Opportunities for Quebec foundries in the supply of carbon and alloy steel castings

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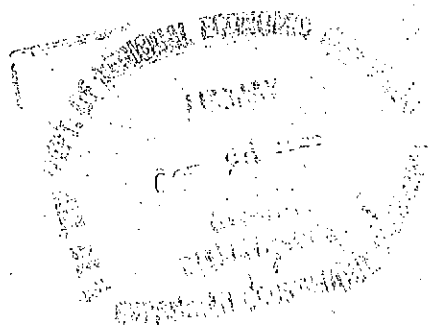
OPPORTUNITIES FOR QUEBEC FOUNDRIES IN THE SUPPLY OF CARBON AND ALLOY STEEL CASTINGS

PREPARED FOR:

MINISTERE DE L'EXPANSION ECONOMIQUE REGIONALE
MONTREAL, QUEBEC



MAY, 1976

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May 1976

M. J.J. Cardinal
Ministère de l'expansion
économique régionale
Stock Exchange Tower
800 Carré Victoria
Montréal, Québec

Dear M. Cardinal:

We are pleased to enclose our report on "Opportunities for Quebec Foundries in the Supply of Carbon and Alloy Steel Castings".

May we draw your attention to the Recommendations and the details of Section 4.0. In these sections we outline an excellent opportunity for Quebec for the development of one or more new medium sized foundries of a jobbing nature, having a capacity of 1000 to 3000 tons per year of finished castings of a size range up to 1000 pounds.

We appreciate the opportunity of carrying out this work, and look forward to being of service in the future.

Yours sincerely,

M. L. Nickerson, P.Eng.

I N D E X

		Page
1.0	Executive Summary	1
	1.1 Objective	1
	1.2 Conclusion	1
	1.3 Recommendations	2
2.0	Steel Castings	4
3.0	Market	7
	3.1 Survey Methodology	7
	3.2 Market Forecast	8
	3.2.1 Introduction	8
	3.2.2 Summary	8
	3.2.3 Capacity Forecast	16
	3.2.4 Thermo-Nuclear Market	17
	3.2.5 Petrochemical Markets	20
	3.2.6 Gas and Oil Markets	21
	3.2.7 Industrial Manufacturers	22
	3.3 Imports and Exports	24
	3.3.1 General	24
	3.3.2 Imports	24
	3.3.3 Exports	26
4.0	Potential for Quebec	29
	4.1 Summary	29
	4.2 Recommended Jobbing Foundries	30
5.0	Some Interview Reports	35

A STUDY OF OPPORTUNITIES FOR QUEBEC FOUNDRIES IN THE SUPPLY OF CARBON AND ALLOY STEEL CASTINGS

1.0 Executive Summary

1.1 Objective

Robertson, Nickerson, Group Associates Limited were retained to study the opportunities for Quebec foundries in the supply of carbon and alloy steel castings over the next ten years. The demand sectors to be studied were thermo-nuclear, petrochemical, gas and oil, and industrial manufacturing.

1.2 Conclusions

1. The total market for steel castings over the next ten years (1976 to 1985) is a minimum of 2.5 million tons and a maximum of 2.9 million tons. The minimum demand represents an average minimum growth per year of 5,400 tons. (See Section 3.2.2 for details).

2. Castings demand by end users in the thermo-nuclear, petrochemical and gas and oil sectors is expected to increase substantially. A good but modest rate of growth of castings demand is forecast for industrial manufacturing end users, over the forecast period. (See Section 3.2 for details.)

3. The demand forecasts indicate a need for increased foundry capacity of at least 40% over the next ten years, or an average of 4% per year. The demand is primarily for carbon and low alloy steel castings of a size range up to 1000 pounds. (See Section 3.2.3 for details.)

4. Most Quebec steel casting foundries are moving into higher production volume markets. The few smaller foundries are generally of a specialized nature and cannot be upgraded to serve the low to medium volume jobbing markets.

5. The area of greatest potential for Quebec is in the establishment of a number of new medium sized steel jobbing foundries, primarily serving the Ontario/Quebec medium volume markets for machinery and equipment end users, including those serving the thermo-nuclear, petrochemical and gas and oil sectors. The opportunity is assessed as excellent for the establishment of at least one of these foundries in Quebec immediately, and perhaps several over the next three to six years. (See Section 4.0 for details.)

1.3 Recommendations

1) Carry out a feasibility study into the establishment in Quebec of one or more medium sized steel casting foundries producing quality castings in the range of 1000 to 3000 tons per year of finished steel castings of a size up to 1000 pounds each. (Without limiting the generality of the forging, the feasibility study should concentrate on establishing the competitiveness of the proposed size of foundry to compete in the low to medium casting volume ranges.)

2) There appears to be increased opportunities for the manufacture of machinery and equipment in the thermo-nuclear, petrochemical and gas and oil sectors. An overview of opportunities in the thermo-nuclear field has already been completed and specific opportunities are under study. It is recommended that studies also

be undertaken in the petrochemical and gas and oil fields, if this has not already been done. The increased manufacture of machinery and equipment in these sectors in Quebec will not only benefit Quebec manufacturers but also increase the demand for the supply of Quebec produced steel castings. There is also a need to relate common elements of manufacturing potential in all three fields i.e., related equipment that can be manufactured in the same plants.

2.0 Steel Castings

There are four broad classes of castings by metallurgical specifications given in the Steel Castings Handbook:

1) Carbon Steels

   Low 0.20% carbon

   Medium 0.20/.50% carbon

   High 0.50% carbon

2) Low Alloy Steels

   Less than 8% of alloying elements, including carbon

3) High Alloy Steels

   In excess of 8% alloying elements, but excluding the wear resistant steels

4) Wear Resistant Steels

   Generally in excess of 8% alloying elements

For purposes of simplification two groups were used: Low Alloy and Carbon Steels and High Alloy (including wear resistant steels). It should be noted that it is very difficult to differentiate between carbon and low alloy steel as the primary categorization is by mechanical properties.

The following indicates the disposition of castings by material classification. This information is from the 1974 "Report of the Canadian Ferrous Foundry Industry". This shows Carbon and Low Alloy at 87% of demand and High Alloy as 13% of demand. The user sample taken for this report on the jobbing market showed Carbon and Low Alloy at 73% and High Alloy at 27%.

Canadian Production 1974
By Broad Metallurgical
Specifications by % of Total (Tons)

	Category			
	Carbon	Low Alloy	Manganese*	High Alloy
Ontario	76	15	4	5
Quebec/Maritimes	69	12	18	1
Canada Total	74	13	10	3

*Manganese - wear resistant

The primary material source for steel casting foundries is scrap steel. Virtually all castings, with the exception of special alloys are produced from scrap steel. Foundries buy directly from local scrap steel dealers in their area and carry out their own melting and refining operations.

Jobbing runs are generally in the low values up to 3 to 4 tons. However, because of a disinclination of the established foundries to become involved in lower runs it could be expected that some jobbing work might need the semi-production run level. This would be the case for example, with valve and pump manufacturers.

A well finished casting is always a requirement; the question is, "how good is good?". In general the relationship is to the end-use rather than a set of defined standards. There is little doubt that the definition of "acceptable as-cast surface finish" is rising. Firstly, because the equipped manufacturer wants to

avoid the very expensive process of hand grinding. Secondly, it creates more confidence in the internal integrity of the casting if it is free from surface imperfections on the outside. The majority of users contacted required a good quality of surface finish. The finish, however, does not have to be of the level produced by a lost-wax or ceramic process.

There is an excellent opportunity for a jobbing foundry which will produce "good castings". This means a high quality of metallurgical control in the form of, a skilled metallurgist, a modern sand moulding system, e.g. chemical and, quality inspection control, etc. There is very little, if any, potential for "dirt-castings" if for no other reason than that equipment manufacturers are no longer able to support the high labour cost penalties involved in curing casting defects.

The ultimate objective is to cast to finished dimensions particularly for form and shape surfaces. The actual practical level required by the market is one that would be achieved by a high grade moulding system without special biscuit or ceramic prepared moulds.

For the future (about 2-3 years) there is every likelihood that normal cycling of market demand plus the pressure by manufacturers to reduce their labour costs will necessitate higher dimensional accuracy and surface finishes.

Standard tests such as Die-Penetrant, etc., will satisfy most of potential customers.

There is a segment of the market which does require X-Ray and other more sophisticated techniques.

3.0 Market

3.1 Survey Methodology

The use of STATCAN statistical information for the evaluation of Canadian steel castings markets presents many difficulties. This was recognized in the Department of Industry, Trade & Commerce 1974 "Report of the Canadian Ferrous Foundry Industry". In that report it was noted that, for example, steel foundries are classified with the basic steel mills and therefore identity is merged with the much larger statistics for these mills. Further, the method of classification results in large sections of the industry being included with other industry groups and so on. There is also some question of the accuracy of the statistics which are available.

As a result, it is necessary to use care in the selection and use of available statistics ensuring that data is compared with other primary sources for verification, such as data obtained from extensive field interviewing of users and casters.

In this report, our primary information source has been field data gathered by interviews of over a hundred buyers of castings in a sampling of industry sectors, interviews with casters, material suppliers, and individual experts in the industry and in government. Our secondary information source has been statistical data from STATCAN, the Department of Industry, Trade & Commerce, the Department of Energy, Mines & Resources, published trade reports and other sources. We have also used some U.S. industrial trade statistics for comparison purposes only.

While all relevent data has been extracted from the

buyer interviews and is contained in this report, a sample of some of the interviews has been included as Section 5.0, to give the reader a "feel" for buyer views on the market.

3.2 Market Forecast

3.2.1 Introduction

Both minimum and maximum demand forecasts have been made. In developing these forecasts, the difference between STATCAN statistics and those gathered by DOITC from the industry has been taken into account. For example, the 1974 DOITC "Report of the Canadian Ferrous Foundry Industry" showed a difference in steel casting production of about 25% from STATCAN data. To some extent this is due to the classification of some foundries (particularly captive foundries) with other industry groups. In general, minimum demand forecasts reflect STATCAN statistics in the base period and maximum forecasts reflect the higher DOITC data in the base period. Since the STATCAN statistics include many captive foundries the minimum forecast perhaps better reflects the "open" market demand and has therefore been used for comparison purposes in assessing trends and capacity requirements.

