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***LES RESSOURCES D'ARIANNE INC.***

***GREENHOUSE GAS ACCOUNTING REPORT  
1999-2010***

**Accounting completed on January 20<sup>th</sup>, 2012**

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## **SUSTAINABLE DEVELOPMENT POLICY AND GREENHOUSE GAS ACCOUNTING PROGRAM**

September 20<sup>th</sup>, 2010, the management of Arianne Resources Inc. announced the creation of a greenhouse gas (GHG) accounting program. In May 2009, Arianne met with the UQAC Chair on Eco-advising in order to get advice about sustainable development in mineral exploration. The intent of these meetings was to find ways to make the Company's projects more environmentally, socially and ethically responsible. In September 2010, the Company thus established its position regarding this accounting process. The paragraphs below are taken from that press release:

*"1- Since this summer, Arianne Resources has been adhering to a GHG accounting program. This accounting is part of the management's intent to reduce the Company's environmental footprint. By measuring the GHG produced by each of the Company's exploration projects, we will improve our sustainable development and environmental responsibility initiatives. **The GHG inventory will allow Arianne Resources to identify projects that are problematic in terms of GHG emissions, and implement appropriate reduction and compensation measures.***

*2- The mandate given to the Chair on Eco-advising aimed to produce an estimate of greenhouse gas emissions over the life cycle of a mine. This document, which is available on our Website, is an estimate of GHG emissions that will be produced by operations at the future Lac à Paul open-pit mine. The document describes, among other things, the emissions produced by the transport of the apatite concentrate by truck or pipeline. It is an additional tool to assess the environmental impact of this mine. Mining operations would likely generate from 478,870 to 572,038 tonnes of CO<sub>2</sub> eq., depending on the transportation method (pipeline vs. truck).*

*3- Arianne Resources is currently finalizing the Company's sustainable development policy, which will be included in our next Annual Report, to be released in 2011. The accounting of GHG emissions produced by mineral exploration activities is an innovation. The majority of life cycle analyses start with extraction and omit the exploration phase, which is not without consequences and is part of the product life cycle. For example, to date the overall exploration activities for the Lac à Paul deposits have generated 181 tonnes of CO<sub>2</sub> equivalent. **The Company is studying a number of scenarios by which it can offset its GHG emissions and become carbon neutral.***

The Arianne Resources sustainable development policy was accepted by the Board in April 2011, the text of which includes a declaration and objectives.

### **- Declaration**

*"The Company is fully aware of the non-renewable character of mineral resources, the irreversible consequences of harvesting, and the range of human needs their various uses can fulfil, today and tomorrow. In that context, the Company believes in mineral exploration that includes sustainable development throughout its social and economic spinoffs, and through enhanced environmental accountability and ethics. **As such, the policy confirms and strengthens the sustainable development commitment made by Les Ressources d'Arianne Inc.**"*

### **- Objectives**

*"Les Ressources d'Arianne Inc. wants to engage in a sustainable development approach and is motivated to become a leader in responsible mineral exploration, notably:*

- *Through responsible use of the land.*
- *Through respect and understanding of the stakeholders of that land.*
- ***Through application of the “life cycle” approach.***
- *Through contribution to sustainable development in Quebec society.*

The two documents thoroughly describe the importance Arianne Resources attaches to GHG accounting, and the implementation of reduction and/or offset measures. The next step of the accounting process (now in place for a year) involves measuring our GHG emissions in an effort to reduce and/or offset our footprint and become carbon neutral.

Arianne Resources is aware of the positive spinoffs (investment, social acceptance, polished company image...) tied to the adoption and application of a company sustainable development policy. In addition, application of reduction and/or offset measures should also generate further beneficial results.

This report is a summary of the greenhouse gas emission accounting efforts covering the company’s exploration work, and proposes a number of potential measures to Board members.

