CLEAN ENVIRONMENT COMMISSION

REPORT ON

PRECISE-TO-FORM CASTINGS INC.

INVESTMENT CASTING FOUNDRY OPERATION

AUGUST 17, 1988

TABLE OF CONTENTS

FIGURE

APPENDIXES

CLEAN ENVIRONMENT COMMISSION REPORT ON PRECISE-TO-FORM CASTINGS INC.

BACKGROUND

On March 8, 1988 Precise-to-Form Casting Inc (PTF) registered a proposal to operate a foundry to manufacture investment castings at 19 Henlow Bay in the West Fort Garry Business Park in the City of Winnipeg. Due to the proclamation of the new Environment Act on April 1st, there was insufficient time to process the application under that Act. The proposal was subsequently advertised by the Environment Department under the Environment Act and a considerable number of concerns were received from residents of adjacent residential subdivisions about possible air pollution from the proposed operation.

On May 27th the Commission was requested by the Minister of Environment and Workplace Safety and Health to hold a hearing to consider the proposal and provide a report on the matter subsequent to the hearing under Section 7 (3) of the Act. Arrangements were made to hold the hearing at 7 p.m. June 27, 1988 in the South Winnipeg Technical Centre, a location near the PTF building and central to the residential areas from which concerns had been received. The hearing was advertised in the June 13, 1988 edition of the Winnipeg Free Press and each person who had previously registered a concern with the Department was notified by letter of the hearing.

On June 17, 1988 the Commission received a copy of a letter from PTF to the Environment Department enclosing an environmental impact statement (EIS). Copies of this report were immediately forwarded to the citizens who had registered concerns.

On June 23rd, in response to a request from the Commission for information, the Commission was apprised by the Department of Environment Planning of the City of Winnipeg that the P.T.F. Castings Inc. premises were located on property zoned M2-Limited Industrial District under zoning By-Law number 1800 and that the use proposed by P.T.F. conformed to the M2 regulations. As such, an interim occupancy permit had been issued on June 9, 1988 by the City.

On June 22, Environmental Control Services provided a precis of the Company's environmental impact assessment with comment regarding the discharge of contaminants expected from the operation. On June 27, 1988, Wardrop Engineering Inc., Consultant to PTF, sent the Commission a letter reporting on potential emissions from PTF Castings Inc. and a summary of the results of their investigations on behalf of the Company. Copies of these two documents were distributed to attendees at the hearing.

HEARING:

The hearing was held at the South Winnipeg Technical Centre at 7 p.m., June 27 with approximately 100 persons in attendance.

PROPONENTS POSITION

The position of Precise-to-Form Castings Inc. was presented by Messrs A.S. Leach, Board Chairman, A.N. Vesuwalla, President, G. Schofield, Chief Engineer as well as Mr. G.D. Guest of Wardrop Engineering Inc, Consultants acting on behalf of the Company. The Wardrop submission took into account a telephone survey of some 6 investment casting firms at other locations in North America and measures taken to regulate contaminants.

