PN-ACD-017

WORLD ENVIRONMENT CENTER

UKRAINE

ENERGY CONSERVATION/WASTE MINIMIZATION DEMONSTRATION PROJECT

FACILITY REVIEW AND ASSESSMENT

AT

LAZ - BUS MANUFACTURING PLANT

IN LVIV

USAID/WEC COOPERATIVE AGREEMENT
NO. ANE-0004-A-00-0048-00

World Environment Center
419 Park Avenue South, Suite 1800
New York, New York 10016

JUNE 1998

Project Description	Facility Review & Assessment at Bus Manufacturing Plant
Project Type	Facility Review & Assessment
Country	Ukraine
Industrial Sector	Automobile Industry
Dates	March 28 – April 2, 1998
Funding Source	United States Agency for International Development
Participants	Bus Manufacturing Plant & World Environment Center
Project	Facility Review & Assessment
Business Development	

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I INTRODUCTION

In September 1995, the World Environment Center (WEC) initiated providing technical assistance, training and information dissemination services related to industrial pollution control in Ukraine This activity is performed within the framework of a much broader assistance program to Ukraine funded by the United States Agency for International Development (USAID) and involves a whole spectrum of large scale issues

WEC's program in Ukraine is implemented in two stages as follows

Stage I - called **Demonstration Program** includes a number of Energy Conservation/Waste Minimization Demonstration Projects (EC/WMDP) implemented at various large industrial plants The main goal of this stage is to *demonstrate* to these enterprises the beneficial aspects of a Waste Minimization/Energy Conservation Program Through the *demonstration projects,* an effort is made to encourage enterprises to incorporate such programs into the permanent policy of plant management The intent is, among other things, to demonstrate that pollution prevention and energy conservation programs are not just additional expenses, but help to improve production efficiency and subsequently increase profitability of the enterprises A number of demonstration projects were established at selected plants in the Dnipropetrovsk, Donetsk and Lviv regions Some of them are already completed, others are underway

Stage II - of WEC programs in Ukraine is Facility Review & Assessment and is called the **Impact Program** The intent of this stage is to *disseminate to a much wider audience* energy conservation and waste minimization concepts and the benefits resulting therefrom To further the impact of the demonstration phase, seminars and workshops were held for plant managers from major industrial enterprises In addition, study tours were organized in the U S

Under the Stage I activity, in October 1997, Dr Bohdan Aftanas of the WEC staff visited, among other facilities, the Bus Manufacturing Plant in Lviv, and met with Dr Vasyl Trach, President, and Mr Vasyl Vasylyshyn, Technical Director Both managers expressed interest in WEC's program and requested that they be considered for participation in the Energy Conservation/Waste Minimization Demonstration Project

Subsequently, from March 28 through April 2, 1998, WEC's team visited the Bus Manufacturing Plant with the objective of identifying facilities where the EC/WMDP could be performed and the type of monitoring equipment which will be required to implement the demonstration project

Findings and conclusions resulting from this visit are presented in this report

II EXECUTIVE SUMMARY

A WEC team, consisting of Dr Bohdan Aftanas, Program Manager, Mr Donald Hamaker, P E , Consultant, and Mr Oleh Naumko, WEC coordinator, visited the Bus Manufacturing Plant in the city of Lviv, Ukraine The objective was to identify a viable Energy Conservation/Waste Minimization Demonstration Project within the facility From March 28 to April 2, 1998, the team met with plant officials for this purpose

The Bus Manufacturing Plant (LAZ) is a large joint-stock company with an annual capacity of 8,000 buses of various types However, at the present time, the plant is experiencing an extremely difficult period, and production of buses has fallen drastically During the previous winter, the financial situation has forced the plant to completely suspend all operations, which resumed shortly before the visit of the WEC team

Discussions with the plant management as well as observations made during the tour of the plant facilities, led to the conclusion that due to current circumstances at the plant, establishing an Energy Conservation/Waste Minimization Demonstration project *would not be feasible* Instead, it was decided that WEC's consultant-specialist would assess some production facilities and provide his recommendations for improvement mainly focusing on the painting operation In addition, during this visit several questions such as those concerning sludge disposal and reuse, disposal of waste oil, hydrocarbon emissions, cleaning of spray booths, escape of powders from the painting enclosure, etc were posed by plant personnel to WEC's specialist Specific discussion of those, as well as some other questions and issues including related recommendations, are presented in subsequent chapters of this report Also included with this report is technical information requested by LAZ, which is in the form of catalogs and videocassettes concerning High Pressure Water Jet System at automotive paint shops as practiced in the United States

III FINDINGS

The LAZ Bus Manufacturing Plant is a very large facility located in Lviv, Ukraine which covers 88 4 Hectares (218 4 acres) Total built up area amounts to 215,000 square meters (2,322,000 Square Feet), and is comprised of numerous buildings

The plant was established in 1945 to produce vehicles of various types In the 1950's, LAZ produced buses for the Soviet Union at a rate of approximately 15,000 per year After the Soviet Union breakdown, trolley buses of larger sizes were produced However, market share in Russia and other newly independent states has been greatly reduced

The company is a joint stock company with 66% of the shares owned by the State

Various types of buses (35 different types) both of in-city type, and trolley type are built for domestic use as well as export The present plant capacity of 8,000 buses per year is only being utilized at 1,500 buses per year

