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Attached is a prospectus and feasibility study by International Aluminum. The feasibility study covers the removal of the black dross pile from the old Maralco Kent site.

In summary, the project to separate the salt from the oxides will cost $2.38 million and the oxides are essentially valueless F.O.B. Kent. A user in British Columbia will pay to freight the washed oxides to his location in the interior of British Columbia.

Regards,

Phil Stansfeld

PS/dcb

Enclosure

INTERNATIONAL ALUMINUM INC.

PROSPECTUS & FEASIBILITY STUDY

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INTRODUCTION

International Aluminum was incorporated in December, 1988, whose <u>initial</u> singular purpose was the salvaging of the land and building at the Maralco site at 7820 South 202nd in Kent, Washington. The now defunct corporation had amassed at the property about 50,000 tons of rotary furnace black dross which, when deemed dangerous and/or hazardous because of its chloride and certain oxide contents, had rendered the property <u>less than</u> valueless due to the cost of disposal of that material in an approved dump site. (See Section II).

Two former Maralco employees, Philip K. Stansfeld and Nace E. Halpin, founded International Aluminum to investigate alternatives to the expensive mode of hauling and dumping this material.

Mr. Stansfeld is a graduate metallurgical engineer with a degree from the University of British Columbia (1967) and has wide and varied experience in the aluminum industry. He worked at Kaiser Aluminum's Trentwood, Washington, facility for five years, Noranda Ltd. for one year, and for Maralco for 13 years at both their Seattle and Kent locations. He is a member of ASM and AFS and has taught metallurgical courses for the ASM Society.I He has given papers at both the ASM and AFS and acted in a consulting role for most of the aluminum foundries in the Pacific Northwest while working for Maralco and later for his own company. He is co-holder with various Boeing personnel of a patent for a method of melting aluminum-lithium based alloys. His current activity, particularly in the last year, has been to research and develop a methodology for the handling of the aluminum industry's black dross.

Nace E. Halpin is a University of North Dakota graduate in Business (1950) and a graduate of Harvard Business School's program for Management Development (1965). While working for Kaiser Aluminum, he was Chief Industrial Engineer at the Trentwood works for many years and Operations Superintendent when he left their employ in 1970. He was one of the partners who bought Maralco in 1971, which operated successfully for ten years. He is co-holder of a patent on the recovery of salt from black dross and is mentioned in numerous Kaiser Aluminum patents.

BLACK DROSS - ROTARY SALT BATH FURNACE OPERATION

Black dross is the solid by-product of rotary furnace processing of aluminum melting furnace skimmings, and also the rotary furnace melting of light gauge aluminum products such as used beverage cans and machine shop borings. In both instances, a molten salt bath (approximately 1/2 KCL, 1/2 NACL) is utilized in their processing. While the molten salt vehicle is the same, the physical processes differ. In the case of the skimmings, aluminum oxides and aluminum metal are both present in the skimmings at varying ratios. The purpose of the rotary furnace melting is to a) separate and salvage the aluminum metal in the skim, and b) to prevent further oxidation of the metal in the skim. In both cases molten salt is used as the medium to prevent oxidization during melting and to combine physically (not chemically) with the aluminum oxides. This stratifies the molten metal which in due course is poured off. The residue of aluminum oxides and salt (still molten) is also poured off, becoming the black dross.

The above is a very cursory description of the process of rotary furnace melting, which can be quite complex in its execution, depending on the type of product being processed. This will be described in more detail.

Again, compositionally the black dross is essentially salt and aluminum oxide. The salt used is evaporated Great Salt Lake brine from Utah, the oxides are generated in the melting dross when atmospheric oxygen comes into contact with the liquid aluminum in the rotary furnace.

Within the water insoluble phase of the black dross are other oxides from alloying constituents and impurities. Other oxides may include silica, zinc, copper, iron, manganese, chrome, tin, lead, nickel, and titanium - many of these in only trace amounts and within the IAI process these stay out of the brine, remaining as solid oxides.