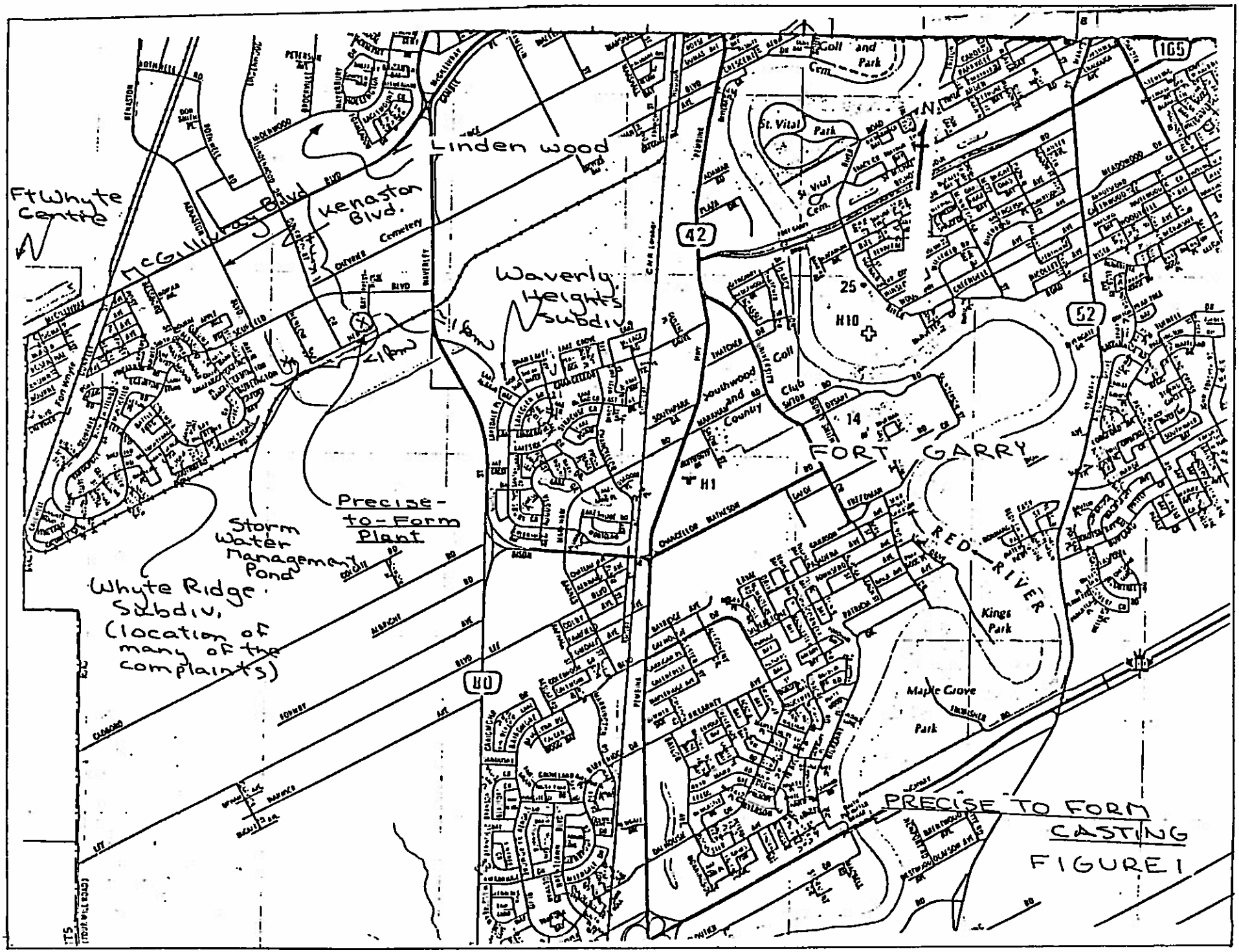
The Company location is in a new industrial subdivision in west Fort Garry (figure 1). The Company was formed in 1987 from shareholders who are primarily Winnipeg based. The area is zoned M2 which permits foundry operations. An occupancy permit has been received from the Winnipeg Planning Department. The building, parking lot surfacing and landscaping is virtually complete. The equipment has been delivered and is being installed preparatory to start-up this summer.

The Company will be producing exceptionally high quality castings of components for such purposes as jet engine parts and artificial limb elements. This operation at present will be casting ferrous and aluminum products. The method being used is known as investment casting.

In this casting method a mold or die of the desired finished product is initially manufactured. Wax is then injected into the die to make a wax copy of the finished product. The wax pattern is removed from the die and is dipped into a ceramic slurry, coated with a fine resin sand, and then dried. This step is repeated until a self supporting shell 3/16 to 5/8 inches (5-16 mm) thick is formed. This is then autoclaved to melt the wax leaving the ceramic shell which contains a cavity of the exact shape of the finished product. The ceramic shells are fired to remove any residual wax. Molten metal is poured into the heated ceramic shell mold. The mold is cooled; the shell is broken and the casting is cleaned by shot blasting. The individual casting are removed and subject to secondary operations such as heat treatment, straightening, machining and inspection.

Infrequently some complex castings require that an additional soluble wax core be used. When utilized, this core is subsequently dissolved by using a 0.1N (3.7%) hydrochloric acid solution.

