MONITORING REPORT

Nueva Aldea Biomass Power Plant Phase 1

CDM Registration Reference Number: 258

VERSION 01

Monitoring period:

From: January 01, 2005
To: September 30, 2006

Celulosa Arauco y Constitución S.A.

September, 2006

SUMMARY TABLE

Name of the CDM project activity:	Nueva Aldea Biomass Power Plant Phase 1
CDM registration reference number:	258
Starting date of the project activity:	29/09/2003
Starting date of the first crediting period:	01/01/2005
Length of the first crediting period:	Seven (7) years.
Maximum length of the crediting period:	3 x Seven (7) years
Period covered by the current monitoring report:	01 January 2005 – 30 September 2006 (both days included)
Total net emission reductions claimed in the monitored period:	**147,374 tCO_2eq**

1. Project description and current status

Project description

The proposed project activity consists in the construction and operation of a new 30MW biomass cogeneration power plant located inside a new forestry complex by Arauco: the Nueva Aldea Industrial Complex or the Nueva Aldea Project.

The proposed project activity is designed to use own and third party biomass for steam and electric power generation. Biomass from industrial and forestry operations in Chile is normally dumped in piles for natural decay. The project activity is presented by Celulosa Arauco y Constitución S.A. (from now on, Arauco), a leading forestry and pulp-producing company in the world.

The Nueva Aldea Industrial Complex is built in two phases.

Phase 1, that consists in the construction of:

- A sawmill.
- A plywood mill.
- A log-processing mill.
- A biomass cogeneration power plant.

Phase 2 that consists in the construction of:

- A new 856,000 tons per year of bleached kraft pulp mill.

When the Arauco administration evaluated the Nueva Aldea Phase 1 project, it decided to build an integrated cogeneration facility in order to optimize the energy performance of the industrial complex, to perceive additional revenues from power generation and to capture the benefits of the Kyoto Protocol.

In the Nueva Aldea Phase 1 complex, approximately 60% of the electric power generated by the new Power Plant is destined to serve the internal needs of the Nueva Aldea Industrial Complex in Phase 1. The remaining 40% of the electric power generation is sold mainly to the spot market in the Interconnected Central System grid (SIC grid) and to some free (non-regulated) customers of Arauco Generación[1].

It must be noted that since the common practice in the Sawmill and Plywood industries[2] does not include the cogeneration of electric power, the entire net electric power generation capacity of the

[1] Arauco Generación S.A. is a subsidiary of Celulosa Arauco y Constitución S.A.. Arauco Generación provides administration services to Arauco in the areas of engineering and electric power generation.

[2] The log-processing mill does not really constitute an industry in Chile, however it is not the common practice in these mills to have a cogeneration unit in-site either.

new power plant in Phase 1 represents a net increase of clean energy in the SIC, and therefore considered part of the proposed project activity.

The Nueva Aldea Phase 1 project activity participants believe that biomass power generation constitute a sustainable source of power generation that brings clear advantages to mitigate global warming. Using the available natural resources in a rational way, the Nueva Aldea Phase 1 project activity helps to enhance the development of renewable energy sources in Chile, in particular the use of biomass generated as a by-product of the forestry industry, which has a significant potential in the country. The proposed project is a good example to demonstrate the viability of electricity generation as a source of revenue not only to the Sawmill / Plywood panel industry, but also to all forest-related industries. It is worthy to highlight, however, that none of the sawmill / plywood mills in Chile (and very few in the world) have this additional power generation capacity, making the Nueva Aldea Phase 1 Power Plant facility quite unique and particular in its type.

Baseline methodology

The name of the approved baseline methodology applied to the project activity is:

"Consolidated baseline methodology for grid-connected electricity generation from biomass residues", ACM0006. (version 1)

Applicable baseline scenario: Nº3.

Documentation

The project was validated by DNV and registered on March 31, 2006. The Project Design Document, validation report, request for registration and registration approval are available on the UNFCCC website: http://cdm.unfccc.int/Projects/registered.html

Implementation and current status

The project has been completed as planned and described in the Project Design Document (PDD). Though the Nueva Aldea Phase 1 project falls under the category of an "early CDM project activity" (started functioning before the CDM registration date), the monitoring plan has been implemented and enforced just as described in the corresponding PDD.