## **GHG EMISSIONS FROM RESSOURCES D’ARIANNE EXPLORATION**

### **○ Accounting**

The Company owns numerous projects in Quebec and Mexico, involving both precious metals and industrial minerals. The primary industrial minerals project is the Lac à Paul phosphorous-titanium deposit, located north of the Saguenay–Lac-Saint-Jean region, in the province of Quebec, Canada. The major precious metals projects are, for their part, the El Rey gold and silver project in Mexico’s Sinaloa State, and the James Bay gold and/or base metals projects, with properties (Opinaca and Black Dog) located south of the Opinaca reservoir in Quebec, Canada. Recently, the Company acquired new claims with geological interest for phosphorous and titanium, along with elements from the rare earths group (these recent claims await authorization). The properties owned by Arianne Resources are listed in **Table 1**.

GHG emissions were accounted by team members (Patricia Néron until January 2011, followed by Josée-Anne Pomerleau until August 2011 and by Guylaine Blackburn until now, with the cooperation of Daniel Boulianne), and not by a third party. At this stage, it should be noted that accounting was limited to the available bills and information that could be confirmed (estimated consumption of certain vehicles, for example). Some of the properties whose GHG emissions were accounted are no longer in the Arianne Resources portfolio, since the accounting effort reaches back to 1999. The results of the accounting process are summarized in **Table 2**.

**Table 1: List of Ariane Resources properties - December 31<sup>th</sup>, 2011**

| Canada                            | Secteur/Area                          | Province      | Substance/<br>commodity | Nb de<br>claims | Intérêt/<br>Interest                  |
|-----------------------------------|---------------------------------------|---------------|-------------------------|-----------------|---------------------------------------|
| <b>PROPRIÉTÉS/<br/>PROPERTIES</b> |                                       |               |                         |                 |                                       |
| Opinaca                           | Baie James<br>James Bay               | Québec        | Au                      | 165             | Mis sous option par Mine<br>Virginia  |
| Black Dog                         | Baie James<br>James bay               | Québec        | Au                      | 23              | 100% Ressources d'Ariane              |
| Penaroya                          | Nord de l'Abitibi<br>North of Abitibi | Québec        | Au-Cu-Zn-<br>Ni         | 6               | 100% Ressources d'Ariane              |
| Brouillan-Ouest                   | Nord de l'Abitibi<br>North of Abitibi | Québec        | Au-Cu-Zn-<br>Ni         | 15              | Mis sous option par NQ<br>Exploration |
| R-14                              | Chibougamau                           | Québec        | Au                      | 78              | 100% Ressources d'Ariane              |
| Chico                             | Chibougamau                           | Québec        | Au                      | 6               | 100% Ressources d'Ariane              |
| Héva Ouest                        | Abitibi                               | Québec        | Au                      | 4               | 100% Ressources d'Ariane              |
| Héva Est                          | Abitibi                               | Québec        | Au                      | 25              | 100% Ressources d'Ariane              |
| Mirepoix                          | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 30              | 100% Ressources d'Ariane              |
| Lac de la Roche                   | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 95              | 100% Ressources d'Ariane              |
| Zone 4                            | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 3               | 100% Ressources d'Ariane              |
| Duhamel                           | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 95              | 100% Ressources d'Ariane              |
| Lac aux Canots                    | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 27              | 100% Ressources d'Ariane              |
| Laliberté                         | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 68              | 100% Ressources d'Ariane              |
| Perceneige                        | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 44              | 100% Ressources d'Ariane              |
| Étienniche                        | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 67              | 100% Ressources d'Ariane              |
| Taillon                           | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 10              | 100% Ressources d'Ariane              |
| Île Blanche                       | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 288             | 100% Ressources d'Ariane              |
| Pipmuacan                         | Saguenay-lac-St-Jean                  | Québec        | Phos.-Tit.              | 40              | 100% Ressources d'Ariane              |
| Lac des Joncs                     | Saguenay-lac-St-Jean                  | Québec        | ETR/REE                 | 23              | 100% Ressources d'Ariane              |
| Lac Tremblant                     | Saguenay-lac-St-Jean                  | Québec        | ETR/REE                 | 12              | 100% Ressources d'Ariane              |
| Catherine                         | Saguenay-lac-St-Jean                  | Québec        | ETR/REE                 | 9               | 100% Ressources d'Ariane              |
| Lac de la Cache                   | Saguenay-lac-St-Jean                  | Québec        | ETR/REE                 | 12              | 100% Ressources d'Ariane              |
| Lac Gracien                       | Saguenay-lac-St-Jean                  | Québec        | ETR/REE                 | 14              | 100% Ressources d'Ariane              |
| <b>DÉPÔTS/<br/>DEPOSITS</b>       |                                       |               |                         |                 |                                       |
| <b>Lac à Paul</b>                 | <b>Saguenay-lac-St-Jean</b>           | <b>Québec</b> | <b>Phos.-Tit.</b>       | <b>471</b>      | <b>100 % Ressources d'Ariane</b>      |
| Capellière/Dulain                 | Saguenay-lac-St-Jean                  | Québec        | Marbre blanc            | 31              | 100 % Ressources d'Ariane             |
| Boileau                           | Saguenay-lac-St-Jean                  | Québec        | Quartzite               | 4               | 100 % Ressources d'Ariane             |
| Moly Hill                         | Abitibi                               | Québec        | Molybdène               | 2               | 100 % Ressources d'Ariane             |