Perhaps even less frequently a ceramic core will have to be used in the production of a complex casting. Conventional methods such as shot blasting cannot be used to remove this core and therefore a leaching process is employed using a warmed, dilute solution of sodium hydroxide.


Ft Whyte Centre
McGillivray Blvd
Kenaston Blvd.
Linden Wood
Waverly Heights Subdiv
Precise-to-Form Plant
Storm Water Management Pond
Whyte Ridge Subdiv. (location of many of the complaints)
Fort Garry
Red River
Kings Park
Maple Grove Park
St. Vital Park
St. Vital Cem.
Calvary Cemetery
Fort Garry Golf Club
Southwood Golf Course
H1
H10
PRECISE TO FORM CASTING
FIGURE 1

Potential Emissions

(a) Hydrochloric Acid Fumes.

As noted, a IN hydrochloric acid solution (3.7%) will be used to dissolve soluble wax cores as required. Any small amount of hydrochloric acid fumes are not directly vented to the outside and will be diluted with the general plant air before discharge from the building. Calculations based on vapor pressure of the acid solution indicate that acid vapor emissions would be only 10% of the Provinced Ambient Air Guildelines (100 micrograms per cubic metre) for hydrochloric acid based on a worst case scenario, i.e. this calculation assumes that the fumes would be allowed to build up in the plant over an 8 hour day before exhausting them to the atmosphere. Approximately 10 litres of concentrated hydrocloric acid will be stored on site at any one time.

(b) Sodium Hydroxide Fumes

A dilute sodium hydroxide solution at temperatures of 60°C will be used to leach ceramic cores as required. Under these conditions it is expected that emissions of sodium hydroxide vapors will be effectively zero. The water vapor from this process will be vented outside.

(c) Other Gases

As part of the ceramic firing process, 2 gas fired furnaces will be used to remove any residual wax from the ceramic shell. Both furnaces are equipped with afterburners to convert the hydrocarbons produced during the wax removal process to carbon dioxide, water vapor and ash.

At the hearing, it was pointed out by a Company representative that in the event that the after burner failed during the emission control cycle on the autoclave that the process would be shutdown.

(d) Particulates

The quantity of particulate matter expected in the discharge is estimated at 60 micrograms per cubic meter, which is approximately 1/4000th of the limit that has been normally established for industries in many orders of the Commission issued under the previous Clean Environment Act for this type of operation in accordance with recommendations of the Environmental Management Division. The level of emission estimated is much lower than the maximum desirable limit established under the Provincial ambient air quality guidelines.

Melting pots on furnaces used to melt aluminum and steel will be open to the indoor atmosphere of the plant. These furnaces emit very low levels of fumes. The process is one only of melting metals and dissipation of metals to the atmosphere will not occur. General plant air is discharged to the atmosphere through roof extraction fans.

Dust produced from shot blasting and grinding is being collected in cyclone type dust collectors to minimize dust emissions into the work area and beyond into the atmosphere (via roof exhaust ducts). Since the nature of the business is to produce high quality investment casting products, it is important to control dust, particularly in the wax dipping and drying rooms. Dust will be collected from the air entering these areas in bag filters and removed off-site to a waste disposal ground.

(e) Odors and Noises

Odors and noises are expected to be absent from this operation. Liquid waste will be neutralized and discharged to the City of Winnipeg wastewater collection system to meet the requirements of the sewer use bylaw of the city.

(f) Solid Waste

All solid waste will be removed by contract to a registered waste disposal ground.

CITIZEN CONCERNS

A considerable number of citizens spoke at the hearing. Many requested additional information of the Company representatives and Environmental Management Division staff or made statements about their concerns. Many of the concerns were repeated in successive statements.

Most of the spokespersons resided in Waverly Heights which is located southeast of the industrial plant. These residents drew particular attention to the direction of prevailing winds with concerns that many residences where located downwind of the industrial park in which the plant is located. There were also a core of residents from Whyte Ridge Subdivision located west of the plant who expressed concern about the proximity of the plant relative to their residences.