Sustainability, economic and social well-being

The Nueva Aldea Phase 1 Power Plant reduces carbon emissions by replacing fossil fuel-based electricity generation and preventing forestry biomass to be left to decay. The project promotes sustainable development by:

- Fostering the diversification of electricity generation towards renewable energy sources in the country.

- Using clean, efficient and top of the line technology to generate power, thus, conserving natural resources and the environment.

- Becoming a benchmark of an efficient and renewable energy generation project in the country. This encourages the development of modern and more efficient generation of electricity and thermal energy throughout the country using renewable biomass sources.

- Optimizing the use of natural resources, avoiding new uncontrolled waste disposal places in the surrounding area of the Power Plant.

2. Monitored parameters

All parameters needed to make the emission reduction calculations according to the monitoring plan are described in the PDD, section D.2. This section provides additional explanatory information to the monitored data.

The following table provides information about the monitored data for the baseline and project emission data variables:

Project activity monitored data

ID number.	Data variable.	Additional comments
1. $BF_{i,y}$	Quantity of biomass of type i combusted in the project plant.	The biomass from forest operations was constantly monitored during the verification period. The volume of the biomass was constantly measured and recorded each time at the entrance of the plant. The apparent density of the biomass was also measured (electronic weighing bridges) and used to determine the dry amount of biomass combusted in the power boiler. The biomass consumption at the Power Plant was determined by considering the biomass purchases (measured) and stock variations (measured) during each month.
2. NCVi	Net calorific value of biomass fuel type i.	The net calorific values of the biomass types entering to the power boiler were measured (local lab in the area) and recorded each year.
3. EF_{CH4}	Methane emission factor for combustion of biomass in the project plant.	The same methane emission factor and conservativeness factor for biomass controlled burning used in the PDD was used to calculate the methane emission from controlled burning in the power boiler. (IPCC default factor for controlled biomass burning of biomass, adjusted by a validated conservativeness factor.).
4. AVD_y	Average return trip distance between biomass fuel supply sites and the project site.	Distances from biomass providers to the plant were constantly monitored and recorded. This variable was calculated and reported on a monthly basis for the calculation of the project activity emission reductions each month.
5. TL_y	Average truckload of the trucks used for transportation of biomass.	Idem as above.
6. $EF_{km,CO2}$	Average CO_2 emission factor for transportation of biomass with trucks.	The same IPCC default factor used in the PDD was used in this case.
7. $COEF_{CO2,i}$	Emission factors.	This factor was calculated using IPCC default values (Carbon content and fraction of carbon oxidized) and local national data (Net calorific values of the corresponding fossil fuels).
8. OF_y	On-site use of transport fuel.	Fossil fuel for on-site biomass transportation was constantly monitored and monthly recorded.
9. FF_y	Fossil fuel used in Power Boiler.	Fossil fuel used in the power boiler was constantly monitored at the power plant.

Baseline monitored data

ID number.	Data variable.	Additional comments
10. EG_y (EG_h if dispatch data OM is used)	Net quantity of electricity displaced by the project activity from the grid.	The net energy displaced from the grid resulted from subtracting the additional energy consumption of the power plant due to the project activity to the gross energy generation of the power plant (measured). The additional power consumption was determined by subtracting the baseline electricity consumption (established in the PDD) to the total energy consumption of the power plant (measured).
11. EF_y	CO_2 emission factor of the grid.	Calculated as the average (equal weights of 50% for each) between the OM and BM SIC emission factors.
12. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid.	This factor was calculated according to the chosen baseline methodology (which indicates to follow the ACM0002 methodology). For this coefficient and according to the PDD, the Simple Adjusted OM factor was used. For the 2006 coefficient, the information was available only until September 2006.
13. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid.	This factor was calculated according to the chosen baseline methodology (which indicates to follow the ACM0002 methodology). In this case, the BM was calculated for each year (ex-post) and in each case, the weighted average of the emission coefficients of the most recent power plants responsible for 20% of the total power generation each year was used. For the 2006 coefficient, the information was available only until September 2006.
14. $F_{i,y}$	Amount of each fossil fuel consumed by each power source / plant.	This information was directly obtained by the CDEC-SIC dispatch center or directly from the electric power companies themselves.
15. $COEF_i$	CO_2 emission coefficient of each fuel type i consumed by the electric power generators in the relevant grid.	This factor was calculated using IPCC default values (Carbon content and fraction of carbon oxidized) and local national data (Net calorific values of the corresponding fossil fuels).
16. $GEN_{j/k/n,y}$	Electricity generation of each power source / plant j/k or n.	This information was directly obtained by the CDEC-SIC dispatch center. For the 2006 generation, the September 2006 information was used.
17.	Identification of power source / plant for the OM calculation.	This information was directly obtained by the CDEC-SIC dispatch center.
18.	Identification of power source / plant for the BM calculation.	This information was directly obtained by the CDEC-SIC dispatch center.
19. λ_y	Fraction of time during which low-cost / must-run sources are on the margin.	This factor was calculated from information directly obtained from the CDEC-SIC dispatch center. For the 2006 coefficient, the information was available only until September 2006.
20.a $GEN_{j/k/ll,y}$ IMPORTS	Electricity imports to the project electricity system.	This information was directly obtained by the CDEC-SIC dispatch center. There are no imports / exports to the project activity electricity system.
20.b $COEF_{i,jy}$ IMPORTS	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur).	See 20.a above.

