizational structures and responsibilities, environmental control procedures, the management of risks, emergency and contingency plans, staff training requirements, operational auditing, and public communications and consultation. Botnia has provided their corporate environmental policies along with relevant project specific information within their EIA Summary Document (Chapters 4 and 5) and in Section 8 of the main EIA. ENCE has prepared a separate document referred to as an environmental and social action plan (Plan de Acción Ambiental y Social, ESAP) which includes a summary of corporate environmental policies and specific project management plans for a variety of activities.

Botnia's EIA documentation focuses on their proposed mitigation and monitoring programs but also identifies potential risks related to plant process equipment and spills. The documentation includes specific actions and design measures intended to reduce or eliminate such risks as well as the need to develop specific operational emergency plans for each mill process. In February 2006, Botnia provided a schedule for the completion of their ESAP. Most elements will be completed by the time the mill commences operations. Table 5.2-1 shows the tasks associated with this plan, the task deadline, and the status as of February 2006.

A social and environmental action plan was prepared by ENCE in 2006 (August 2). This document provides a summary of corporate management policies pertaining to environmental and social responsibilities and to health and safety. Specific plans and their basic content are outlined in Table 5.2-2.

## Table 5.2-1: Schedule and Status of Botnia's Environmental and Social Action Plan

| Task | Deadline | Status |
|---|---|---|
| 1. Develop & Implement an Integrated Management System for Environmental + Occupational Health & Safety issues and achieve certification to ISO 14001 + OHSAS 18001 | 1 year post start up | Not yet started. Will include:<br>• Quality Management System ISO 9001:2000<br>• Environmental Management System ISO 14001:1996<br>• Occupational Health and Safety Management System OHSAS 19001<br>• Chain of Custody of Wood SMS 1003<br>• HACCP System DS 3027:2002<br>• Inspection of Renewable Energy Production (RECS) |
| 2. Develop & Implement a Hazardous Material Management Plan as specified in IFC guidelines | Prior to start up | Preliminary plan prepared. |
| 3. Develop and Implement an Emergency Response Plan to cover expected emergency events and impacts on plant and on the surrounding communities | Prior to start up | Preliminary plan presented to IFC. |
| 4. Develop and Implement a transportation plan including road and river transport of wood and pulp all the way to the export terminal | Prior to disbursement | Preliminary plan prepared. |
| 5. Develop a community development plan to guide future community based actions | Prior to commitment | Preliminary plan presented to IFC. Recently revised. |
| 6. Develop a strategy and detailed plan for conservation set aside as per the permit | Prior to disbursement | FOSA has presented Mafalda area to DINAMA (Botnia will file in DINAMA). Plan also presented to IFC. |
| 7. Develop detailed design and operational procedures for landfill and for the hazardous waste storage cell and submit to IFC for prior approval | Prior to construction of the landfill | Landfill design ongoing. |
| 8. Implement groundwater monitoring program in FOSA owned plantation holdings | Prior to disbursement | Planned monitoring presented to IFC. |
| 9. Demonstrate that IFC's standards on environmental and social impact assessment, as well as on issues of occupational health and safety are fully met at the site to be used primarily for the export of the pulp | Prior to disbursement | Audit planned in February 2006 |

**Table 5.2-2: Contents of ENCE's Environmental and Social Action Plan**

| Plan Title | Description |
|---|---|
| 1. Pollution Abatement and Prevention | Technological investments adopted to mitigate the environmental impacts during the operation of the mill. |
| 2. Construction Management | Construction phase mitigation actions. |
| 3. Hazardous Materials Handling. | Hazardous materials management guidelines. |
| 4. Emergencies | Emergency prevention and response. |
| 5.Transportation | Management of impacts associated with water and road transportation. |
| 6. Community Plan Development | Community action planning for social activities and programs. |
| 7. Natural Resource Conservation | Environmental conservation and protection actions. |
| 8. Solid Waste Management | Procedures for the collection and disposal of solid wastes from industrial operations. |
| 9. Hydrological Resources | Design of studies pertaining to the effect of plantations on the hydrological cycle. |
| 10. Environmental Monitoring | Monitoring and follow-up of air emissions, liquid effluent, solid waste and other environmental elements. |
| 11. Public Communication and Consultation | Procedures for communicating environmental and social monitoring/study results. Communication channels and opening with the community on the environmental and social performance. |