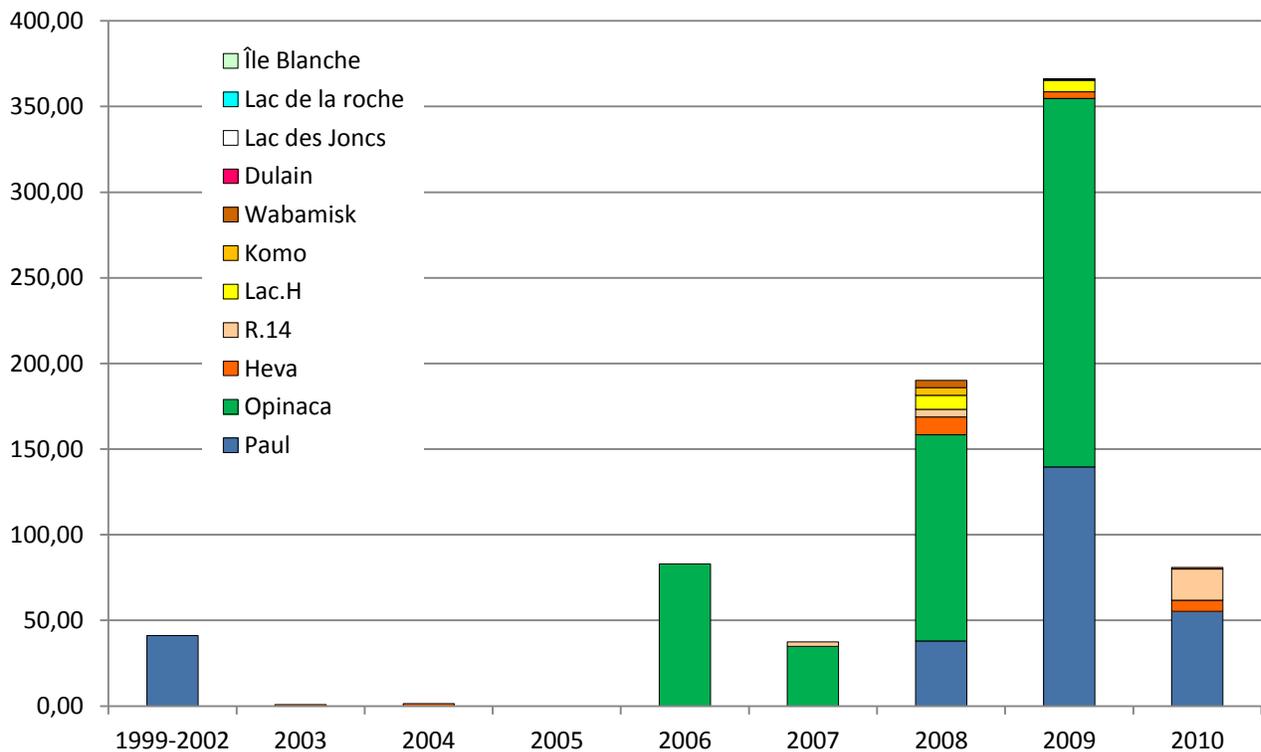
| Mexique/Mexico | État/State     | Substance/<br>Commodity | Intérêt/Interest  |
|----------------|----------------|-------------------------|---|
| <b>El Rey</b>  | <b>Sinaloa</b> | <b>Au, Ag</b>           | <b>Option pour acquérir 100%<br/>Option to acquire 100%</b> |