As indicated in the PDD, the total amounts of biomass and fossil fuels were monitored. The additional amounts (the ones related to the project activity) were calculated following the exact description in Annex 3 of the PDD. This calculation:

- Determines the biomass amount related to the project activity (i.e. used to generate power) using a coefficient defined in page 81 of the PDD: “Electric power generation factor for Nueva Aldea PI”. This factor is fixed for all the crediting periods of the project activity.

- Uses the additional biomass to determine the additional fossil fuel consumption due to the project activity. The calculation assumes direct proportionality between the biomass and fossil fuel consumption at the power plant.

Monitoring of complementary data

To perform the calculation of the net emission reductions of the project activity, some additional data was monitored. The following table provides some information of these variables.

Complementary data

BDt / m^3st	This factor was calculated each month to determine the amount of bone-dry biomass (BDt) from humid volumetric quantities of biomass (cubic meters). To do so, the biomass humidity, the volume and the apparent density of the biomass were used and monitored at the Plant.
Biomass humidity	This variable was constantly measured and monthly reported for the calculation of the net emission reductions of the project activity.
CH_4 emission factor for uncontrolled burning of biomass	According to the baseline methodology ACM0006, version 01, page 33, project participant may undertake measurements or use referenced default values to calculate the CH_4 baseline emissions from uncontrolled burning of biomass of the project activity. Given that by the time the PDD was written there were no local measured factors available, the validator indicated the use of the suggested IPCC default factor corrected by the lowest (most conservative) adjustment factor. This lead to extremely conservative CH_4 baseline emissions from the project activity, since in reality a significant portion of the biomass is left to natural decay in the open air, releasing a much higher amount of CH_4 than if it were burned in an uncontrolled way. As a result, the Project Participant explicitly mentioned in the PDD (page 66) and in the validation report (page A36) that a local CH_4 measurement would be attempted in order to have a more accurate and fair estimation of the baseline emissions from this source. Preliminary results of the local measurements conducted nearby the Nueva Aldea Power Plant, indicate a CH_4 emission factor for uncontrolled biomass burning of the same biomass type used in the Nueva Aldea Power Plant of 600 Kg of CH_4 / TJ. The associated standard deviation of the measurement falls within the 30% range; therefore the associated conservativeness factor that is used in the corresponding baseline emission calculations is 0.94. The project proponent will provide full access to the measurement report once it is available. The report is expected during the first two weeks of November 2006.

Summary of the main monitored data

According to the monitoring plan outlined above, the following table shows a summary of the main monitored data of the project activity during the monitored period.

Summary of main monitored data per year

		2005	2006
Operating Margin	(tCO_2/GWh)	657.3	691.3
Build Margin	(tCO_2/GWh)	232.8	220.4
Combined Margin	(tCO_2/GWh)	445.1	455.8
Net energy displaced from the grid	(GWh/yr)	133.1	138.1
Additional biomass due to project activity	(BDT/yr)	68,559	70,145
Net calorific value of the biomass	(TJ / 000 ton)	17.97	17.85
Avg distance between sawmills and P.Plant	(Km)	89.9	132.3
Avg load for 1 trip	(Ton/truck)	30.2	29.8
Additional fossil fuel consumed in P. Boiler			
Diesel	(Lt/yr)	188,832	310,154
Fuel Oil	(ton/yr)	0	0
LPG	(Lt/yr)	0	0
Addit. fossil fuel used for biomass transp. in P.Plant			
Diesel	(Lt/yr)	31,062	23,677

Note: Year 2006 considers only from January to September.