The following is a brief description of the rotary salt bath furnace operation for a typical light gauge aluminum product:

1) A quantity of the salt potash mix (NACL and KCL) is charged and brought to a molten state in a gas firing rotating brick-lined furnace.
2) With burners off, the light gauge material is "charged" into the molten salt in the furnace.
3) The furnace is rotated with the molten salt coming into intimate contact and coating the product.
4) The furnace is then fired to bring the mixture to temperature, which upon being reached (in time) results in the stratification of the molten salt (with any resulting oxides) atop the molten metal.
5) The lower molten aluminum strata is then tapped from the bottom of the furnace for alloying.
6) The salt-oxide phase is poured off for disposal.

This method of melting aluminum has been utilized in the Pacific Northwest since the mid-1950's and has since spread to the rest of the United States and Europe. The principal advantages of this method of melting aluminum are:

1) The prevention of melting loss by coating the preventing contact with oxygen during and after melting.

2) The flexibility of the furnace in keeping alloy integrity by melting in discrete batches.
3) The ability to condense quickly by melting large quantities of light gauge and/or feathery materials by using the molten salt as a heat sump.

The main disadvantage of the rotary salt bath furnace is the production of a black dross component which has to be disposed of. In the 1960's and 1970's this was not an expensive proposition, since almost any dump site would accept the material. However, the coming awareness in the late 1970's and the present to the potential impact of the salt leaching into the aquifer and/or streams has made the disposal of the salty oxides a very real economic problem.

THE I.A.I. PROCESS AND PILOT OPERATION

A brief background of the circumstances leading to the accumulation of the black dross at Maralco may serve for those unfamiliar with the details. Maralco had been dumping the black dross for a nominal fee at a nearby landfill for perhaps a year after the commercial aluminum plant was built in 1980. Shortly after the plant started operations in 1981, the black dross was deemed a dangerous or hazardous waste due to its salt content, and therefore no longer acceptable at the local dump sites. Concurrent to the above, Maralco was developing a salt recovery technology which included the extraction of the soluble chlorides from the black dross by leaching with water; i.e., washing to form a semi-saturated brine. The water was then evaporated from the brine using a patented (by Maralco personnel) process, producing a salt prill. The development of this technology lead to the accumulation of the black dross which was to be processed later as the technology improved and equipment was added. The technology was virtually developed when a severe recession ensued which struck first the metals producers and then the entire economy. Because of Maralco's high debt caused by cost overruns, start-up problems, high interest rates coupled with a metals recession in general, and a mounting black dross pile, the corporation which had been in Chapter 11 closed its doors. The black dross pile remained.

The International Aluminum, Inc. (I.A.I.) process uses the experience previously developed at Maralco vis a vis oxide washing but with many added refinements. For example, the pH is maintained during the washing and settling of the oxides at a level that precludes the dissolution of heavy metals that may be present. Repeated washings of the oxides are required to lower the alkali content to an acceptable level for the cement companies. The brines are re-used until they are too saturated with salt to be utilized for washing, at which point they are tested for discharge into the Metro system. Note that in the pilot phase no difficulty was encountered controlling this to Metro standards.

Initially for the pilot plant operation (approved earlier), the chemical analysis of the liquids and solids had been contracted to a local (Kent area) laboratory. However, it was soon realized that 1) a great amount of testing was required, and 2) that timeliness even in the pilot phase was needed to produce any quantity of material.l Additionally, the results of the testing had been very encouraging for an economic solution to the black dross problem. This led to the purchase of several laboratory instruments for testing including 1) An ion counter, and most importantly, 2) an atomic absorption photospectrometer. This and supporting laboratory chemicals and paraphernalia give I.A.I. a complete "wet" laboratory capability on site, and so we are able to chemically analyze the brines and the resultant mineral (oxide) product.

In preparation for the pilot trial run, the brine accumulations in the ponds from precipitation run-off from the black dross piles into the existing ponds and back yard puddles were tested and found to be within limits for discharge and were then dumped into the Metro system. This was done in close coordination with the Metro personnel. Note that this close coordination with Metro is required in order to minimize the impact of the brine on their system.

The following is a chronological progress report on I.A.I.'s Kent site pilot test:

1) July 15, 1988: Start by International Aluminum of extensive laboratory testing of black dross piles.

