

FACT SHEET No. 48

Alcan Smelters and Chemicals Ltd., Jonquière Works

1955 Mellon Boulevard

Jonquière, Quebec

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A list of 106 industrial plants has been established under St. Lawrence Vision 2000 (SLV 2000), the second phase of the St. Lawrence Action Plan, launched in 1988. The overall objective is to reduce liquid toxic waste and virtually eliminate discharges of persistent toxic substances.

The 106 industrial plants designated under SLV 2000 are divided into four groups, each of which has been given a specific objective. The ALCAN SMELTERS AND CHEMICALS LTD. complex, located in Jonquière, is part of Group 4, comprising the 50 plants targeted under the St. Lawrence Action Plan.

The objective set for Group 4 is to pursue cleanup efforts and perform environmental monitoring to achieve a 90% reduction in liquid toxic waste. Between 1988 and 1995, the 50 plants reduced their toxic effluent discharges by 96%.



INDUSTRIAL PLANT

Integrated industrial works

The Jonquière works of ALCAN SMELTERS AND CHEMICALS LTD. is an integrated complex comprising two industrial plants, the Arvida and the Vaudreuil plants. The Vaudreuil plant is a large inorganic chemistry facility which fabricates metallurgical and commercial alumina, alumina hydrates (dried and super-white) and aluminum fluorides. In 1995, it had an annual production capacity of 1 400 000 t of metallurgical alumina, 60 000 t of commercial alumina, 100 000 t of dried hydrate, 50 000 t of super-white hydrate and 48 000 t of aluminum fluorides. The plant operated at 76% capacity for metallurgical alumina, 63% for commercial alumina, 56% for dried hydrate, 32% for super-white hydrate and 94% for aluminum fluorides.

The Arvida plant fabricates primary aluminum as well as anodes and cathodes used in aluminum making. In 1995, the plant had an annual production capacity of 235 000 t of aluminum and operated at 80% capacity. The complex employed a work force of 3000.

PRODUCTION

Vaudreuil plant

PRINCIPAL RAW MATERIALS

- Bauxite
- Sulphuric acid
- Sodium hydroxide
- Chlorine
- Fluorspar
- Lime
- Fuel oil and natural gas

FINISHED PRODUCTS

- Metallurgical and commercial alumina
- Hydrates (dried and super-white)
- Aluminum fluorides
- Cryolite

Arvida plant

PRINCIPAL RAW MATERIALS

- Green coke
- Pitch
- Anthracite
- Alumina
- Aluminum fluorides
- Cryolite
- Vegetable oils
- Natural gas

FINISHED PRODUCTS

- Various forms of aluminum
- Anodes and cathodes
- Calcinated coke

TREATMENT MEASURES

INITIAL EFFLUENT VALUES

Aluminum and fluorides

According to 1988 company data for mercury and cyanides, and the 1989 Action Plan characterization results, the complex had an average effluent discharge of 64 308 m³/d, containing:

- 3000 kg/d of suspended solids (ss)
- 2642 kg/d of aluminum
- 334 kg/d of fluorides
- 100 kg/d of oil and grease (o&g)
- 2.2 kg/d of polycyclic aromatic hydrocarbons (PAHS)
- 5.3 kg/d of cyanides
- 1.2 kg/d of arsenic
- 20 to 53 g/d of mercury

At that time, the annual aluminum production capacity was twice its present level. It dropped from 440 000 t in 1987 to 235 000 t in 1992, once a new plant went on stream in Laterrière and 10 of the 14 Söderberg pot rooms were phased out.

RESOURCES AND USES TO PRESERVE

A popular recreation area

The middle Saguenay attracts large numbers of anglers, water sports enthusiasts and vacationers from the large population basin along the riverbanks. The area around the river has many recreational facilities, including parks, footpaths, lookout points, golf courses and cross-country ski trails. In Chicoutimi, water-based activities centre around two marinas. Fishermen flock to the area, drawn mainly by the diversity of fish species (smelt, brook trout, walleye, pike, whitefish, perch, salmon). The Saguenay flats, floodplain and drainage area are key ecological resources acting as natural water filters and providing habitat for an abundance of flora and aquatic fauna (smelt, eel, brook trout) as well as diverse species of waterfowl.

WATER QUALITY BASED OBJECTIVES

Environmental protection

Water quality based objectives are established to preserve local resources and uses. These guidelines, expressed as maximum permissible loads and concentrations for effluent released into the environment, are used in choosing treatment methods which best promote environmental protection. The water quality based objectives for ALCAN SMELTERS AND CHEMICALS LTD. are available on request.