Some differences between the monitored data and the one used to calculate the net emission reductions in the registered PDD are due to the following reasons:

1. The use of some referential data instead of actual monitored data (i.e. conversion factors, humidity factors, etc.).

2. An improvement in the accuracy of some monitored data that was previously used to calculate some emission reduction coefficients in the PDD (i.e. the CDEC-SIC made some ex-post corrections in the power plant generation data for the past years).

Leakage

As explained in the PDD, there are two sources of biomass from which the Nueva Aldea Phase 1 Power Plant can source its biomass needs:

1. Biomass from industrial operations, consisting basically in biomass generated by local sawmills.
2. Biomass from harvesting, pruning and thinning operations from managed forestlands.

Though there were no official studies in the country about the supply / demand situation of forest biomass in the relevant area, Arauco performed a annual studies for 2005 and 2006 using official bulletins from INFOR[3] as well as other (whenever available) official sources to calculate the biomass supply and demand in the Nueva Aldea Phase 1 influence area. This study was part of the monitoring plan of the Nueva Aldea Phase 1 project activity and was carried out according approach L2 of the baseline methodology. A detailed and confidential excel spreadsheet with the monitored data and the calculation of the forest biomass supply / demand situation each year is provided to the DOE to establish the quality and validity of the data sources and the accuracy of the calculated numbers. The following table provides the final results of such study:

NUEVA ALDEA PHASE 1 INFLUENCE AREA SUPPLY / DEMAND SITUATION

Biomass supply		**2005**	**2006**
Biomass from industrial operations	(m^3st/yr)	3,003,016	3,322,324
Biomass from forest operations	(m^3st/yr)	1,537,889	1,521,594
Total supply	**(m^3st/yr)**	**4,540,905**	**4,843,918**
Biomass demand			
Total demand	**(m^3st/yr)**	**1,665,180**	**2,296,359**
Biomass from industrial operations / Total biomass demand	(number)	1.8034	1.4468
Biomass from forest operations / Total biomass demand	(number)	0.9236	0.6626
Total supply / total demand	**(number)**	**2.7270**	**2.1094**

According to the table above, it is clear that quantity of available biomass in the influence area of the project activity is greater than the 25% threshold established in option L2 of the consolidated baseline methodology. Arauco could also establish this situation for the entire VIII region (a much larger area than the influence area of the Nueva Aldea Phase 1 project activity) and considering only the biomass from industrial operations:

VIII REGION SUPPLY / DEMAND SITUATION

		2005	**2006**
Biomass from industrial operations	(m^3st/yr)	15,488,641	16,747,223
Total biomass demand	(m^3st/yr)	10,010,727	11,281,694
Biomass from industrial operation / total demand	**(number)**	**1.5472**	**1.4845**

[3] INFOR stands for "Instituto Nacional Forestal" or "National Forestry Institute" in English.

These results are consistent with the fact that in the last years the existing biomass power plants in the area / region continue to function without restriction and that new biomass based projects are being considered[4] and built in the VIII region.

From the above analysis, it is possible to conclude that the Nueva Aldea Phase 1 biomass Power Plant has not caused a biomass supply shortage in its influence area, and therefore has not caused other biomass consumers to switch from biomass fuels to fossil fuel sources. For these reasons, the associated leakage to the Nueva Aldea Phase 1 project activity is zero.

$$L_y = 0$$

Biomass sources

Though the monitoring plan of this project activity does not demand Arauco to monitor this variable, as is the case in other similar CDM project activities by Arauco, this variable has also been incorporated to the monitoring plan of the Nueva Aldea Phase 1 project activity.