It should also be noted that, given the differences in total production figures, there is still good correlation between STATCAN and DOITC data, if the STATCAN data is assumed to be a representative sample of the industry, rather than reflecting the total industry.

3.2.2 Summary

The minimum total demand for steel castings over the next ten years (1976 to 1985) is forecast at about 2½ million tons. (See Table I.) This represents a demand increase of about 41%

over the corresponding 1966 to 1975 period. By 1985, the average minimum annual demand is forecast at 269,100 tons per year. This represents an average minimum increase of about 5,400 tons per year over the forecast period. (See Table II). (Note: The minimum annual demand does not reflect total captive and non-captive foundry demand. See Section 3.2.1.)

The demand forecast correlates well with the ten year regression analysis. (See Appendix A.) However, there has been a higher rate of growth of demand in the last five years, which if continued, would result in even higher demand levels than those forecast. The current minimum forecast may therefore be considered a conservative figure.

The primary demand over the forecast period is for carbon and low alloy steel castings at 83.5% with high alloy demand at 16.5%.

TABLE I

Forecast 1976-1985
Demand For Steel Castings

	1976-1985 Demand Forecast (Tons)	
	Minimum Demand	Maximum Demand
Carbon and Low Alloy	2,098,000	2,582,000
High Alloy	412,000	412,000
TOTAL	2,510,000	2,994,000

TABLE II

Forecast 1985
Annual Demand For Steel Castings

	1985 Annual Demand Forecast (Tons)	
	Minimum Demand	Maximum Demand
Carbon & Low Alloy	216,100	266,400
High Alloy	53,000	55,500
TOTAL	269,100	321,900

Caution: The demand forecast cannot be compared with the specific historical demand for any one year. It must be taken in the context of the highly cyclical nature of demand in the industry.

The total tonnage demand of high alloy over the forecast period will increase by about 25% over the corresponding 1966 to 1975 period. This is a slower rate of growth than for carbon and low alloy steel castings and primarily reflects the relatively slow growing average demand for manganese and abrasion resistant steel castings, which forms about 75% of total demand for high alloy. One major sector in which growth of demand for high alloy is evident is the thermo-nuclear market. (See Section 3.2.4).

In the three end use sectors studied, i.e. thermo-nuclear, petrochemical, and gas and oil, the total demand over the forecast period is 160,734 tons or about 6.4% of total minimum demand. (See Table III.) This represents a major increase in these sectors, primarily fuelled by major expansions in the energy and oil sectors in Canada. The gas and oil sector presents the largest demand primarily associated with machinery and equipment needs for exploration and extraction. Petrochemical is next, associated with the development of gas and oil feedstocks in Canada. The thermo-nuclear sector, while lower in tonnage requirements than the other two, represents a higher dollar value due to the higher value of castings for this industry. The thermo-nuclear sector is of course associated with the electrical energy demand in Canada and based on the forecast demand of the Canadian Nuclear Power Program. (See Appendix B.)

The forecast for the general industrial sector is for continued expansion of demand totaling about 2.4 million tons over the forecast period. (See Table III.) This represents

a higher growth rate than in the past, but not to the same degree as the energy and oil based sectors. The major industrial users will continue to be the automotive, railways and general machinery and equipment sectors. Details of all demand sectors are outlined in the following sections.

The size distribution of castings is detailed in Table IV. This information was obtained by a survey of users and correlates well with the distribution reported by casters in the 1974 "Report of the Canadian Ferrous Foundry Industry". No major change in this distribution is foreseen over the forecast period. Note that about 78% of demand is for castings up to 1000 pounds in weight. Average casting sizes in this demand sector are forecast (from user data) at:

Average Size	% of Total by Weight
60 lbs.	50%
200 lbs.	30%
650 lbs.	20%

TABLE III

Forecast 1976-1985
Demand by Industry Sector

(Tons)

	1976-1985 Minimum Demand
Thermo-Nuclear	38,406
Petrochemical	42,918
Gas and Oil	79,410
Other Industrial	2,349,266
TOTAL	2,510,000

TABLE IV

Carbon and Low Alloy Steel Castings

Size Distribution of Castings

	0 to 100 lbs.	100 to 1000 lbs.	1000 plus
RNGAL Survey	3139 tons 45%	2300 tons 33%	1515 tons 22%
National Survey	42%	25%	33%

3.2.3 Capacity Forecast

According to the 1974 "Report of the Canadian Ferrous Foundry Industry" steel foundries were operating at about 83% of stated economic steel casting capacity. At that level of capacity, RNGAL's survey of users reported extremely long lead times with waiting periods of 24 months not uncommon in some demand sectors. It seems likely therefore that the 83% "economic capacity" figure was in fact much higher in terms of providing reasonable lead times to users.

Since that period there has been a decline in the economy but lead times reported by users in late 1975 and early 1976 still ranged from eight to twelve months. These are unacceptable lead times to users, given they had an alternate source of castings. It is estimated therefore, that capacity increases of at least 40% or about 4% per year will be needed over the next ten years just to keep pace with increasing demand. Higher capacity increases will be needed to reduce current long lead times. Excluding expansion by existing firms (which is of course taking place) this would mean the equivalent of building three to four new medium sized foundries per year over the period 1976-1985.

Obviously, expansion of existing large foundries will take place, excluding the development of such large numbers of new foundries. However, the example is given to illustrate the potential for new foundry development, particularly the potential for new medium sized foundries. (Further details on this aspect as related to Quebec is given in Section 4.0.)

The demand forecast to 1985 is based on analysis of capital expansion in the various demand sectors, as reported by the major industry leaders. The forecast expansion in these industries was then converted to constant dollars (to eliminate inflationary effects) and related to base castings usage in the industries. It is interesting to note that this methodology provided a very close correlation to the regression analyses of historical demand. (See Appendix A.)

An important factor to keep in mind in relation to these demand forecasts is the highly cyclical nature of annual demand. The demand forecasts in this report are based on the average demand to be expected, not the peaks or valleys in any one year. The effect of regression analysis to eliminate such peaks and valleys and assess average trend increases over time can be readily seen in the graphs in Appendix A. This method of analysis ensures that assessment of the need for capacity increases is based on the average requirement. In this respect it is important to note that the reported 83% "economic capacity" is almost on the regression line, indicating that both the demand forecast and the capacity requirements are conservative estimates.

3.2.4 Thermo-Nuclear Market

The demand for castings by the thermo-nuclear market is detailed in Table V.

TABLE V

Thermo-Nuclear Market Demand

1976-1985 (Tons)

Nuclear Specifications (Class I)		Non-Nuclear Specifications	
Carbon & Low Alloy	High Alloy	Carbon & Low Alloy	High Alloy
2,292	12,052	22,976	1,086

The total demand is 38,406 tons. It should be borne in mind that this represents a much higher dollar value of market than indicated by the tonnage, as various nuclear castings are two to three times higher in cost than conventional castings. Some examples of prices are as follows:

Reactors

Nuclear Spec (Class I) SS $12.50 per pound - CS $5.00 per pound

Non Class I Spec SS $10.10 per pound - CS $4.00 per pound

Conventional High Quality

CS $2.00 per pound

It should be noted that prices vary greatly depending on type of casting and quality requirements.

The specifications for Class I nuclear castings are very stringent and even well established foundries have difficulty in supplying to specifications. However, about 63% of the forecast castings demand, while of high quality, is for commercial grade castings.

The above forecast of casting demand is based on the nuclear power construction program as forecast to 1990. There have been a number of changes since our previous report "Manufacturing Opportunities for Quebec Firms in the Supply of Parts and Equipment to the Nuclear Products Industry" with some evident slowing in the rate of planned construction due to financial restraints and environmental concerns. This slower growth however, is reasonably minor over the forecast period, with some slippages of a year or so in individual plants plus a move towards larger numbers of smaller sized facilities, rather than a few large plants. (See Appendix B for details.)

3.2.5 Petrochemical Markets

The demand for castings by the petrochemical industry is forecast at 42,918 tons over the period 1976 to 1985. The majority of the demand is for carbon and low alloy castings and represents at least a doubling of average annual demand.

Forecasts of petrochemical industry expansion on which to base castings demand, are highly volatile. Much depends on the availability of petrochemical feedstocks. The National Energy Board has forecast demand rising from 40,200 BBL per day to 242,000 BBL per day by 1994 and indications are for a doubling of basic petrochemical operations in Quebec, Ontario and Alberta in the period 1980 to 1994. However, various sources indicate expansion in the 80's may be moderated by a lack of feedstocks. We have taken this into account using forecasts of capital expansion up to 1980 as reported by the industry, and assuming a leveling off for the remaining period. The forecast therefore may be considered to be a lower limit which would increase substantially should predicted feedstock shortages not materialize.

The growth of the petrochemical industry is taking place in Ontario, Quebec and Alberta. However, in terms of castings demand, it is not the location of the petrochemical industry which is of importance, but the location of the machinery and equipment suppliers to this industry. It is these suppliers who create the demand for castings. Since most of these suppliers are located in Ontario and Quebec, expansion of the petrochemical industry in Alberta is expected to primarily increase the

castings demand in Ontario and Quebec, rather than in Alberta. There may be some increased machinery and equipment manufacturing in Alberta serving the petrochemical industry, but this is unlikely to be significant over the forecast period.

The forecast demand for castings in the petrochemical industry is based on forecasts of the future capital expenditures of the industry for expansion. The forecast is projected from a 1973 base, using constant dollars to eliminate the inflation effect of available capital expenditure data. Capital expenditure information was obtained from various government agencies and correlated with data as reported by the industry.

It is important to carefully consider the different treatment given the petrochemical industry by statistical sources as compared to general usage of the term in the industry. For statistical purposes, the petrochemical industry is generally classified as those industries in Major Group 19, particularly SIC 378, 373 and 375. Oil and gas firms providing feedstocks to the petrochemical industry are generally classified to SIC 365. A variety of sources tend to classify various mixtures of such firms to the petrochemical industry, including sources within the federal government as well as industry literature. Many of these classifications are not directly comparable with one another without careful examination.