**Table 2: Metric tonnes of CO<sub>2</sub> equivalent emitted by properties from 1999 to 2010**

|                         | <b>total</b>  | <b>Arianne</b> | <b>Tree cutting</b> | <b>Drilling</b> | <b>Excavation</b> | <b>Other</b> |
|-------------------------|---------------|----------------|---------------------|-----------------|-------------------|--------------|
| <i>Lac à Paul</i>       |               |                |                     |                 |                   |              |
| 1999-2002               | 41.24         | 5.71           |                     | 33.61           | 1.92              |              |
| 2008                    | 37.92         | 13.76          |                     | 14.55           | 5.34              | 4.27         |
| 2009                    | 139.70        | 13.28          | 49.00               | 73.90           | 2.77              | 0.75         |
| 2010                    | 55.25         | 1.57           | 4.20                | 38.92           | 10.56             |              |
| <i>Opinaca</i>          |               |                |                     |                 |                   |              |
| 2006                    | 82.94         |                |                     | 82.94           |                   |              |
| 2007                    | 34.84         | 3.67           |                     | 29.62           |                   | 1.55         |
| 2008                    | 120.37        |                | 96.00               | 19.86           | 3.61              | 0.90         |
| 2009                    | 214.98        | 0.28           | 214.70              |                 |                   |              |
| <i>Heva</i>             |               |                |                     |                 |                   |              |
| 2003                    | 0.95          | 0.95           |                     |                 |                   |              |
| 2004                    | 1.40          | 1.40           |                     |                 |                   |              |
| 2008                    | 10.42         |                | 9.00                | 1.42            |                   |              |
| 2009                    | 4.00          |                | 4.00                |                 |                   |              |
| 2010                    | 6.60          | 2.06           |                     |                 | 4.54              |              |
| <i>R.14</i>             |               |                |                     |                 |                   |              |
| 2007                    | 2.55          | 2.55           |                     |                 |                   |              |
| 2008                    | 4.56          |                |                     | 3.49            |                   | 1.07         |
| 2010                    | 18.16         |                | 11.80               |                 | 5.99              | 0.37         |
| <i>Lac.H</i>            |               |                |                     |                 |                   |              |
| 2008                    | 8.05          | 3.13           |                     |                 | 4.92              |              |
| 2009                    | 6.67          | 1.73           |                     |                 | 4.94              |              |
| <i>Komo</i>             |               |                |                     |                 |                   |              |
| 2008                    | 4.48          | 0.59           |                     |                 |                   | 3.89         |
| 2009                    | 0.44          | 0.44           |                     |                 |                   |              |
| <i>Wabamisk</i>         |               |                |                     |                 |                   |              |
| 2008                    | 4.27          |                |                     |                 |                   | 4.27         |
| 2009                    | 0.51          | 0.51           |                     |                 |                   |              |
| 2010                    | 0.83          | 0.83           |                     |                 |                   |              |
| <i>Mexique - El Rey</i> |               |                |                     |                 |                   |              |
| 2008-2010               | 26.08         | 0.40           |                     | 10.38           |                   | 15.30        |
| <i>représentation</i>   |               |                |                     |                 |                   |              |
| 2008-2010               | 40.00         |                |                     |                 |                   | 40.00        |
| <b>total</b>            | <b>867.21</b> | <b>52.86</b>   | <b>388.70</b>       | <b>308.69</b>   | <b>44.59</b>      | <b>72.37</b> |
| <b>pourcentage (%)</b>  | <b>100%</b>   | <b>6.10%</b>   | <b>44.82%</b>       | <b>35.60%</b>   | <b>5.14%</b>      | <b>8.35%</b> |

Note: The Lac H, Komo and Wabamisk projects are no longer in the Ressources d'Arianne portfolio. Indeed, the projects were transferred to Mine Virginia in the spring of 2011.