EFFLUENT TREATMENT

Two settling basins and extensive recycling systems

The ALCAN SMELTERS AND CHEMICALS LTD. Jonquière works includes four outfalls emptying into the Saguenay River. Wastewater released through the main industrial outfall is treated in two settling basins equipped with booms to facilitate oil recovery in case of spills. Liquor from the scrubbers (wet method) is treated and recycled. Leachate from the pot lining storage cell is returned to the process stream. Several projects under the wastewater treatment program (PAE) implemented in 1992 have already provided for the elimination, reduction, recycling, treatment at source and pH control of industrial effluent. Treated wastewater is discharged into the Saguenay.

PREVENTION AND CLEANUP SYSTEMS IMPLEMENTED

Improvements estimated at \$25 million

Between 1993 and 1995, many projects were carried out under the ALCAN SMELTERS AND CHEMICALS LTD. Jonquière Works' wastewater treatment program.

The company installed a pumping station for the recovery and recycling of seeping water from the gupsum disposal site and the industrial waste disposal site. The modified treatment has cut down on surface-water contamination. Installation of a supernatant water drainage and treatment system has lessened the risk of overflowing red-mud pond. Introduction of an acid control system addition has helped eliminate acid peaks, while a system for carbon dioxide (CO₂) flooding upstream from settling basins has reduced basic peaks. Introduction of a system for recirculating cooling water to the fluoride plant has reduced water consumption. PAH loads in the effluent have been reduced by a new system for recycling the direct-contact cooling water from the cathode plant and shutdown of the green coke pile in the anode plant area. Total cyanides in the effluent have been reduced in part by the confinement and recovery of water from a former debrasquing section.

About \$25 million has been spent on the projects completed thus far. Some 95% of domestic wastewater is intercepted and directed either into the municipal sewerage system or to treatment in septic tanks with a tile drainage field. The entire PAE program should be completed in 1999.

REGULATORY COMPLIANCE - WATER COMPONENT

Work in progress

Extensive measures were taken from 1993 to 1995 under the wastewater treatment program. Beginning in January 1996, standards will be applied to industrial effluent. Moreover, second-phase standards will be established.

POLLUTION ABATEMENT

CHIMIOTOX INDEX ABATEMENT OF TOXIC POLLUTION

Mostly arsenic and aluminum

The Chimiotox index gauges the load of all toxic substances present in industrial effluent, using the toxicity factor assigned to each one. It is used, among other things, to monitor discharge trends over the years (see Figure 1) and determine the proportion of each pollutant (see Table 1).

Table 1 gives the Action Plan characterization data gathered in 1989, as well as the Chimiotox values estimated from those figures, for an effluent flow of 65 253 m³/d. In testing for more than 120 substances, 28 were found. The figures show a predominance of arsenic in the treated wastewater. Arsenic makes up 64% of the Chimiotox index, followed by aluminum (25%), oil and grease (4%) and indeno(1,2,3-*cd*) pyrene (1.5%).

Figure 1 is plotted from the 1989 Action Plan characterization results. The Chimiotox indices for 1988 to 1995 were estimated from the 1989 characterization data and the monthly company data for aluminum, cyanides, arsenic, polycyclic aromatic hydrocarbons and mercury. As a result of the treatment measures implemented, the Chimiotox index fell by 63% from 1988-1995.

Table 1 *Chimiotox Index (1989) - Alcan Smelters and Chemicals Ltd., Jonquière Works**

| Substance | Load (kg/d) | Toxic Weighting Factor | Chimiotox Units (CU) |
|---------------------------------|-------------|------------------------|----------------------|
| Arsenic | 1.280 | 57 143 | 73 143 |
| Aluminum | 2 617.890 | 11 | 30 091 |
| Mineral Oil and Grease | 45.390 | 100 | 4 539 |
| Mercury | 0.023 | 1 661 667 | 3 833 |
| Indeno(1,2,3- <i>cd</i>)pyrene | 0.053 | 32 154 | 1 704 |
| Vanadium | 16.000 | 71 | 1 143 |
| Benzo(a)anthracene | 0.025 | 32 154 | 804 |
| Total Phosphorus | 11.240 | 50 | 562 |
| Dibenzo(a,h)anthracene | 0.016 | 32 154 | 514 |
| Silver | 0.050 | 10 000 | 500 |
| Benzo(a)pyrene | 0.005 | 100 000 | 500 |
| Benzo(b)fluoranthene | 0.015 | 32 154 | 473 |
| Benzo(k)fluoranthene | 0.014 | 32 154 | 434 |
| Butyl benzylphthalate | 0.084 | 5 000 | 420 |
| Cyanides | 1.470 | 200 | 294 |
| Chloroform | 1.931 | 64 | 123 |
| Chromium | 0.200 | 500 | 100 |
| Ammonia Nitrogen | 102.600 | 0.8 | 82 |
| Copper | 0.080 | 424 | 34 |
| Naphthalene | 0.884 | 34 | 30 |
| Dichloro-2,4 phenol | 0.006 | 5 000 | 30 |
| Selenium | 0.130 | 200 | 26 |
| Di-n-butylphthalate | 0.069 | 250 | 17 |
| Acenaphthene | 0.030 | 333 | 10 |
| Phenol | 0.037 | 200 | 7 |
| Nitro-2 phenol | 0.771 | 7 | 5 |
| Antimony | 0.270 | 2 | <1 |
| Benzene | 0.006 | 25 | <1 |

CHIMIOTOX INDEX

119 420

* For effluent discharge of 65 253 m³/d (28 substances detected in testing for more than 120).