3.2.6 Gas And Oil Markets

The demand for steel castings by the gas and oil industry is forecast at 79,410 tons over the period 1976 to 1985. The demand is primarily for carbon and low alloy castings.

The demand represents a substantial increase over current levels of between double to triple present usage. In the oil sector, demand growth is being fueled by exploration, extraction and transmission rather than by expansion of refinery capacity. Little growth is expected in the latter area with capacity adequate for the forseeable future. Refineries intend to concentrate more on improving existing facilities than on new capital additions. In the gas sector, expansion is likely to be curtailed by forecast shortages, resulting in a lower demand for capital expansion of gas processing plants.

Capital expansion is primarily taking place in exploration and extraction and the demand for machinery and equipment in this sector will create large demands for castings over the forecast period. Much of this expansion is taking place in Western Canada, particularly in Alberta with regard to extraction from the Sands. However, as previously detailed, it is not the location of expansion which is important to castings demand, but the location of the equipment and machinery manufacturers serving the industry. In this area, the domestic suppliers are primarily located in Ontario and Quebec and a significant change is not expected over the forecast period. The castings demand for the oil and gas sector is therefore expected to be centered in Ontario and Quebec.

3.2.7 Industrial Manufacturers

The demand for steel castings by industrial firms is forecast at 2,349,266 tons (excluding the thermo-nuclear, petrochemical and gas and oil sectors) over the period 1976

to 1985. The distribution of this demand is as follows:

Forecast Distribution of 1976 to 1985 Castings Demand (Tons)

Carbon and Low Alloy	1,963,986
High Alloy	385,280
TOTAL	2,349,266

This demand represents an increase of about 32% over the corresponding 1966-1975 demand. The highest rate of forecast increase is in the carbon and low alloy sector. While the high alloy demand is increasing, particularly with regard to the thermo-nuclear market, much of this demand is in the manganese and abrasion resistant steel castings where demand is highly volatile and shows little consistent upward trend over the past years.

The major demand sectors are automotive, railways and the Miscellaneous Machinery and Equipment Manufacturers group (SIC 315). This latter sector manufacturers a very wide range of machinery from construction equipment to pulp and paper equipment. Disposition of castings is estimated as follows:

Automotive	- 19%
Railways	- 36%
*Machinery & Equipment	- 31%
Other	- 14%

*Note: This includes the nuclear, petrochemical and gas and oil equipment manufacturers.

The majority of demand in the automotive, railways and machinery and equipment sectors is for carbon and low alloy castings. The use of high alloy tends to be concentrated in

construction, mining and pulp and paper sectors.

3.3 Imports and Exports

3.3.1 General

Import and export statistics on steel castings can be misleading. It is important to note that the data concerns rough castings only.

If castings have been machined or classified as a part for a piece of equipment, it is not recorded in the statistics as a casting. As a result, there is no data on the import or export of finished castings.

3.3.2 Imports

Steel casting imports are detailed in Table VI. As indicated, these are for rough castings only. No data exists on the import of finished castings. It is believed that large volumes of finished castings are imported into Canada under various equipment classifications but this cannot be confirmed from the data. However, we are aware, from other surveys we have done in various equipment industry sectors, that very large volumes of castings are imported as components, particularly by U.S. subsidiaries. In general, such subsidiaries are often only carrying out assembly operations in Canada. They usually do all sheet metal and wiring work in Canada but import components from their parents. Such imports are usually in high volume industries where the large scale buying economies of scale in the U.S. make it difficult for Canadian foundries to compete. However, in many instances the buying patterns of U.S. subsidiaries are traditional, more than economically motivated, and we have found many instances

TABLE VI

Steel Castings Imports

	Tons	$'000
1975	9,100	
1974	7,775	9,665
1973	14,533	14,473
1972	7,973	6,176
1971	5,662	5,163
1970	7,126	6,614
1969	6,758	6,821
1968	4,753	4,939
1967	7,013	6,507
1966	7,974	6,608
1965	5,303	4,735
1964	5,160	3,482

where Canadian foundries had never been invited to bid on requirements. It was simply easier to continue buying from the parent.

In the latter areas, there may be potential for Quebec foundries to replace a portion of the import market, particularly in those sectors where growth of Canadian demand is improving economies of scale. However, to determine the most appropriate market sectors requires data which is not available from existing sources. It is therefore recommended that a survey of users in selected industry sectors be carried out to determine import volumes and the potential for Quebec suppliers.

3.3.3 Exports

Steel casting exports are detailed in Table VII. Again, the difference between STATCAN statistics and the DOITC 1974 "Report of the Canadian Ferrous Foundry Industry" must be taken into account. The 1973 exports in that report are listed at 22,000 tons or 135% higher than the STATCAN report for that year. This is due to the difference in treatment for classification and other factors as previously reported. Undoubtedly, the higher DOITC figures are the more correct figures.

Almost all exports were to the United States and consisted primarily of high volume, low cost items. The average disposition of exports were:

Motor Vehicle Equipment	- 35%
Construction & Municipal	- 29%
Mining	- 12%
Other	- 24%

There were few casting exports in the specific end user sectors of thermo-nuclear, petrochemical and gas and oil. Exports in the machinery sector were also extremely low.

Over the next five years, it is expected that high production items will incur increasing difficulties in the U.S. market. On the other hand, the increasing size of U.S. foundries plus the introduction of highly automated facilities for increased volume production is creating difficulties for smaller users with low volume demands. It can be expected that markets in the U.S. for lower volume production of quality castings exported from Canada will improve and expand over the forseeable future. This indicates an improved export potential for medium sized jobbing foundries.

TABLE VII

Steel Casting Exports

	Tons	$'000
1975	12,988	13,856
1974	10,244	9,013
1973	9,352	6,930
1972	7,523	6,392
1971	7,506	6,645
1970	8,240	7,850
1969	9,308	7,624
1968	7,839	5,039
1967	6,405	4,155
1966	9,162	5,351
1965	5,877	3,326
1964	7,622	3,804

4.0 Potential For Quebec

4.1 Summary

As detailed in Section 3.2.3 the demand forecasts over the period 1976 to 1985 indicate a need for increased casting capacity of at least 40% or 4% per year. There is substantial demand increases in the end use sectors studied, as well as the the overall castings market. Most of this demand increase will take place in Ontario and Quebec, despite the major gas and oil related activities in Alberta. (See Sections 3.2.5 and 3.2.6 for details.) As a result there are opportunities for the expansion of foundry capacity in Quebec to serve these expanded markets.

In assessing the best opportunity for expansion of current Quebec foundry capacity, we would recommend consideration of first establishing additional medium sized jobbing capacity as opposed to expansion of the larger production type capacity in the several specialized areas. This is not to say that there are not opportunities for the expansion of large production type facilities. As indicated by the demand forecasts, such opportunities do exist. However, much of this capacity we believe will be added by the larger Quebec foundries as a matter of course, in response to the observed demand increases. In turn, the smaller Quebec foundries do not have the technical or financial ability to enter these markets in competition with the larger established producers. (Typical jobbing foundry distribution by size is detailed in Table VIII.)

But a supply gap has formed in the market which is not being exploited. This gap appears to be in the development of medium sized jobbing foundries (1000 to 3000 tons per year) (note Table VIII) capable of handling lower volume or semi-production runs in casting sizes up to 1000 pounds. (See Table IV.) This gap has been developing for the last several years and the trend is reinforced by the forecasts in this report. The demand is growing sufficiently for the larger casters to turn more and more to the larger production run jobs rejecting the medium sized runs. In turn the smaller foundries do not have the capability of expanding into this market sector.

We would therefore recommend concentration at present on the establishment of new medium sized jobbing foundries in Quebec, along the lines detailed in Section 4.2. Some preliminary data is provided but a feasibiltty study is recommended to determine appropriate sizing and economic viability to fit the market demand.

4.2 Recommended Jobbing Foundries

The recommended foundries would be medium sized plants producing 1000 to 3000 tons per year of finished castings of a size range up to 1000 pounds. The foundry would primarily exploit the market for castings for machinery and equipment in the three sectors examined (thermo-nuclear, petrochemical and gas and oil) plus the Miscellaneous Machinery and Equipment Group (SIC 315) and other general manufacturing areas.

There are of course, traditional large users of steel castings in the automotive and railway operating and equipment

TABLE VIII

Jobbing Foundry Distribution by Size

Province	Jobbing	Size
Newfoundland		
United Nail & Foundry Co. Ltd.	J	M
Nova Scotia		
Maritime Steel and Foundries Ltd.	J	L
Ontario		
Babcock & Wilcox Canada Ltd.	J	L
Black-Clawson-Kennedy Ltd.	J	M/L
C.S. Castings Ltd.	J	S
Dayton Steel Foundry of Canada Ltd.	J	S
Designed Precision Castings	J	S
Dominion Foundries and Steel Ltd.	J	L
ESCO Ltd.	J	L
Fahralloy Canada Ltd.	J	L
Fahralloy-Wisconsin Ltd.	J	L
Industrial Fine Castings Ltd.	J	S
Johnson, Matthey & Mallory Ltd.	J	S
Mid-Canadian Investment Castings Ltd.	J	S
Welmet Industries Ltd.	J	L
Quebec		
Amseco Joliette Div.	J	L
Canadian Steel Foundries	J	L
Lynn MacLeod Mattallurgy Ltd.	J	L
Sorel Steel Foundries Ltd.	J	L
Supreme Precision Castings (1963) Ltd.	J	S
Unitcast Div. Midland-Ross of Canada	J	L
Vestshell Inc.	J	S

S = Small (less than 1000 tons/year)
M = Medium (1000-3000 tons/year)
L = Large (3000 and up tons/year)

sectors. (See Section 3.2.7.) However, these large users are matched by equally large casting producers of a size range outside of the recommended area. There are special opportunities for short runs of castings for these sectors which should be exploited, but this would not be the primary market.