Citizen stated that a residential developer had given assurances that industries to be located in the West Fort Garry Industrial Park would be pollution free. There was a concern expressed that this foundry could be the first of many more industries responsible for the emission of pollutants and that while a single plant may not create much of a problem, the cumulative effect of many discharges from several of these plants could adversely impact the nearby residences. In response to this concern, it was noted that

industries emmitting contaminants would have to register under the Environment Act and that the limits imposed would reflect recognition of the discharge of contaminants from multiple sources.

A number of residents were upset that the plant construction had already been virtually completed but the environmental concerns were only now being addressed. Reference was made to the new Environment Act which would in future prevent construction until the environmental licence had been issued. In this particular case, the Company's registration for licensing was made under the former Clean Environment Act before the new Environment Act was proclaimed.

Many of the residents expressed concern about monitoring programs following start-up of the plant. In their view monitoring should be as exhaustive as possible to protect citizens in the nearby residential communities. A view was expressed that personnel other than the Company's should undertake monitoring. There was also a suggestion that the residential area developer should operate continuous monitoring to ensure that industries located within the development were meeting regulated requirements.

There was some criticism of the surveys that Wardrop had undertaken of other precision casting firms in North America. In the view of some, the surveys should have been more detailed and include: information on the location of these plants with respect to surrounding land use; proximity to residences; information on whether the plants or residences were present first; reference to the air quality guidelines or standards in effect in these other jurisdictions (See Appendix A).

Residents were interested in knowing about plans respecting expansion of the operation. The company replied that there were no expansion plans within the next 5 years.

There were also concerns expressed about heavy metals. The Company's representative stated that the casting was limited to steel and aluminum. Molten steel and aluminum would be produced from pure ingots by melting in a furnace. Furnace off-gases would be discharged to the general plant environment and subsequently exhausted from roof vents. Plant personnel reported that there would be very low levels of fumes from melting small quantities of metals and these would be dissipated into the interior of the plant and thereafter to the general outside environment from roof ducts. The representative from the Environment Department confirmed that there should not be a problem with metal fumes at the temperatures required to melt the metals utilized in the plant operation.

ENVIRONMENT DEPARTMENT PRESENTATION

Mr. Larry Strachan, Chief of Environmental Control Programs of the Environmental Management Division, reviewed the proposal as presented by the Company and responded to questions voiced at the hearing. Based upon his understanding of the process and the control equipment, the level of the constituents of concern (NaOH, HCl and particulate matter) should be of the

order as proposed by the Company and their consultants in their environmental impact assessment. He stated that emission levels were expected to be very low from this operation. His expectation was that because of the type and method of melting the metals for casting that this operation should produce no metal emissions.

He felt that although the emission levels were low, there should be monitoring at some regular interval. With regard to monitoring, he noted that the Department would inspect the facility twice annually for compliance but that monitoring would be the responsibility of the Company.

His view was that there will be neither environmental or health problems to the residents in the nearby subdivisions.

COMMISSION FINDINGS

(a) Citizen Concerns

The hearing was attended by a large number of concerned residents from both the Waverley Heights as well as the Whyte Ridge residential subdivisions. These two neighborhoods straddle the industrial subdivision in which the Precise-to-Form operation is located. The housing developments are separated from the plant by approximately one kilometre.

Several citizens complained that the developer of both this business park and some of the residential housing had assured house buyers that only industries or businesses having absolutely no potential for emissions ("pollution free" industries) would be allowed into the industrial park (which has been advertised as a "business park"). The business park has been zoned by the City of Winnipeg for "light industry" which includes foundries as an allowed use. The Company is properly located in accordance with the City zoning and obtained the City's necessary approvals, e.g. building and occupancy permit.

The Commission believes that the logical means of the prevention of any perceived undesirable industries from locating in the business park would primarily lie in the City's zoning of the property. The zoning also specifies the type of operations that are allowed within the designated zone.

It is the Commission's opinion that part of the large public interest and concern probably resulted from the Environment Department's newspaper advertisement announcing the registration of this operation for an environmental license under the new Environment Act. This advertisement (quite corectly) described the operation as a casting foundry utilizing sodium hydroxide and hydrochloric acid in the operation with potential for emission of these chemicals to the atmosphere.