Each time a biomass supplier delivers biomass fuels to the Nueva Aldea Power Plant, the supplier must sign a reception bill in which the supplier declares to know and comply with the outstanding Chilean forest law. This law mandates that all harvested forest plantations must be replanted; therefore it guarantees the sustainable source of the biomass fuels (as well as the source of any other products from the forest industry). The law also establishes that the purchase of products that come from illegally managed forestlands is also considered illegal in Chile.

Since the Chilean forest law is very stringent, failing to comply with it may imply hefty penalties for the transgressors in some cases. For these reasons all Arauco plants tend to be very selective in choosing their suppliers and have tight quality controls in the reception of raw-material.

[4] Including some new biomass cogeneration projects by Arauco itself.

Quality assurance

Quality control and quality assurance mechanisms for the monitored data were implemented as mentioned in the registered PDD. The following table provides additional information in the same format as the one used in the PDD.

Data	Uncertainty level	QA/QC procedures implemented during the monitored period.
1	Low	Biomass fuels, as well as any other raw material that enters the Nueva Aldea Phase 1 Complex is weighed at the entrance of the complex (incoming and exiting trucks). In addition, the cargo volume of each truck carrying biomass fuels is also registered. Biomass inventory is monthly measured and therefore biomass consumption at the Nueva Aldea Phase 1 Power Boiler is duly calculated each month. Since the Nueva Aldea Power Phase 1 complex (as well as most of Arauco subsidiaries) uses the SAP systems, there are periodic and continuous consistency checks between the information that is loaded in SAP and the receipts from all suppliers including biomass. This is necessary not only to ensure the accuracy of the information used to calculate the Nueva Aldea Phase 1 net emission reductions, but also to ensure the good quality of the information used for accounting and tax-reporting purposes. This further ensures the good quality of the information used to calculate the emission reductions of the Nueva Aldea Phase 1 project.
2	Low	During the monitored period the NCV of the biomass per type combusted in the Power Boiler was measured each year, presenting minimum differences from one year to another. Comparisons with corresponding IPCC default values also validated and confirmed the measured values.
3, 6, 7, 15, 21.b	Low (CO_2) / Medium (CH_4)	Local values were used whenever possible. In cases in which they were not available, IPCC factors were used instead.
4	Low	Since the location of each biomass supplier is known (i.e. 99% of the biomass comes from permanent type sawmills in the nearby area), distances were obtained for each biomass supplier point from a regional road map.
5	Low	Trucks that transport the biomass are all of standard sizes. This variable was calculated from measured data (weight and volume of the cargo). Electronic weigh-bridges in which the measurements were performed receive periodic calibration and maintenance.
8, 9	Low	Fuel meters received periodic maintenance and calibration and the consistency of metered fuel consumption was checked with purchase dispatch bills.
10	Low	Electricity meters received periodic maintenance and calibration as per instructed by the equipment manufacturer. In addition, the Nueva Aldea administration performed periodic (monthly) consistency checks in the corresponding electric bus where the Nueva Aldea Phase 1 Power Plant connects to the SIC grid. Finally, the plant manager also performed consistency checks between the total energy generated by the plant and the total biomass fired at the power boiler (efficiency checks).
11, 12, 13, 14, 15, 16, 17, 18, 19, 20a, 20b	Low	As mentioned in the PDD, the quality control of this data is beyond the control of the project operator. However, the project proponent obtained similar results comparing its own calculations with the ones performed by others independent and external parties (i.e. OECD studies). The results were also consistent with IPCC data.

21, 22	Medium	The biomass surplus index was calculated using as much official information as possible. Practical consistency checks were performed whenever it was feasible (i.e. low cost biomass power plants in the influence area continue being low cost-must run power units after the Nueva Aldea Phase 1 Power Plant started operating).
Biomass origin[5]	Low	In most cases, the Nueva Aldea biomass suppliers have some kind of sustainability certification (i.e. Certfor) or have signed supply contracts explicitly declaring to comply with the outstanding forest Chilean law that guarantees a sustainable origin of the biomass sold to the Nueva Aldea Phase 1 Power Plant.

In addition to the above, the project proponent implemented a dedicated information system designed exclusively to guarantee the quality of the information related to the Nueva Aldea Phase 1 CDM project activity. The system uses the same principles of the ISO 9001 version 2000 norm and will be soon incorporated to the Nueva Aldea's ISO-14,001 / OHSAS 18,001 systems.