We estimate the current Ontario/Quebec market at present for jobbing steel castings at about 48% of the total value of shipments, adjusted for imports and exports. An approximate volume for the current jobbing markets in Ontario and Quebec are therefore as detailed in Table IX. This indicates a total market of 103,490 tons of which 78% is for carbon and low alloy steel and 22% is high alloy.

From interviews with buyers, we have obtained data on a sample of users in the jobbing market. This sample jobbing demand is detailed in Table X. The sample demand is 8,925 tons of which 73% is carbon and low alloy and 27% is high alloy. This is a very close correlation between statistical data and survey results.

Of the sample, a very conservative estimate of 10% would seek another supplier in order to reduce current lead times. Extrapolating this result to the total market would give a conservative jobbing market open to new foundries of 10,349 tons. This is enough to support five foundries of an average output of 2000 tons per year, operating in Ontario and Quebec.

Further, as indicated by the forecasts, demand is rising sufficiently to ensure an increasing market potential for such new medium sized foundries.

TABLE IX

Annual Ontario/Quebec Market for Steel Jobbing Castings

(Tons)

	Carbon & Low Alloy (Tons)	High Alloy (Tons)
Ontario	54,340	18,363
Quebec	26,371	4,416
Total	80,711	22,779

TABLE X

Sample Demand of Jobbing Market Survey

(Tons)

	Carbon & Low Alloy (Tons)	High Alloy (Tons)
Ontario	4,657	902
Quebec	1,908	1,458
	6,565	2,360