The designation of the operation as a "foundry" may have produced the mental image of a large, ugly factory building discharging large volumes of black smoke through a chimney. This may indeed be the picture of a typical iron foundry of an earlier era. Of course the fact that black smoke will not be emitted from this operation does not in itself present any guarantee that harmful emissions will not be generated; however, the Company representatives explained at the hearing that the high-tech investment casting operation, which has been constructed, bears little resemblance to a typical iron or steel casting foundry operation.

(b) Foundry Operations and Emissions

Under the proposed foundry operation, only pure pre-alloyed metals will be melted in induction or resistance furnaces at much lower temperatures than are necessary for some other foundry operations and without the impurities, fluxes and other additives that are often present. The metals to be utilized in this operation are basically iron and aluminum. Both Company representatives and Environment Department officials noted that fumes from the furnace would be very small and would enter the building workplace initially before eventual exhaust to the atmosphere (the furnaces have no direct roof or wall exhaust). The metals are melted at relatively low temperatures and under these conditions it was the Environment Department officers view that there would be low or no emissions from the furnace operation.

The furnace employed to burn out residual wax is equipped with an afterburner to convert the hydrocarbons into an environmentally innocuous form before discharge to the atmosphere. The proponent agreed that the furnace operation should be discontinued if the afterburner fails during the wax burn-out cycle.

Dilute hydrochloric acid and sodium hydroxide are to be used only when required to remove wax and ceramic from the casting. These operations are not expected to generate any significant emissions which will adversely affect public health or the environment.

The Commission believes that this industrial plant is an exceptionally clean foundry operation and that potentially harmful emissions to the atmosphere will be difficult to detect.

(c) Survey of Other Investments Casting Firms

The Company engineering consultant was in touch with six investment casting companies in other parts of Canada and the United States in an endeavor to generate information concerning the quantity of air emissions from this industry. The results

of the survey indicated that the air emissions were very low and not of the nature of an environmental or health concern. A follow up survey of these same operations by the Commission showed that several of the plants surveyed were located close to residences. In some cases the industry was in place before the residences; in other cases the industry followed the residential development. None of the industry personnel surveyed were aware of environmental problems associated with their operations or of citizen complaints (See Appendix A).

(d) Emission Limit and Monitoring Requirement

Both the Environment Department representative and the citizens felt that the industry should be monitored. Views ranged from continuous to infrequent monitoring. Some citizens suggested that the company, which developed the business park as well as residential areas, should be required to conduct continuous monitoring.

It is the Commission's opinion that only the emission of particulate matter need be regulated. The monitoring of particulate matter must also take into account any metal emissions. The Commission recommends that an initial monitoring be carried out following the start-up of plant operations and that monitoring be done thereafter at a frequency of at least once a year.

COMMISSION RECOMMENDATIONS:

(1) Emissions:

(a) Hydrochloric Acid and Sodium Hydroxide.

As a result of the concentrations employed, temperatures, the physical chemistry of hydrochloric acid and sodium hydroxide and infrequency of use, it is not expected that this acid and base will evolve into the plant atmosphere or subsequently to the exterior of the plant to any significant or perhaps even detectable degree.

It is therefore recommended that a limit for hydrochloric acid and sodium hydroxide is not appropriate or required for this operation.

(b) Particulate Matter and Metals.

Particulate matter from the operation is expected to be less than the maximum acceptable level concentration specified in the "Manitoba Objectives and Guidelines for Various Air Pollutants — Ambient Air Criteria" (.12 micrograms per cubic metre). The normal particulate matter level specified for a new industry in previous

A P P E N D I X A

Report of the Commission's Technical Advisor on Post Hearing Contact with Investment Casting Companies

During the course of the hearing, the Consultant for Precise-to-Form Casting Inc., Mr. Guest, referred to telephone contacts and discussions he had held with management personnel of six investment casting operations at North American locations. The firms were those referred to by Wardrop Engineering Inc., acting on behalf of Precise-to-Form Castings Inc., in a report dated June 27, 1988. These contacts were made in order to identify the character and extent of environmental impacts from the investment casting industry.