**Figure 1: Yearly GHG emissions in CO<sub>2</sub> equivalent for all company projects located in Quebec**



Ressources d’Arianne activities are therefore responsible for the emission of **867.21 tonnes of CO<sub>2</sub> equivalent** for the 1999-2010 period. The highest emissions come from the Lac à Paul and Opinaca projects, as they underwent intensive drilling and stripping work in recent years, which produce high amounts of emissions. Moreover, due to its location, the Opinaca project (as do the other projects in the James Bay area) requires a great deal of transportation which, again, generates high amounts of GHG emissions.

Company activity levels were very high in 2008 and 2009 due to the exploration of a large number of projects.

## DISCUSSION AND PROPOSED OFFSET MEASURES

### - *Emissions reduction*

Accounting the GHG emissions resulting from our exploration work yields information on a number of items:

- The activities with the highest emissions are drilling, tree cutting and equipment and material transportation to and from sites.
- The years when Company activity was distributed among several projects at various locations throughout Quebec are the years with the highest emission levels (2008 and 2009).

One of Arianne Resources’ objectives, within the framework of its sustainable development policy, is to reduce the impact of its activities on the environment and local communities. As concerns decreasing

the environmental impact, the easiest means is to reduce our GHG emissions. In the light of the accounting results, the solution would involve **reduce transportation on all our projects, because it seems to be difficult to reduce emissions due to drilling and tree cutting.**

- *Offset measures*

- *Amounts to be offset*

Because Arianne Resources has been collaborating with the UQAC Chair on Eco-advising for many years, here the offset possibilities offered by the Chair and/or its cooperating organizations.

For the demonstration that follows, the rates used are found on the Carbone boreal website at <http://carboneboreal.uqac.ca/> and proposed by Pierre-Luc Dessureault. Carbone boreal offers rates in the mid-range (\$28/tonne for offsets and \$56/tonne for the climate positive option).

Ressources d'Arianne's activities have been responsible for generating **867.21 tonnes of CO<sub>2</sub> equivalent** since 1999. This means that offsetting our total CO<sub>2</sub> emissions would require planting **6 194 trees, or \$24,281.88 of carbon credits**. Furthermore, offsetting through the **climate positive program** would cost **\$48,563.76**. This solution is the simplest and most commonly used to offset GHG emissions and become carbon neutral.

### *Climate positive*

*The Climate Positive<sup>TM</sup> concept, developed by the UQAC Chair on Eco-advising, deals with one of the great fundamental principles of sustainable development: intra- and inter-generational equity. The Carbone boreal offset program invites each and every contributor to be Climate Positive<sup>TM</sup> by offsetting twice the emissions generated by the activity they wish to offset.*

*Indeed, the latest IPCC reports shows that even if significant headway is made in terms of limiting GHG emissions on a global scale, non-offset emissions could double pre-industrial concentrations by mid-century. By offsetting twice the measured GHG emissions, this state of affairs can be delayed, giving today's needy and future generations room to manoeuvre as they try to adapt to climate change in terms of knowledge, infrastructures, and technologies. The idea is to unite the principle of accountability with that of precautionary measures.*

*Contributors who undertake the Climate Positive<sup>TM</sup> option will receive special mention in the Carbone boreal registry and the mention will appear on the offset certificates.*

- *Proposed offset measures*

GHG emission offset measures greatly vary: planting trees, buying carbon credits, funding research projects related to emission reductions or offsets..., numerous organizations today offer offset solutions. The reliability of the former and the true impacts of their proposed measures are however difficult to assess; the number of fraudulent transactions is on the rise. This report proposes three possibilities for carbon offset. The three solutions are not restrictive, nor are they separate. Other solutions can be applied in combination with the following two suggestions.