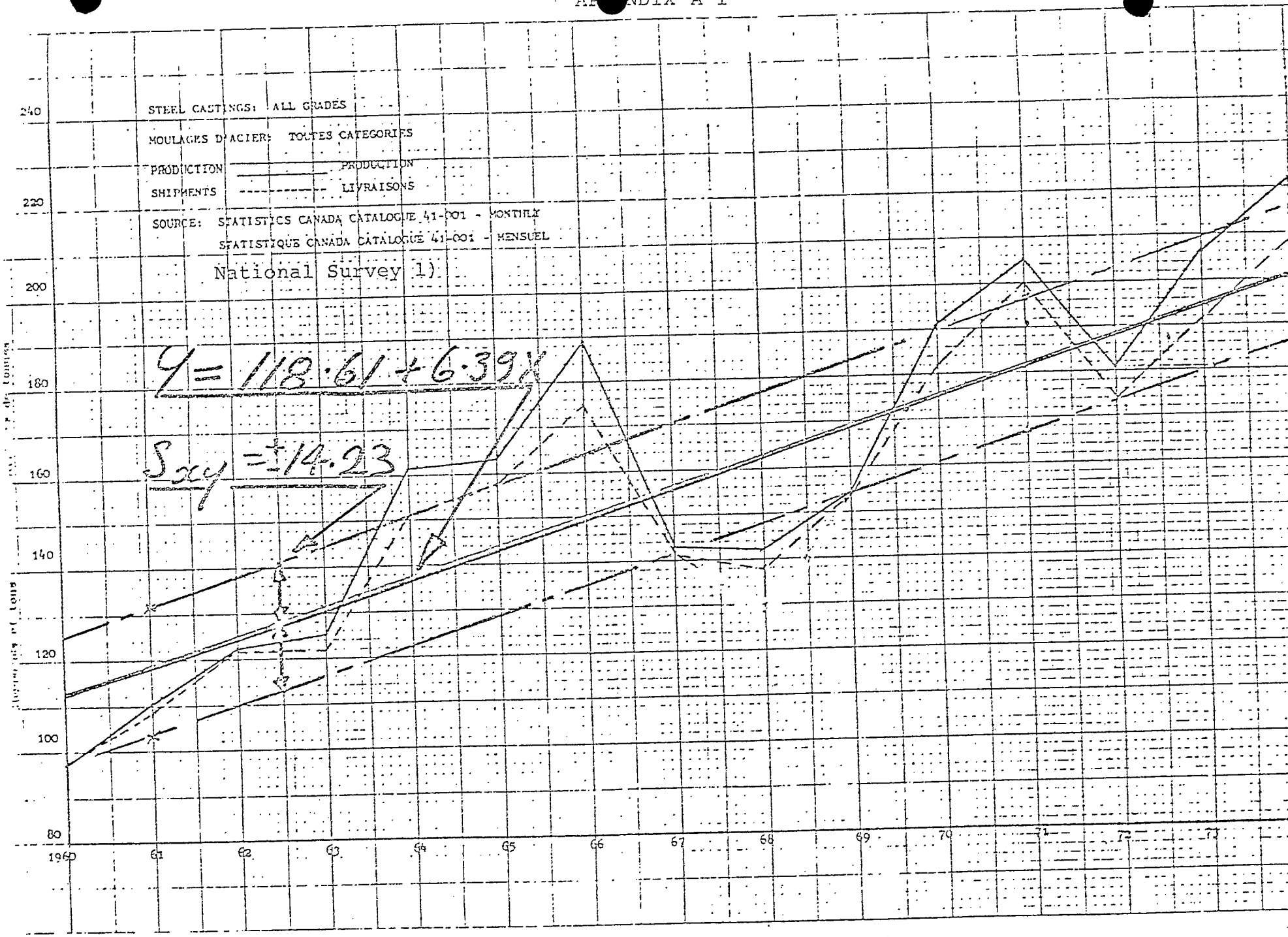
APPENDIX A

A-1 Steel Castings: All Grades

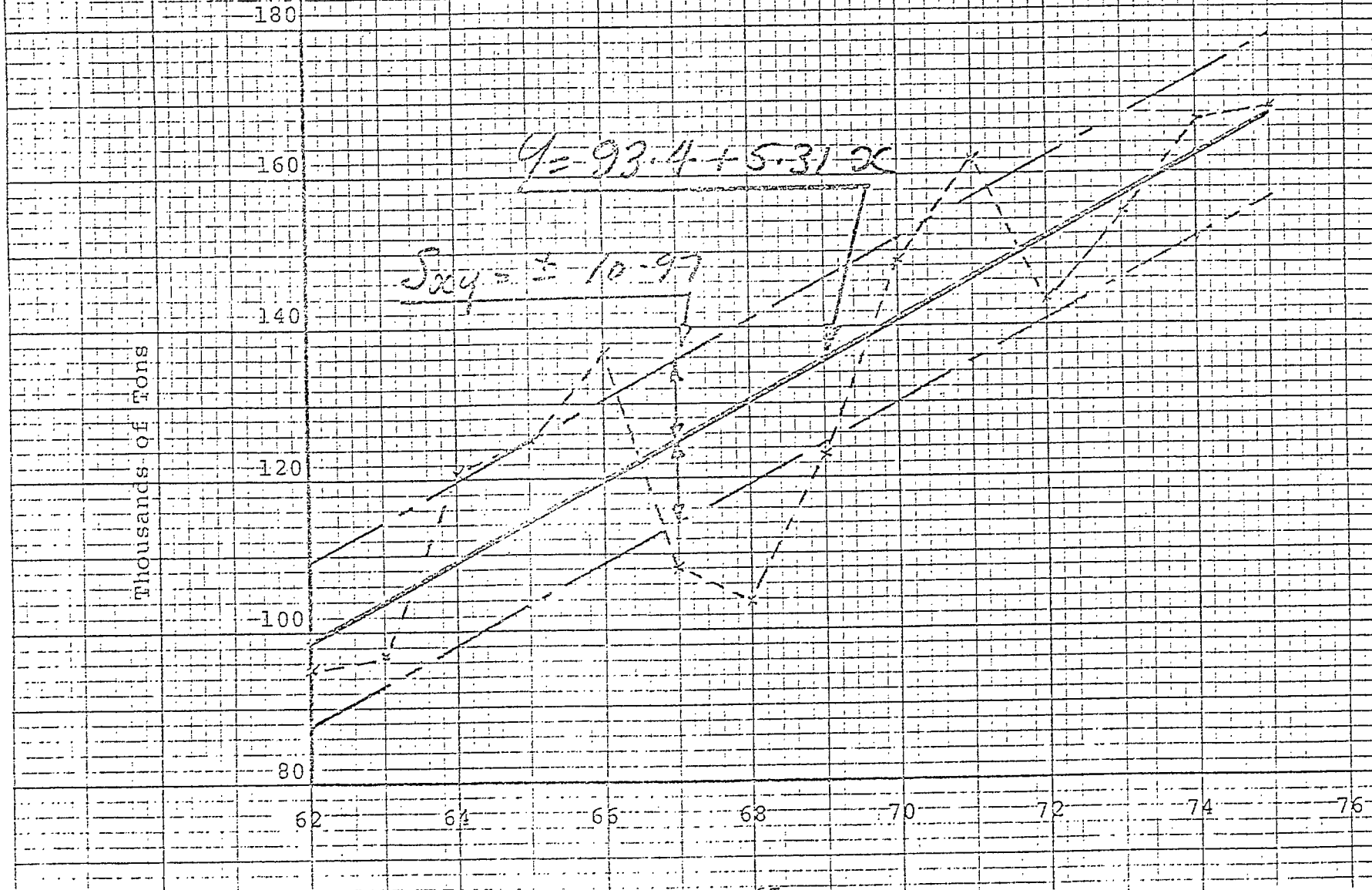
A-2 Carbon and Low Alloy Steel Castings

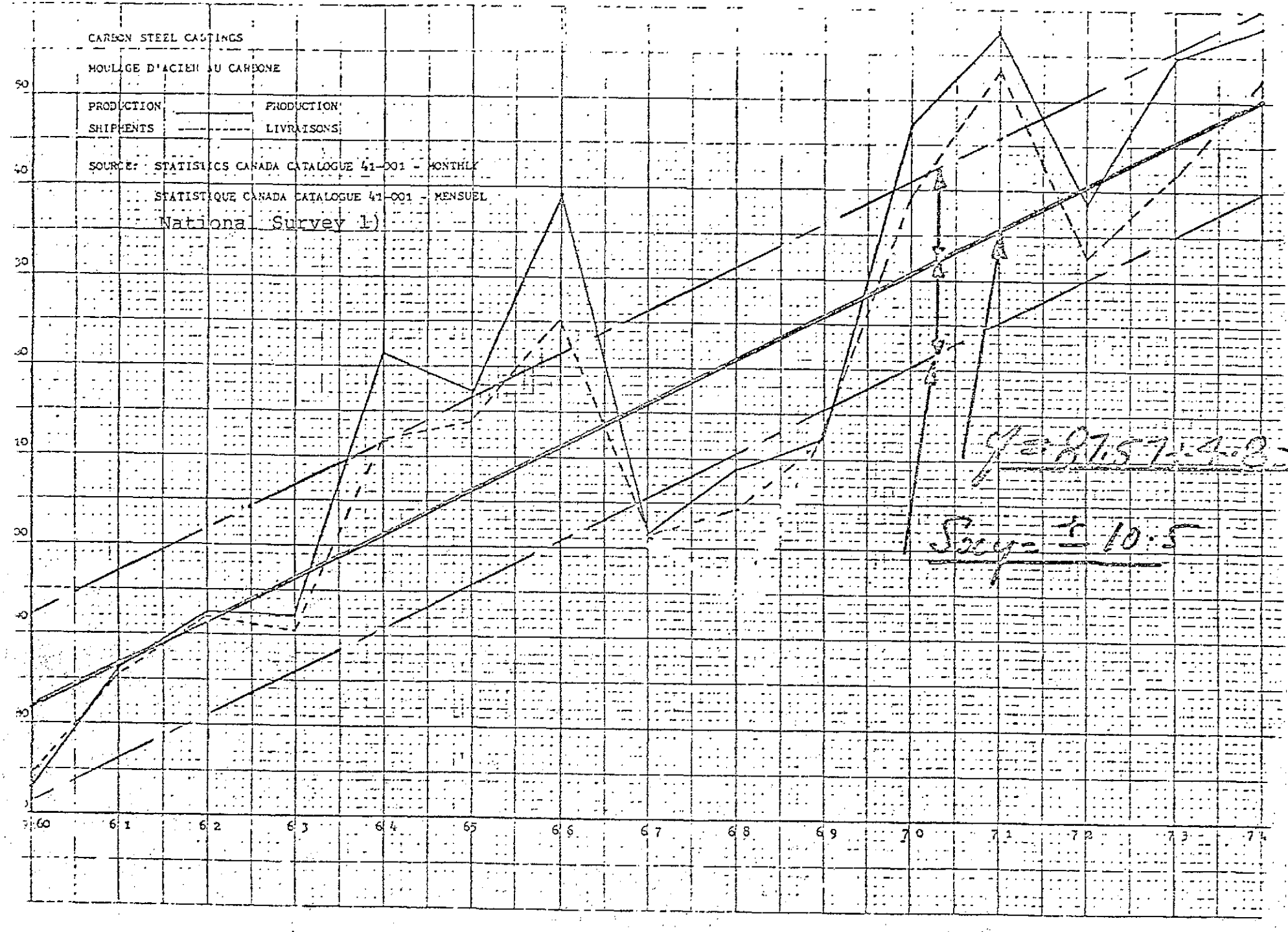
A-3 Carbon Steel Castings

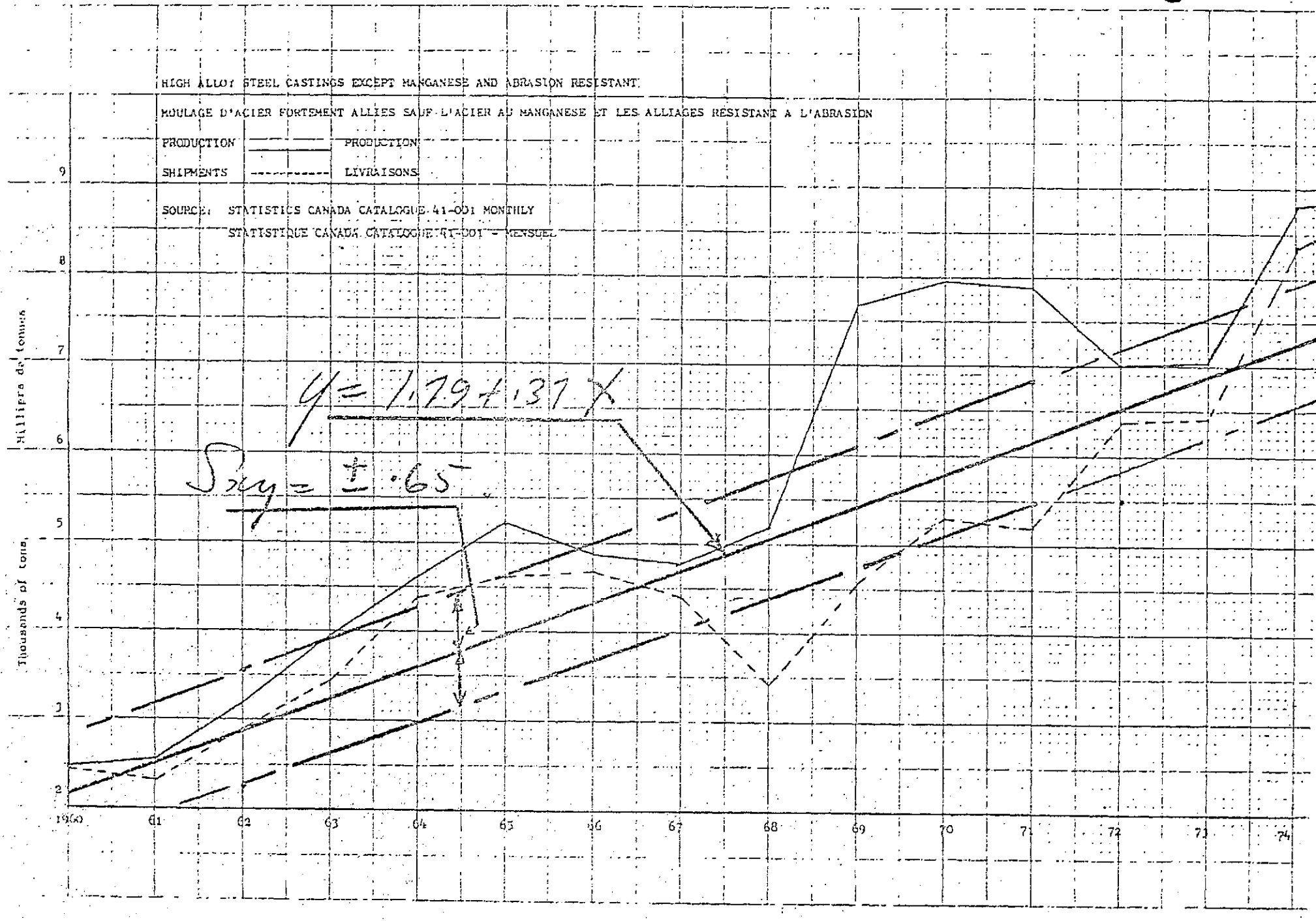
A-4 High Alloy Steel Castings


STEEL CASTINGS: ALL GRADES
MOULAGES D'ACIER: TOUTES CATEGORIES
PRODUCTION PRODUCTION
SHIPMENTS LIVRAISONS
SOURCE: STATISTICS CANADA CATALOGUE 41-001 - MONTHLY
STATISTIQUE CANADA CATALOGUE 41-001 - MENSUEL
National Survey 1)
$\bar{y} = 118.61 \pm 6.39$
$S_{xy} = \pm 14.23$
240
220
200
180
160
140
120
100
80
1960
61
62
63
64
65
66
67
68
69
70
71
72
73

Carbon and Low Alloy Steel Castings
Production
Shipments
Source: Statistics Canada Catalogue 41-001 - Monthly
National Survey 1)




CARBON STEEL CASTINGS
MOULAGE D'ACIER AU CARBONE
PRODUCTION
PRODUCTION
SHIPMENTS
LIVRAISONS
SOURCE: STATISTICS CANADA CATALOGUE 41-001 - MONTHLY
STATISTIQUE CANADA CATALOGUE 41-001 - MENSUEL
National Survey 1)
50
40
30
20
10
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74


HIGH ALLOY STEEL CASTINGS EXCEPT MANGANESE AND ABRASION RESISTANT
MOULAGE D'ACIER FORTEMENT ALLIES SAUF L'ACIER AU MANGANESE ET LES ALLIAGES RESISTANT A L'ABRASION
PRODUCTION
PRODUCTION
SHIPMENTS
LIVRAISONS
SOURCE: STATISTICS CANADA CATALOGUE 41-001 MONTHLY
STATISTIQUE CANADA CATALOGUE 41-001 - MENSUEL
Thousands of tons
Milliers de tonnes
9
8
7
6
5
4
3
2
1960
61
62
63
64
65
66
67
68
69
70
71
72
73
74
$\hat{y} = 1.79 + .37 X$
$S_{xy} = \pm .65$