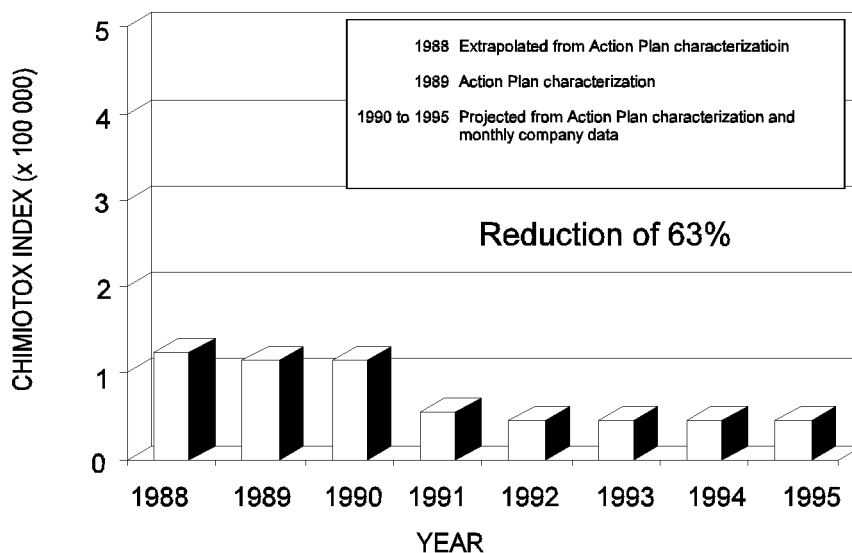


Figure 1 *Changes in toxic effluent discharges, 1988-1995 - Alcan Smelters and Chemicals Ltd., Jonquière Works*

VIRTUAL ELIMINATION OF PERSISTENT TOXIC SUBSTANCES

PAHs and mercury

One long-range objective of SLV 2000 is the virtual elimination of 11 persistent bioaccumulative toxic substances from the St. Lawrence and its tributaries. The targeted substances are those designated by the International Joint Commission in August 1993: PCBs, DDT, dieldrin, toxaphene, dioxins, furans, mirex, mercury, lead alkyl, benzo(a)pyrene and hexachlorobenzene.

Two of the 11 targeted substances, benzo(a)pyrene and mercury, were detected during the 1989 Action Plan characterization study. The benzo(a)pyrene load was 5 g/d at the time; the mercury load was 23 g/d. The wastewater treatment program implemented in 1992 provides guidelines for virtual elimination of these compounds.

PEEP TOXICITY REDUCTION

Average toxicity

The Potential Ecotoxic Effects Probe, or PEEP, combines the results of six standardized bioassays measuring the toxic effects of effluent. The results are expressed on a logarithmic scale of increasing toxicity ranging from 1 to 10 and are used to monitor discharge trends over the years. One series of bioassays was conducted for the Jonquière works of ALCAN SMELTERS AND CHEMICALS LTD. The 1990 PEEP index was estimated at 4.3, in the average range of the PEEP indices found for the 50 Action Plan plants.

REDUCTION IN SUBSTANCES MONITORED

Drop in effluent loads

According to company data, in 1995 the complex had an average effluent discharge of 69 000 m³/d, containing:

- 2160 kg/d of suspended solids (ss)
- 470 kg/d of aluminum
- 284 kg/d of fluorides
- 94 kg/d of oil and grease (o&g)
- 1.1 kg/d of cyanides
- 30 g/d of mercury
- 0.3 kg/d of arsenic
- < 0.1 kg/d of polycyclic aromatic hydrocarbons (PAHs)

For 1988-1995, figures supplied by the company show PAHs reduced by 95%, aluminum by 82%, ss by 28%, fluorides by 15% and o&g by 6%.

KEY POINTS

- Implementation of several treatment measures; projects completed to date have cost \$25 million
- Commitment to a wastewater treatment program in 1992
- 63% reduction in the Chimiotox index

Based on December 1995 inventory.
Information reviewed by Gilles Legault, SLV 2000.

ADDITIONAL INFORMATION

Chimiotox index and PEEP:

Gilles Legault, Environment Canada (514) 283-3452.

Water quality based objectives:

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Published by authority of the Minister of the Environment
© Minister of Supply and Services Canada 1996
Catalogue No. En153-6/48-1996E
ISBN 0-662-23355-7

(Aussi disponible en français sous le titre *Établissements Industriels - faits saillants*).