2) September 20, 1988: Court approval of concept of a 90 day pilot operation for feasibility.

3) During October 1988: Application by International Aluminum to Metro for permit.

4) January 26, 1989: Conditional acceptance by Metro for permit.

5) March 10, 1989: Approval by Metro for actual pilot discharge after site inspection by Metro.

6) March 1 - April 15, 1989: Installation of conveying, mixing, and pumping equipment by International Aluminum.

7) April 7, 1989: Application for power installation.

8) April 26, 1989: Power installed.

9) May 1, 1989: Begin trial run.

10) May 30, 1989: End trial run.

11) August 4, 1989: Publication of this document which includes feasibility discussions.

The results of the pilot operation have been conclusive and the prognosis for a reasonably viable economic solution to this ecological problem is certain. The alternative of hauling and dumping the material at the Arlington, Oregon, site is vastly more expensive and ecologically not as sound. No other acceptable alternatives to the above two (in one mode or another) are deemed possible now or in the foreseeable future.

FEASIBILITY, EQUIPMENT, AND COSTS

To determine the feasibility of the project, several discussions were held with Metro regarding the maximum amount of salt the Metro sewer system could handle in a 24 hour period. Metro determined from their studies that a maximum of 34,000 pounds of salt could be assimilated into their system per day without deleterious effects, and the permit was issued for the pilot operation on that basis. Again, close coordination was required with Metro during the test, which indeed sustained no harmful effect on Metro's equipment (according to a verbal preliminary report from Metro) during the pilot operation.

The following are the salient factors used in the calculations for the time and equipment requirements for the processing of the salty oxides at Maralco:

1)	Material to be processed	50,000 tons (100,000,000 pounds)
2)	Salt to Metro per day	34,000 pounds per day
3)	Salt content in pile	20%
4)	Salt for disposal at 20%	10,000 tons (20,000,000 pounds)
5)	Oxides for disposal	90,000 tons (80,000,000 pounds)
6)	Days required for salt disposal $\frac{20,000,000}{34,000}$	588 days
7)	Years required (5 days/week)	2 years, 3 months

To accomplish the project in the above time, the following equipment with its attendant costs will be required.

1)	3 used mixers at $25,000 each	$ 75,000
2)	1 front end loader	60,000
3)	3 charging ponds at $18,000	54,000
4)	1 concrete pump	45,000
5)	6 settling ponds at $17/sq. ft.	102,000
6)	1 portable office, etc.	20,000
7)	3 slurry pumps at $2000	6,000
8)	Added site preparation (plumbing, electrical)	22,000
9)	Screen machinery at $10,000	30,000
		$ 414,000

At the end of the project there will be some salvage value of the above equipment. Due to the adverse operating conditions; i.e., contact with the corrosive salty brine, and also the effects of the oxides on moving parts, this was deemed to be about 15% or $60,000.

The costs of running the operations for 27 months not including freight of oxides has been calculated to be about $2,030,000 not including depreciation of about $350,000, but including a 15% managerial fee -- or profit of $300,000 -- for a total cost of $2,380,000.00. In addition to this on site processing, the cost of freight of the washed oxides to the cement maker is offset almost exactly by the price paid. (In effect, the oxides have zero value f.o.b. Kent, but at least there will be no additional charges for disposal after the oxides are washed.) IAI has a letter from its oxide customer supporting this aspect of the economics.

The land and building will be worth about $3,000,000 after rehabilitation costs of perhaps $200,000. The repair of the building's south walls will be approximately $100,000 with an additional $100,000 to be spent in soil washing and/or soil additions. Note that soil washing is an easy process to incorporate within the IAI process, and this possibility has been discussed with the Department of Ecology.

I.A.I. FUTURE

The future course of I.A.I. could involve:

1) The sale of black dross "closed loop technology" to the rotary salt bath furnace operators in this country and abroad. This would include an economical use for the oxides. In Washington and California, several rotary bath operations are shipping the black dross "back" to the salt flats in Utah and elsewhere in the southwest.

2) The installation of an alloying aluminum remelting facility in another section of the state near present reduction facilities. This facility would entail the aforementioned "closed loop" technology.