APPENDIX B

B-1 Prospective Canadian Nuclear Plants This Century

B-2 Planned Capacity Additions To Ontario Nuclear Power Program

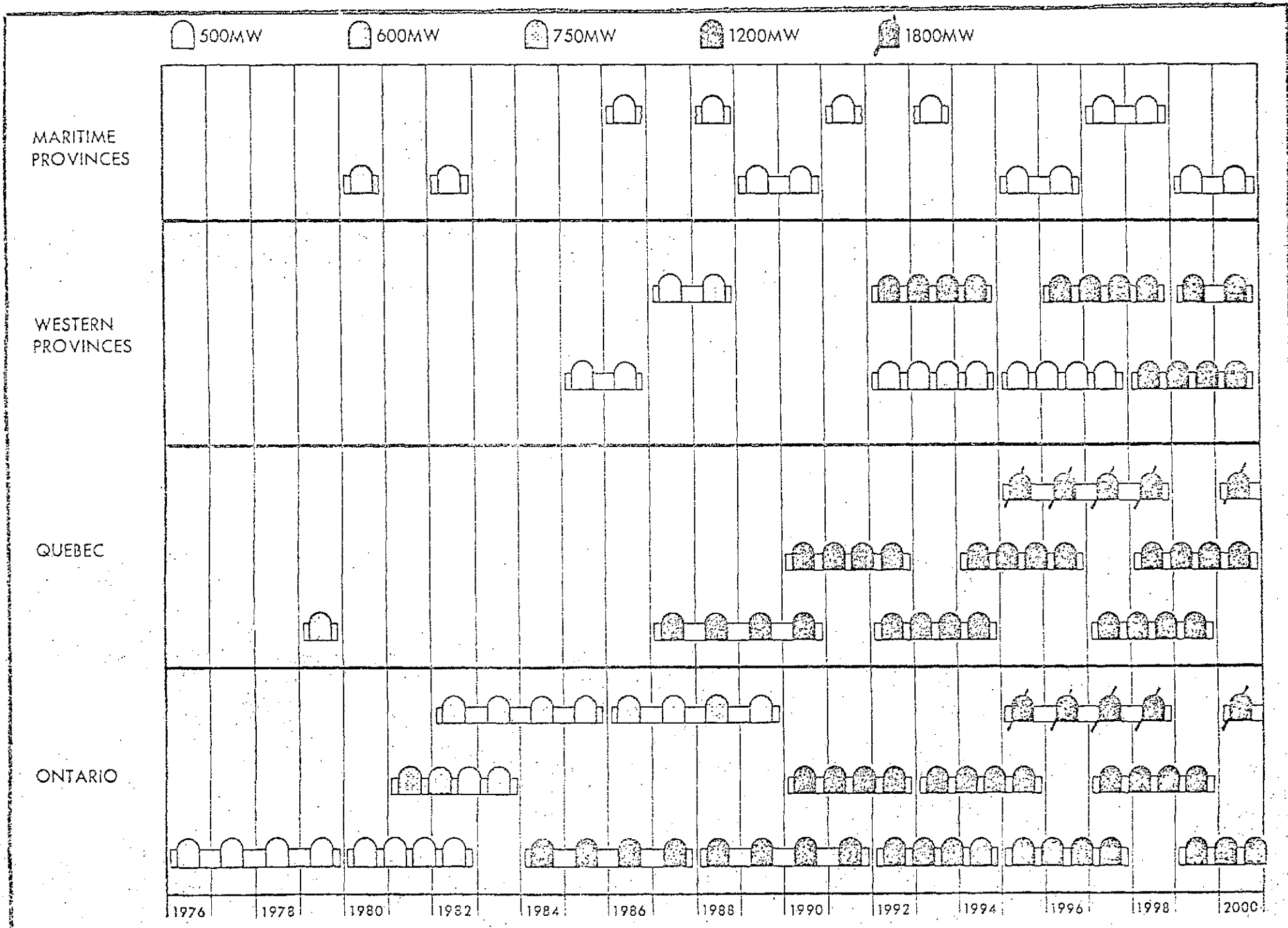


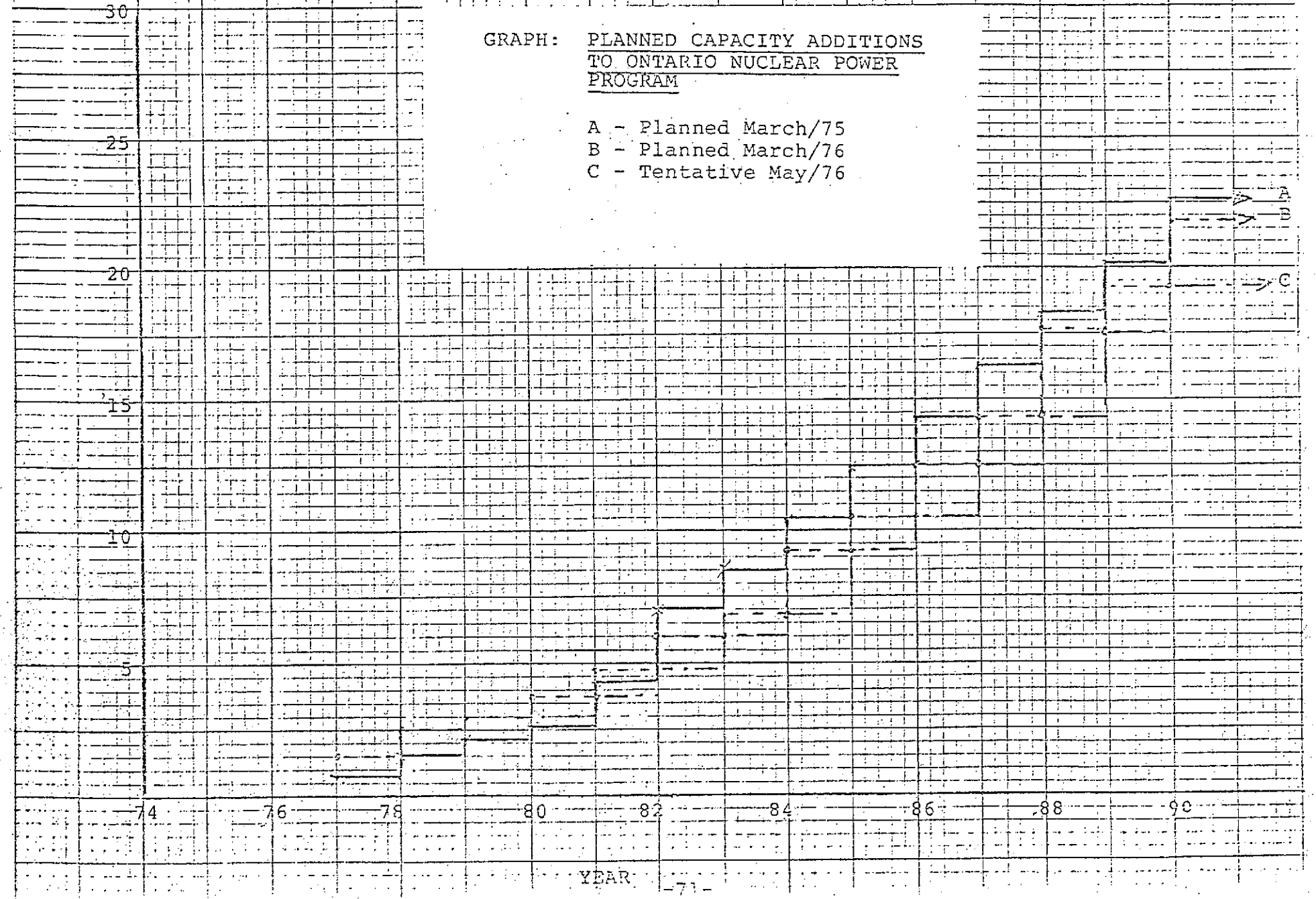
Figure 1

PROSPECTIVE CANADIAN NUCLEAR PLANTS THIS CENTURY

APPENDIX B-2

GRAPH: PLANNED CAPACITY ADDITIONS TO ONTARIO NUCLEAR POWER PROGRAM

A - Planned March/75
B - Planned March/76
C - Tentative May/76



APPENDIX "C"

HISTORICAL MARKET & CAPITAL EXPENDITURE DATA

Petrochemical Products

Value of Shipments ($ millions)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Industrial Chemicals Total	553.8	617.6	685.4	770.0	795.8	846.9	891.4	895.9	951.5	967.2	1,196.8
Ontario	347.7	376.5	423.8	478.4	482.8	526.2	561.4	566.3	588.6	605.6	753.6
Quebec	102.1	124.1	131.0	135.8	144.4	144.1	151.7	148.6	154.7	146.9	172.1
Alberta	49.0	54.2	58.6	72.9	80.5	77.6	71.8	73.5	87.1	95.0	116.3
B.C.	49.7	53.8	59.6	63.7	X	X	60.5	55.7	62.5	64.4	72.4
Others	5.3	9.0	13.4	19.2	88.1	99.0	46.0	51.8	58.6	55.3	82.4
Plastics & Synthetic Resins Total	139.1	155.7	155.5	158.2	161.7	167.6	194.3	193.6	210.6	234.8	302.5
Ontario	47.2	52.6	54.2	X	X	X	X	84.6	97.1	99.0	120.8
Quebec	61.6	73.5	69.7	64.3	64.7	64.2	75.6	78.2	78.1	98.7	139.3
Others	30.3	29.6	31.6					30.8	35.4	37.1	42.4
Paint & Varnish Mfg. Total	171.8	183.8	193.6	200.9	213.4	235.9	241.8	247.4	259.2	283.9	322.4
Ontario	97.4	106.2	114.8	117.4	125.6	139.7	143.7	138.3	142.7	161.7	193.1
Quebec	46.1	48.4	49.1	51.7	52.7	57.3	59.2	67.7	73.7	74.9	86.5
Manitoba	7.6	8.0	8.0	7.0	7.9	8.5	8.1	8.7	8.8	4.9	10.8
B.C.	16.9	17.1	17.6	20.2	22.0	24.0	24.5	24.9	27.1	28.8	35.2
Others	3.8	4.1	4.1	4.6	5.2	6.4	6.3	7.8	6.9	13.6	-

Total Value of New Construction Work Performed

Oil Refineries ($ millions)

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Ontario	7.1	17.4	35.2	14.2	39.6	17.2	15.7	47.4	45.9	49.9	65.4	165.3
Quebec	6.6	11.0	5.9	12.0	48.4	36.5	53.0	45.9	48.5	31.8	50.4	61.0
Alberta	3.0	3.4	.7	2.0	1.8	3.6	.02	-	-	-	-	-
Manitoba	-	-	-	-	-	-	.9	.8	1.2	.5	.8	2.0
Saskatchewan	.3	.4	.7	.8	.6	.3	.4	.3	.2	.2	1.4	.5
British Columbia	1.5	1.7	4.3	11.2	9.7	10.2	3.9	5.5	8.7	5.5	8.7	30.2

Total Value of New Construction Work Performed

Electric Power Construction ($ millions)