- *Buying carbon credits and tree planting*

To offset carbon emissions, purchase of carbon credits from specialized organizations and tree planting are the most common methods. With this offset methods, the choice of the organization or the location of the plantation is crucial. Indeed, it is more appropriate to offset the impact of the company's activities in the area directly affected by these activities.

- *Investment in a research project aiming to limit the environmental impact of our product (phosphorous concentrate) during its life cycle*

Arianne Resources is collaborating in a mycorhyza development project with a Quebec-based research team (Laval University in Quebec City and the Montreal Biodome). Here is a summary of their research : All the cereals in human consumption only develop properly when a mushroom replaces their root systems. Indeed, over the evolution of species, the roots of certain plants became atrophied and can only survive in symbiosis with mushrooms, which assimilate the nutrients (N, P, K, Ca...) and transmit them to the plants for transformation. In return, the plants supply the mushrooms with the amino acids they are unable to produce. Further information is available through the following link: <http://fr.wikipedia.org/wiki/Mycorhize>

The team led by Dr. André Fortin (<http://www.vrr.ulaval.ca/bd/chercheur/fiche/9177.html>) and Dr. Hani Antoun (<http://www.vrr.ulaval.ca/bd/chercheur/fiche/4538.html>) are working on this question. In recent years, they have determined the existence of a large number of mycorhyza on Earth, and that each has a specific genetic profile. They have also discovered that cereals are not the only plants that live in symbiosis with mushrooms. First, they had to determine what types of mushrooms “get along” with what types of plants, and then they looked for practical applications for their work. Through their laboratory experiments, they noted that the mushrooms secreted acids allowing them to dissolve certain minerals and extract the elements needed for the life and growth of the plants they are associated with (e.g. feldspars used in their experiments to obtain Na, Ca and K).

Today, the project includes three research areas:

- **Forest development** – The team is working at implementing mycorhyza, selected during tree planting, and to spread mineral powders that can be used as fertilizers (feldspar, apatite, or mica powders). The goal is to speed up the growth of young trees. Field testing has already been conducted on a Hydro-Quebec dam and the results are promising.
- **Restoration of mining sites** – The team has recently been given a contract for the restoration of a Century Mining site in Val-d’Or. They are looking to use a concentrate like ours (or ours if possible) to enrich their future plantations. They are looking to use the same protocol as used for tree planting in forests.
- **Agriculture** – In recent years they have worked on developing a method for spreading powdered minerals in fields instead of using chemical fertilizers, which tend to quickly disperse when not absorbed by the plants, and end up in rivers and lakes. The initial laboratory results using Moroccan phosphorous concentrate show that the mushrooms dissolve this type of rock very well and that the process is responds to plant needs. They are expecting a sample of our concentrate and will be testing it in the same conditions. For your information, previous studies indicate that the presence of such mushrooms in symbiosis with cereals increase productivity by 15-30 %.

Arianne Resources is already taking part in this project to a lesser extent, as the company has supplied rock samples, and expect to supply 15 kilograms of concentrate for the laboratory experiments. If the tests yield positive results, the research team will be looking for a greater amount of concentrate to

continue their work in greenhouses. Greater participation in the project (financial, material, and time) could yield highly positive spinoffs for our project. Moreover, this investment involves the “life cycle” idea of phosphate concentrate that will be produced in the operation of the future mine.

- *Global TraPs project*

Global Traps is to engage key stakeholders through transdisciplinary mutual learning in building a human-environment system- based understanding of the complete phosphorus supply and demand chain, identifying pools, sinks, and the underlying dynamics of flows so as to jointly identify with strategic stakeholders through case study research, alternatives in use, reuse and recycling.

For more information, please consult the following website: <http://www.uns.ethz.ch/gt/index>

**Bibliography:**

<http://carboneboreal.uqac.ca/>

<http://www.arianne-inc.com/>

<http://www.carbonpositive.net/>