At the hearing on June 27th, several concerned citizens felt that the information base received from the six investment casting firms was incomplete and follow up calls should be made to identify some of the following information: proximity of plants to residential areas; whether the industries or the residences were located first; and environmental requirements in these jurisdictions.

The proponent was prepared to authorize his consultant to obtain such additional information and transmit this to the Commission, as had been suggested by the Chairman during the hearing. However, the Commission decided that it would be more appropriate for the Commission to obtain the information by direct contact with the other industries. The Commission, therefore, obtained the names and addresses of the companies from the proponent and the Commission's staff technical advisor, Mr. J.N. Warrener held telephone discussions with appropriate personnel of the six companies that had previously been contacted by the proponent's consultant.

The following is Mr. Warrener's report to the Commission on these discussion with his summary conclusions.

Invest Cast Inc., Minneapolis, Minnesota

I was in touch with Mr. Bill Walker of this firm at (612) 788-6965. The operation is located in Greater Minneapolis, in Worthington, which adjoins the City of Minneapolis to the north west. Up until a few years ago, the business was located in Minneapolis but the plant experienced a fire which necessitated a move. The new location is in an area designated for light industry. This firm is the largest of a number of industries located in this subdivision. There are residences, which were established before the industry located, within a short distance of the plant (approximately 1 block).

I spoke with a Minnesota Pollution Control Agency representative who indicated that this industry did not have an air pollution control permit. At present the industry was considered in a class of small industries awaiting eventual permitting. The Agency representative was not aware of any complaints against the industry.

A P P E N D I X A

Report of the Commission's Technical Advisor on Post Hearing Contact with Investment Casting Companies

During the course of the hearing, the Consultant for Precise-to-Form Casting Inc., Mr. Guest, referred to telephone contacts and discussions he had held with management personnel of six investment casting operations at North American locations. The firms were those referred to by Wardrop Engineering Inc., acting on behalf of Precise-to-Form Castings Inc., in a report dated June 27, 1988. These contacts were made in order to identify the character and extent of environmental impacts from the investment casting industry.

At the hearing on June 27th, several concerned citizens felt that the information base received from the six investment casting firms was incomplete and follow up calls should be made to identify some of the following information: proximity of plants to residential areas; whether the industries or the residences were located first; and environmental requirements in these jurisdictions.

The proponent was prepared to authorize his consultant to obtain such additional information and transmit this to the Commission, as had been suggested by the Chairman during the hearing. However, the Commission decided that it would be more appropriate for the Commission to obtain the information by direct contact with the other industries. The Commission, therefore, obtained the names and addresses of the companies from the proponent and the Commission's staff technical advisor, Mr. J.N. Warrener held telephone discussions with appropriate personnel of the six companies that had previously been contacted by the proponent's consultant.

The following is Mr. Warrener's report to the Commission on these discussion with his summary conclusions.

Invest Cast Inc., Minneapolis, Minnesota

I was in touch with Mr. Bill Walker of this firm at (612) 788-6965. The operation is located in Greater Minneapolis, in Worthington, which adjoins the City of Minneapolis to the north west. Up until a few years ago, the business was located in Minneapolis but the plant experienced a fire which necessitated a move. The new location is in an area designated for light industry. This firm is the largest of a number of industries located in this subdivision. There are residences, which were established before the industry located, within a short distance of the plant (approximately 1 block).

I spoke with a Minnesota Pollution Control Agency representative who indicated that this industry did not have an air pollution control permit. At present the industry was considered in a class of small industries awaiting eventual permitting. The Agency representative was not aware of any complaints against the industry.

I spoke to City officials who were not aware of any complaints.

This particular industry did little casting that required the use of hydrochloric acid. Sodium hydroxide was employed but at significantly higher temperature (500°C) compared to 60°C proposed at Precise-to-Form. A high stack is used to dissipate fumes mostly steam from the sodium hydroxide operation. There is some noise from fans used for cooling and exhaust which I don't believe is a problem. This plant is operated 7 days per week on a 3 shift basis. The plant operation is subject to scrutiny by OSHA (occupational safety and health) and meets their requirements.