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Ontario	87.9	115.2	148.4	168.4	216.7	233.3	302.4	340.1	318.6	329.3	459.1	600.3
Quebec	250.5	186.1	302.4	296.4	104.6	187.7	217.2	281.1	328.7	417.6	477.2	790.7
Alberta	17.7	20.5	17.4	23.9	42.4	39.1	64.5	80.6	79.1	67.0	113.9	142.6
Manitoba	29.9	21.2	29.4	54.0	135.8	160.8	107.1	92.6	74.6	149.0	148.5	142.1
Saskatchewan	22.4	23.4	36.4	44.0	35.7	25.7	15.0	12.9	11.7	13.8	23.2	33.6
British Columbia	39.9	27.5	139.7	147.4	105.4	72.4	194.7	183.4	163.3	247.7	310.7	373.0

Total Value of New Construction Work Performed

Electric Power Construction ($ millions)

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Ontario	87.9	115.2	148.4	168.4	216.7	233.3	302.4	340.1	318.6	329.3	459.1	600.3
Quebec	250.5	186.1	302.4	296.4	104.6	187.7	217.2	281.1	328.7	417.6	477.2	790.7
Alberta	17.7	20.5	17.4	23.9	42.4	39.1	64.5	80.6	79.1	67.0	113.9	142.6
Manitoba	29.9	21.2	29.4	54.0	135.8	160.8	107.1	92.6	74.6	149.0	148.5	142.1
Saskatchewan	22.4	23.4	36.4	44.0	35.7	25.7	15.0	12.9	11.7	13.8	23.2	33.6
British Columbia	39.9	27.5	139.7	147.4	105.4	72.4	194.7	183.4	163.3	247.7	310.7	373.0

Total Value of New Construction Work Performed

Industrial ($ millions)

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Ontario	199.0	265.6	402.2	326.4	227.2	270.0	413.6	277.2	270.6	342.4	485.4	561.1
Quebec	103.1	144.3	153.8	136.3	122.1	129.9	113.5	160.4	205.6	306.5	390.2	367.9
Atlantic Provinces	40.9	51.6	83.8	54.8	34.4	48.3	77.8	143.4	52.1	51.3	56.4	69.6
Alberta	15.4	16.5	12.5	18.5	19.1	32.9	22.8	25.7	51.4	63.1	48.9	56.8
Manitoba	20.7	22.6	28.1	27.5	38.3	70.9	38.8	43.7	16.0	26.1	24.6	22.0
Saskatechwan	16.4	27.7	38.5	48.9	31.1	18.9	10.9	6.9	7.0	14.4	22.5	16.1
British Columbia	61.4	96.8	106.8	72.7	77.0	117.2	131.9	163.4	103.6	84.1	108.9	130.6

PRIVATE AND PUBLIC INVESTMENT IN CANADA -- ORIGINAL DATA
SUMMARY BY SECTORS, CANADA — TOTAL SECTIONS 1 TO 12

TABLE 1.13

CONSTRUCTION				MACHINERY + EQUIPMENT				SUB-TOTAL				YEAR
I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	T(T)	M(T)	P(T)	A(T)	(T)
5102.0	5406.0	5283.0	5301.0	2367.0	2592.0	2617.0	2723.0	7529.0	7998.0	7901.0	8024.0	56
5596.0	5823.0	5921.0	5784.0	2947.0	2953.0	2800.0	2935.0	8533.0	8776.0	8721.0	8717.0	57
5991.0	6029.0	5996.0	5830.0	2530.0	2497.0	2462.0	2534.0	8521.0	8525.0	8417.0	8364.0	58
5816.0	5979.0	5798.0	5709.0	2459.0	2566.0	2613.0	2708.0	8321.0	8545.0	8411.0	8417.0	59
5942.0	5822.0	5497.0	5453.0	2828.0	2890.0	2713.0	2809.0	8770.0	8712.0	8200.0	8262.0	60
5669.0	5773.0	5574.0	5516.0	2647.0	2657.0	2535.0	2654.0	8336.0	8430.0	8109.0	8172.0	61
5862.0	5921.0	5842.0	5787.0	2734.0	2859.0	2896.0	2928.0	8596.0	8780.0	8738.0	8715.0	62
6060.0	6188.0	6149.0	6157.0	3024.0	3153.0	3163.0	3236.0	9084.0	9341.0	9312.0	9393.0	63
6665.0	7102.0	7011.0	7004.0	3419.0	3709.0	3816.0	3940.0	10084.0	10811.0	10827.0	10944.0	64
8073.0	8355.0	8201.0	8115.0	4232.0	4491.0	4597.0	4750.0	12305.0	12846.0	12798.0	12865.0	65
9180.0	9395.0	9346.0	9283.0	5366.0	5629.0	5451.0	5607.0	14546.0	15024.0	14897.0	14890.0	66
9455.0	9712.0	9486.0	9446.0	5648.0	5908.0	5688.0	5874.0	15103.0	15520.0	15174.0	15320.0	67
10178.0	10255.0	10136.0	9989.0	5623.0	5783.0	5542.0	5546.0	15802.0	16038.0	15678.0	15535.0	68
11054.0	11384.0	11077.0	10824.0	6012.0	5972.0	5940.0	6103.0	17046.0	17356.0	17017.0	16927.0	69
11440.0	11556.0	11211.0	11319.0	6425.0	6609.0	6429.0	6479.0	17865.0	17965.0	17640.0	17798.0	70
12578.0	12849.0	13114.0	13274.0	6643.0	6773.0	6574.0	6911.0	19321.0	19622.0	19688.0	20184.0	71
13635.0	13767.0	14209.0	14470.0	7075.0	7384.0	7579.0	7748.0	20760.0	21151.0	21877.0	22219.0	72
15092.0	15644.0	16.369.0	16952.6	8661.0	9119.0	9172.0	9665.5	23753.0	24763.0	26131.0	26618.1	73
19589.0	20303.0	21498.2	**	10729.0	11274.0	11952.7	**	30318.0	31577.0	32450.9	**	74
23079.5	24116.5	**	**	13801.9	14056.1	**	**	36881.4	37191.6	**	**	75

NOTES. I=INTENTIONS, M=REVISED INTENTIONS, P=PRELIMINARY, A=ACTUALS. ALL DATA IS IN MILLIONS OF DOLLARS
** MEANS DATA NOT AVAILABLE

PRIVATE AND PUBLIC INVESTMENT IN CANADA -- ORIGINAL DATA
SUMMARY BY SECTORS, CANADA — TOTAL BUSINESS

TABLE 1.14

CONSTRUCTION				MACHINERY + EQUIPMENT				SUB-TOTAL				YEAR
I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	T(T)	M(T)	P(T)	A(T)	(T)
2245.0	2429.0	2390.0	2435.0	2254.0	2475.0	2492.0	2601.0	4499.0	4903.0	4882.0	5035.0	56
2868.0	3029.0	3055.0	2922.0	2815.0	2822.0	2673.0	2801.0	5683.0	5846.0	5728.0	5723.0	57
2729.0	2680.0	2509.0	2577.0	2382.0	2340.0	2299.0	2373.0	5111.0	5020.0	4907.0	4950.0	58
2402.0	2514.0	2362.0	2350.0	2285.0	2389.0	2447.0	2543.0	4687.0	4893.0	4809.0	4893.0	59
2468.0	2491.0	2523.0	2326.0	2645.0	2699.0	2535.0	2633.0	5113.0	5190.0	4858.0	4959.0	60
2273.0	2374.0	2350.0	2390.0	2445.0	2446.0	2348.0	2451.0	4718.0	4820.0	4698.0	4841.0	61
2331.0	2335.0	2373.0	2301.0	2506.0	2617.0	2660.0	2695.0	4837.0	4952.0	5033.0	5036.0	62
2526.0	2543.0	2522.0	2533.0	2782.0	2902.0	2926.0	2992.0	5308.0	5445.0	5448.0	5525.0	63
2749.0	3058.0	3015.0	3025.0	3154.0	3426.0	3550.0	3660.0	5903.0	6484.0	6565.0	6685.0	64
3419.0	3626.0	3546.0	3621.0	3951.0	4188.0	4280.0	4431.0	7370.0	7814.0	7826.0	8052.0	65
4072.0	4376.0	4347.0	4390.0	5012.0	5255.0	5161.0	5401.0	9084.0	9631.0	9508.0	9781.0	66
4246.0	4390.0	4174.0	4256.0	5250.0	5389.0	5262.0	5451.0	9496.0	9779.0	9436.0	9709.0	67
4144.0	4262.0	4200.0	4227.0	5189.0	5344.0	5132.0	5091.0	9333.0	9606.0	9332.0	9318.0	68
4513.0	4821.0	4376.0	4398.0	5531.0	5663.0	5530.0	5689.0	10044.0	10394.0	9906.0	10087.0	69
5025.0	5117.0	4902.0	5085.0	6011.9	6197.0	6008.3	6063.0	11036.0	11314.0	10910.0	11148.0	70
5439.0	5575.0	5588.0	5607.0	6172.0	6284.0	6194.0	6403.0	11611.0	11859.0	11782.0	12010.0	71
5695.0	5809.0	5821.0	5926.0	6528.0	6636.0	6557.0	6706.0	12223.0	12445.0	12377.0	13132.0	72
6973.0	6857.0	7041.0	7049.7	8038.0	8494.0	8562.0	8927.4	14811.0	15351.0	15602.0	16127.1	73
8494.0	8940.0	8794.9	**	10094.0	10604.0	11166.8	**	18583.0	19544.0	19951.6	**	74
10667.2	10994.5	**	**	12899.7	13177.5	**	**	23566.9	24172.0	**	**	75