## 5.3 Public Disclosure

The International Finance Corporation contracted a study of stakeholder concerns and interests pertaining to the proposed development of the two mills (Annex G). This study involved direct interviews of a wide range of interested stakeholders in person and over the phone. One of the key products of this study was the elaboration of a set of principles which should be incorporated into meaningful public engagement and dialogue. These principles are extremely relevant and should form the basis of continued interactions among the stakeholders, industry, government, and civil society. They are as follows:

- be meaningful and transparent;
- include broad stakeholder representation;
- provide opportunity for review of credible information;
- respect sovereignty; and
- ensure a safe space for civil discussion.

In this regard, both ENCE and Botnia are committed to ensuring that data pertaining to the operation and potential influence of the mills is readily available for public dissemination and is in a form that the lay public can understand. As required, all routine monitoring program data will be provided to DINAMA as scheduled in the mills' individual operations permits. As such, once in DINAMA's hands, the information will be in the public domain and should be made widely available. In practice, however, it is suggested that the mills should also disseminate key performance data in a proactive manner. It should be noted that DINAMA has required that each mill proponent participate in a "Follow-Up Committee" once operations have commenced. These committees will be presided over by the Ministry of Housing, Territorial Planning, and Environment (MVOTMA), and will be made up of various governmental entities and representatives of the local communities. These committees will allow both the government and the local community to access information about the environmental impacts of the mills. In addition to the committees, the mills should use a public information/community development centre in Fray Bentos, or similar mechanism, as a means to distribute information. The centre should have an area dedicated to the measurement of environmental performance and should include, among other things, data relevant to effluent and receiving environment quality.

Effluent and air quality data will be represented by several key measures that are indicative of the performance of the effluent treatment plants and the overall quality of the effluents. It is proposed that effluent flow, COD, conductivity, and TRS data will be reported to the public to reflect daily operating performance. It is also proposed that acute toxicity data be reported to demonstrate the continued non-toxicity of the effluent. Along with the data itself, regulatory criteria (if applicable) and measures of "typical" mill performance will also be shown for comparative purposes. "Typical" mill performance is to be expressed as the long-term monthly average value (i.e., the average of monthly averages for all available data) and the maximum monthly average (i.e., maximum monthly average for all data available). As indicated, these data will be in a format readily understood by the lay public (pictorial where possible) with full and clear explanation of the information provided where appropriate and/or necessary.

Receiving environment quality data generated by the proposed routine monitoring will also be reported to the public in a timely manner. It is suggested that data for a few key water quality parameters (e.g., conductivity, dissolved oxygen, nutrients) be tracked and shown graphically as data permit for a subset of the proposed sampling stations. Data for the stations upstream and downstream of the mill discharges, as well as at Yaguareté Bay and the water intake for the City of Fray Bentos, would serve for these purposes, providing the public a broad spatial understanding of water quality conditions in the area. Other routine monitoring data (fish, benthos) would be available on a regular but less frequent basis (as defined by the proposed schedule for each), and would be brought forward when available.

It is suggested that a quarterly information circular might be the best vehicle to communicate this information. This quarterly publication would track the environmental performance at the mill, summarize the real time data that are also provided as stand-alone

performance indicators, and describe major mill events that may have occurred. The mills should also use the Internet to distribute this information to help broaden public/stakeholder access. Although common, Internet access is by no means universal in the greater Fray Bentos area. Nevertheless, it would seem reasonable to expect that local Internet use will increase in the future, and that at some point this medium will become a much more significant component of the overall communications plan of each mill. The Internet can also enable more frequent reporting of some of the key environmental quality monitoring results indicated above.

Finally, although the audience might be somewhat limited for the detailed scientific reports that will be generated through routine environmental monitoring, hardcopies (paper) and electronic copies (PDF) of all receiving environment and effluent-related studies will be maintained in a catalogued library at the proposed public information centre in Fray Bentos.

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