[5] This variable has been added to the Nueva Aldea Phase 1 monitoring plan, however is not part of the monitoring plan of the corresponding registered PDD.

3. Emission reductions

Calculation formulas

As presented in the PDD and according to the baseline methodology, the net emission reduction calculation formula for the Nueva Aldea Phase 1 project is:

Project Activity Net Emission savings = Baseline Emissions – Project Activity Emissions – Leakage

or

$$PNE_y = BL_{E,y} - EM_{P,y} - L_y$$

or

$$PNE_y = (BL_{E1,y} + BL_{E2,y}) - (P_{E1,y} + P_{E2,y} + P_{E3,y} + P_{E4,y}) - L_y$$

Where:

$BL_{E1,y}$: Baseline emissions from avoided biomass disposal (tCO_2eq/yr).
$BL_{E2,y}$: Baseline emissions from grid electricity displacement (tCO_2/yr).

$P_{E1,y}$: Project emissions from biomass controlled burning in the Power Plant (tCO_2eq/yr).
$P_{E2,y}$: Project emissions from biomass transportation to the biomass Power Plant (tCO_2/yr).
$P_{E3,y}$: Project emissions from biomass transportation within the Power Plant site (tCO_2/yr).
$P_{E4,y}$: Project emissions from fossil fuel consumption in the Power Plant (tCO_2/yr).

L_y : Are the leakage emissions (tCO_2/yr).

The following section of the monitoring report evaluates each part of this equation and calculates the net emission reductions of the Nueva Aldea Phase 1 project activity on a monthly basis.

Emission reductions for the monitored period

For the calculation of the net emission reductions of the Nueva Aldea Phase 1 project activity, a confidential excel spreadsheet with the monitored data and the monthly / yearly calculation of the net emission reductions is provided to the DOE for the verification of the calculated numbers. For informative purposes, this monitoring report provides a table that shows the monthly net emission reduction of the Nueva Aldea Phase 1 project activity:

Net emission savings per month

		Baseline emissions		Project activity emissions				
Year 2003	**Net emission savings**	Grid emissions	Methane emissions	Methane in P.B.	Fossil fuel in P.B.	Transport onsite	Transport to P. Plant	Leakage
(Months)	**(tCO_2eq/yr)**	(tCO_2/yr)	(tCO_2eq/yr)	(tCO_2eq/yr)	(tCO_2/yr)	(tCO_2/yr)	(tCO_2/yr)	(tCO_2/yr)
Year 2005								
January	**4,155**	3,592	755	20	112	8	51	0
February	**2,968**	2,512	515	14	12	5	30	0
March	**5,162**	4,409	907	25	85	11	36	0
April	**7,060**	5,933	1,362	37	113	11	74	0
May	**8,132**	6,624	1,731	47	75	7	93	0
June	**8,295**	6,640	1,887	51	26	7	148	0
July	**7,753**	6,132	1,764	48	13	6	76	0
August	**5,787**	4,659	1,274	35	12	6	93	0
September	**6,594**	5,368	1,369	37	0	6	100	0
October	**6,496**	5,318	1,260	34	4	7	36	0
November	**2,552**	2,173	442	12	43	3	6	0
December	**7,142**	5,903	1,328	36	4	5	44	0
Total year 2005	**72,095**	**59,262**	**14,595**	**396**	**498**	**82**	**787**	**0**
Year 2006								
January	**8,741**	7,362	1,579	43	37	8	112	0
February	**7,704**	6,598	1,283	35	47	7	88	0
March	**9,321**	7,875	1,608	44	2	7	109	0
April	**9,346**	7,799	1,717	47	1	8	115	0
May	**9,596**	7,915	1,892	51	7	9	144	0
June	**7,879**	6,363	1,731	47	2	8	159	0
July	**6,626**	5,388	1,445	39	31	6	132	0
August	**8,676**	7,008	1,887	51	1	7	161	0
September	**7,390**	6,642	1,684	46	696	3	192	0
October								
November								
December								
Total year 2006	**75,279**	**62,952**	**14,827**	**402**	**824**	**63**	**1,211**	**0**
Total emissions claimed	**147,374**	**122,215**	**29,423**	**798**	**1,322**	**145**	**1,998**	**0**

Note: Net emission savings = Baseline emissions - Project activity emissions - Leakage.

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