PRIVATE AND PUBLIC INVESTMENT IN CANADA -- ORIGINAL DATA
MANUFACTURING,CANADA — PETROLEUM AND COAL PRODUCTS — TABLE 3.18

CONSTRUCTION				MACHINERY + EQUIPMENT				SUB-TOTAL				YEAR
I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	(T)
95.2	84.5	89.2	83.4	16.9	23.3	15.3	9.1	112.1	107.8	105.5	93.0	56
93.5	111.4	119.5	119.4	12.3	14.8	8.9	10.6	105.8	126.2	128.4	130.0	57
140.3	125.7	138.6	138.0	9.9	11.1	10.8	7.3	150.2	136.8	149.4	143.3	58
123.7	123.0	105.1	105.2	9.2	9.8	11.7	12.5	132.9	132.8	116.8	121.7	59
95.9	93.6	87.8	51.9	6.5	9.2	8.4	7.8	102.4	102.8	96.2	59.7	60
104.6	115.0	30.6	27.9	5.9	8.1	4.2	4.0	110.5	123.7	34.8	31.9	61
52.6	55.7	49.7	56.8	13.9	14.9	9.0	8.8	66.5	70.6	58.7	65.6	62
45.7	43.0	42.7	37.9	9.9	9.9	8.0	8.6	55.2	52.9	50.7	46.5	63
19.5	20.3	19.2	20.2	6.0	6.9	4.4	4.2	25.5	27.2	23.6	24.4	64
37.1	49.7	29.3	30.3	6.8	6.9	9.3	10.3	43.9	56.6	39.5	40.6	65
58.4	70.0	56.1	55.5	11.7	12.7	9.6	9.6	70.1	82.7	65.7	65.1	66
58.2	97.9	78.2	78.8	13.4	17.2	18.4	21.4	67.6	115.1	96.6	100.2	67
99.6	111.6	97.5	98.9	25.2	32.8	30.0	28.7	124.8	144.4	127.5	127.6	68
146.8	131.4	119.5	116.9	32.8	32.7	15.0	12.9	179.6	164.1	134.5	129.8	69
189.6	215.8	220.6	213.7	13.7	14.9	13.5	17.4	203.3	230.7	234.1	231.1	70
232.6	233.7	194.2	211.3	34.5	23.9	28.6	20.1	267.1	257.5	224.8	231.4	71
262.6	238.7	211.8	214.0	19.2	21.3	19.7	29.8	281.8	260.0	231.5	243.8	72
301.2	309.9	307.7	229.7	12.7	20.5	12.6	89.1	313.9	330.4	314.3	318.8	73
452.8	1469.1	315.4	**	25.3	28.3	92.2	**	478.1	497.4	407.6	**	74
362.8	374.5	**	**	80.7	89.9	**	**	443.5	464.2	**	**	75

NOTES. I=INTENTIONS, M=REVISED INTENTIONS, P=PRELIMINARY, A=ACTUALS. ALL DATA IS IN MILLIONS OF DOLLARS
** MEANS DATA NOT AVAILABLE

PRIVATE AND PUBLIC INVESTMENT IN CANADA -- ORIGINAL DATA
MANUFACTURING,CANADA — CHEMICAL AND CHEMICAL PRODUCTS — TABLE 3.19

CONSTRUCTION				MACHINERY + EQUIPMENT				SUB-TOTAL				YEAR
I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	(T)
71.0	54.6	47.4	57.9	94.2	85.5	75.1	87.0	165.2	140.1	122.5	144.9	56
45.7	42.3	66.5	65.6	92.6	92.8	82.7	84.1	139.3	135.1	149.2	149.7	57
52.1	46.8	47.8	43.1	97.3	82.4	75.5	73.5	149.4	129.2	123.3	116.6	58
24.0	31.6	24.4	24.5	85.5	65.0	49.7	56.5	109.5	96.6	74.1	81.0	59
34.0	34.0	33.9	34.0	86.6	79.1	76.4	72.1	120.6	114.1	110.3	107.0	60
43.4	41.7	34.6	35.4	112.0	105.4	89.4	90.3	155.4	147.1	124.0	125.7	61
41.3	40.5	45.6	40.1	82.4	73.5	55.5	59.9	123.7	114.0	99.1	100.0	62
42.1	44.0	36.8	39.5	89.4	87.5	80.9	78.5	131.5	131.5	117.7	118.0	63
52.6	47.9	44.6	42.9	93.4	126.4	91.2	101.4	122.0	174.3	134.7	143.3	64
93.1	89.7	76.2	76.7	216.2	203.9	192.9	206.3	309.3	293.6	269.1	279.5	65
81.4	77.7	75.4	76.0	220.5	227.3	201.9	208.9	301.9	305.0	277.3	284.9	66
55.1	79.1	63.4	78.7	210.9	202.4	201.6	191.6	266.0	281.5	265.0	270.3	67
99.7	78.6	86.7	134.1	255.7	229.7	220.5	157.8	355.4	309.3	307.2	291.9	68
40.8	74.8	111.1	119.4	153.5	162.7	111.7	116.1	194.3	237.5	222.8	236.5	69
146.8	131.1	126.5	132.2	129.1	139.9	132.8	129.3	275.9	271.0	259.3	261.5	70
127.4	117.8	111.4	107.6	114.9	107.4	129.2	120.5	242.3	225.2	237.6	227.9	71
77.5	84.7	70.5	78.1	146.3	152.1	149.9	146.4	223.9	236.7	219.4	219.5	72
85.9	93.3	111.6	100.7	131.9	196.5	177.9	192.6	277.8	289.8	289.5	293.3	73
138.1	206.1	184.3	**	286.0	319.0	412.9	**	424.1	525.1	597.2	**	74
444.5	429.9	**	**	708.5	718.9	**	**	1157.0	1148.8	**	**	75

PRIVATE AND PUBLIC INVESTMENT IN CANADA -- ORIGINAL DATA
MINING, CANADA PETROLEUM AND GAS TABLE 2.4

CONSTRUCTION				MACHINERY + EQUIPMENT				SUB-TOTAL				YEAR
I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	(T)
**	**	**	**	**	**	**	**	**	**	**	**	56
**	**	**	**	**	**	**	**	**	**	**	**	57
**	**	**	**	**	**	**	**	**	**	**	**	58
**	**	**	**	**	**	**	**	**	**	**	**	59
**	**	**	**	**	**	**	**	**	**	**	**	60
**	**	**	**	**	**	**	**	**	**	**	**	61
**	**	**	**	**	**	**	**	**	**	**	**	62
**	**	**	233.9	**	**	**	55.4	**	**	**	269.8	63
**	**	273.5	266.7	**	**	38.4	36.6	**	**	313.3	303.3	64
287.6	325.8	373.0	418.4	33.3	38.5	24.5	19.2	321.9	364.3	398.4	437.6	65
428.1	442.5	437.0	449.4	28.2	30.7	46.4	54.2	456.3	473.2	483.4	503.6	66
429.0	461.4	415.0	403.1	78.7	96.7	89.4	71.8	507.7	558.1	503.4	474.8	67
448.0	441.8	419.5	407.4	51.2	59.5	51.3	58.0	499.2	501.3	470.2	465.4	68
483.5	509.3	462.2	465.3	80.1	96.6	91.7	76.6	572.6	605.9	553.9	541.9	69
530.1	569.7	546.3	552.6	81.0	72.8	71.3	86.2	620.1	642.5	617.6	638.8	70
606.4	639.5	646.1	638.4	89.6	82.8	87.1	101.3	696.0	722.3	733.2	740.7	71
677.0	693.7	731.8	729.3	57.5	62.5	77.4	91.2	734.6	756.2	809.0	820.5	72
833.3	830.8	877.6	951.7	85.9	80.1	84.3	83.4	919.2	920.9	961.9	935.1	73
1130.1	1065.3	1040.0	**	196.7	201.1	193.7	**	1326.8	1266.4	1233.7	**	74
1263.1	1446.7	**	**	145.1	221.2	**	**	1408.2	1637.9	**	**	75

NOTES. I=INTENTIONS, R=REVISED INTENTIONS, P=PRELIMINARY, A=ACTUALS. ALL DATA IS IN MILLIONS OF DOLLARS
** MEANS DATA NOT AVAILABLE

PRIVATE AND PUBLIC INVESTMENT IN CANADA -- ORIGINAL DATA
MINING, CANADA OTHER MINING TABLE 2.5

CONSTRUCTION				MACHINERY + EQUIPMENT				SUB-TOTAL				YEAR
I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	I(T)	M(T)	P(T)	A(T)	(T)
**	**	**	**	**	**	**	**	**	**	**	**	56
**	**	**	**	**	**	**	**	**	**	**	**	57
**	**	**	**	**	**	**	**	**	**	**	**	58
**	**	**	**	**	**	**	**	**	**	**	**	59
**	**	**	**	**	**	**	**	**	**	**	**	60
**	**	**	**	**	**	**	**	**	**	**	**	61
**	**	**	**	**	**	**	**	**	**	**	**	62
**	**	**	19.1	**	**	**	42.8	**	**	**	61.9	63
**	**	**	31.4	**	**	45.5	48.0	**	**	77.9	89.5	64
38.9	48.0	53.3	58.9	27.8	30.6	46.0	37.6	66.7	78.6	99.3	96.4	65
82.4	85.1	101.1	107.3	86.7	85.0	71.7	70.5	169.1	170.1	172.8	177.8	66
112.1	92.3	110.0	121.1	106.0	102.7	84.7	85.4	218.1	195.0	194.7	206.5	67
86.6	68.6	102.1	110.2	111.5	128.7	136.6	126.4	176.1	192.2	238.7	236.6	68
78.6	74.0	100.8	128.1	85.9	106.0	111.5	113.8	160.5	180.6	177.9	242.0	69
68.9	59.1	83.3	107.9	98.1	136.3	111.6	115.9	167.0	195.4	174.9	223.8	70
67.9	67.3	85.0	84.6	105.0	109.0	94.4	105.6	160.9	176.3	159.8	190.2	71
45.6	54.7	47.8	59.8	63.0	77.7	80.1	91.3	109.6	132.4	127.9	141.1	72
52.2	65.2	85.0	87.5	82.7	80.0	90.0	79.7	134.9	145.2	145.0	167.2	73
105.9	103.6	109.9	**	111.0	138.9	142.2	**	216.9	242.3	252.1	**	74
116.8	100.6	**	**	174.5	166.6	**	**	291.3	269.2	**	**	75