Designed Precision Castings Inc., Brampton, Ontario

I spoke with Mr. Mike Holland (416) 453-0421 at this operation. This plant is located in an industrial park designated for light industry. There are residences separated by a city block from the plant site. The operation is not licenced by an environmental agency.

The operator noted that precision casting foundries were very much unlike foundries manufacturing iron castings that employ cupola furnaces charged with pig and scrap iron, coke and limestone, at high charging rates, resulting in serious particulate and gaseous emissions that must be regulated. In their precision casting operations only small amounts of metal are melted in induction furnaces that are virtually smokeless. He noted that the process of removing residual wax from the casting required the use of afterburners to control particulate matter. In his view, there should not be a problem with a new precision casting industry being established because the technology is readily available to regulate any air emissions.

I also spoke to an inspector with the environment department who could find no record of complaints.

Cercor Incorporated, Halton Hills, Ontario

I spoke with Mr. A. Hadley (416) 877-6936 at this operation. This precision casting plant is one of many operated by this Company in both North America and Europe. This operation employs about 150 people and is located in a light industrial park in this relatively small town. The plant has been established at this location for several decades. It is bordered on two sides by other industries and on the remaining two sides by residences. The residences were built at this site recently. The major problem to residents from the industrial park as a whole may be one of noise; however, this foundry is not a significant contributor to this problem. He was very defensive of his own industry, noting that investment casting should not be considered as being comparable to iron and steel foundry operations.

Northern Precision Casting, Lake Geneva, Wisconsin

I spoke with Mr. Gerry Brown (414) 248-4461 at Northern Precision Casting. He was reluctant to provide much information since he had spoken to the Wardrop representative at length. The plant is located in an industrial park and in his view there are no problems with the operation with respect to the environment.

Consolidated Casting Inc., Hutchins, Texas

The spokesman for this operation was Mr. John Roberts (214) 225-7305. Hutchins is a suburb of Dallas. The area in which this plant is located is part of a large industrial park. There are no residences within a mile of the plant. The main air emissions are steam from autoclaving and smoke from burning residual wax from molds the latter of which can be controlled by afterburners. In order to reduce the possibility of corrosion to castings, citric acid rather hydrochloric acid is used in this operation. The costs are somewhat higher with the use of citric acid.

Arwood Corporation, Santa Fe Springs, California

I spoke to Mr. Tom McCann (213) 946-4381 at this operation. Santa Fe Springs is a part of Los Angeles near the eastern border. This plant has been located in this area for only a few years. There was no difficulty establishing the facility which is located in an R5 or R6 area, which is zoned as mixed residential and industrial. The plant has been permitted by the city, county, regional, state and federal authorities. In the view of Mr. McCann, the important component in terms of controlling any possible air pollution is the afterburner on the residual wax burning operation.

In summary, it is my understanding that 4 out of 6 of the plants contacted are located close to residential areas (adjacent to and up to two blocks). In two of the four cases, the industry was located subsequent to the residential housing units whereas in one instance housing units have been built adjacent to the industry.

In all cases, the view was expressed that there was not an air pollution problem and there should not be one, particularly from a new plant which could incorporate new technology that would control air emissions.

The main possible source of emission is in the process consists of burning off the residual wax which process is completely controlled by after burners.

I believe that only the California plant is subject to extensive regulatory authority.

A P P E N D I X B

LIST OF EXHIBITS

1. Submission for Approval of Proposal under the Clean Environment Act by Precise-To-Form Castings Inc. under date of March 8, 1988.

2. Environmental information prepared by Precise-To-Form Castings Inc. under date of June 17, 1988.

3. Memo from Environmental Control Programs to Clean Environment Commission under date of June 22, 1988 RE: Comments on Proponent's Environmental Information Report.

4. Letter to Clean Environment Commission from City of Winnipeg Department of Environmental Planning under date of June 23, 1988 on Building and Occupancy Permit for Precist-To-Form Castings Inc.

5. Letter Report from Wardrop Engineering Inc. to Precise-To-Form Castings Inc. under date of June 27, 1988 RE: Potential Emissions from Precise-To-Form Castings Inc.