At the time of the visit, the plant areas were not heated, (nor the office areas) even though the temperature was near zero degrees centigrade (0°C) It was stated to us that the plant had been shut down for many weeks until one week prior to our visit, because of the low temperatures

The current work force is approximately 5,000 In the past at peak production volumes, the work force had reached 10,000 or more

The plant consists of the following departments

- Press Plant,
- Pipe Department,
- Body Production,
- Painting and Galvanization,
- Assembly,
- Mechanical Processing,
- Plastic and Wood Processing Department, and
- Instruments

Descriptions of two departments of major interest are given below

Body Production Department

The main bodies of the buses are constructed primarily of bare steel The main body panels and underbody members are of welded construction, and are assembled on two (2) conveyors As the bodies are welded and mounted on wheels, they pass through the paint shop on four separate conveyors

Painting Department Basic Processes

- Solvent cleanup (white spirits) manually
- Clean and phosphate treat the bodies in a cleaning chamber, passivate and dry
- Spray primer and apply sealer material – dry at 100°C
- Sand defects, apply first topcoat, dry in oven at 130°C
- Lightly sand, wipe with damp and dry tack rags – dry
- Spray second topcoat, dry in oven at 100°C
- Mask and then spray two tone or other colors and dry in oven (100°C)

Operations in Paint Mix Room

The paint mix room is used only for adding solvent to the paint The mix room was originally installed so as to mix and pump the thinned paint to all points of use in the plant However, at today's reduced volumes of 7 to 8 buses per day, one of the circulating systems is used The small amount of paint needed each day (20-30 gallons) is hand mixed in a drum and transported to the paint shop where it is added to the pressure pots which feed the paint to the spray guns

The paint is received at a viscosity of 50 to 60% volume solids which is normally considered high solids paint However, before using the paint, it is thinned to a viscosity of 20 to 23 seconds (viscosity cup), which is then only in the 30 to 40% volume solids range This reduction is evidently required to allow the paint to flow enough to provide an acceptable finish in the cold environment

Normally, paint is best applied in a temperature range of 70 to 90°F (21 to 32°C) Thus, a much less than favorable condition for applying paint exists at the present time This situation makes it much more difficult to reduce emissions and will be discussed further in the Conclusions and Recommendations section of this report

The main ecological concerns of the Bus Plant appear to center around future problem areas, specifically in the Painting and Galvanization Departments Specific concerns/problems and questions fell in the following categories

1 Liquids are pumped to the Waste Water Treatment Plant Sludge reuse or disposal after separation from the liquids is a major problem

2 Utilization/Disposal of waste oil after separation from the water in the waste treatment plant

3 Hydrocarbon emissions to the atmosphere in the exhaust from the painting area (aerosols was their term for this) These emissions are a result of the atomization of the solvents in the paint during the spray and baking process

4 Cleaning of the interior of spray booths, specifically the grates and wall areas

5 Escape of powders from the powder painting enclosure, and the subsequent clean-up of the powder from the surfaces outside of the spray area

These problem areas were discussed and the WEC team specifically visited these areas of the plant Suggestions were later submitted to follow-up on each of these main issues Each is discussed further in Section IV, Conclusions and Recommendations

IV CONCLUSIONS AND RECOMMENDATIONS

The following recommendations pertain to the major areas of concern as expressed by the Bus Manufacturing Plant

1 ***Determine methods of reusing or disposing of sludge generated through the painting process***

All of the waters that are circulated to the spray booths in the Lviv Bus Plant are collected in tanks beneath the floor The solids that are collected in these waters are carried into holding tanks and then later transferred to the waste water treatment plant The sludge collected has to be disposed of The problem is, there is no legal procedure to dispose of the sludge

In the U S , such sludges are dewatered and then hauled to and disposed of in a hazardous wastes landfill LAZ personnel stated that in the past a certain amount of these sludges was blended back into a paint base, which was then used for very non-critical uses, such as painting fence posts and the like The plant has discontinued this procedure Reuse of paint sludge in the U S is not practiced

The disposal of sludges from spraybooths requires the availability of approved landfills, as well as proper treatment facilities to de-water the sludges to a 95% solids level It is unlikely this could be achieved in the near term At some point in the future, it will be necessary to develop landfills which will conform to regulations

2 ***Utilization/disposal of waste oils from waste treatment***

Another problem at the Plant is the disposal of the waste oils collected in the waste water treatment plant There are two different types of waste oils collected One type is the oils used in the machining area for cutting and working the metal parts This oil has never been mixed with water and can be reclaimed and reused quite simply if it is not mixed with other wastes

The second kind of collected oils are that which has been washed off the metal parts before painting This oil is collected with the waste waters from the cleaning baths in the paint shop or galvanizing areas, and is separated from the water in a type of pressure cooker The oil layer is a mixture of many types of oils and greases, and is unusable for any function in the plant At the present time, there is 24 tons of this type of scrap oil on hand, and is being generated at a rate of 2 tons per year at the present rate of production

A suggestion was made to study a means of selling or giving this type of oil to some source which could use the oil for the heat value (BTU) In the U S , many incinerators or boilers can burn waste oils and solvents, assuming there is a sufficient BTU content

It was agreed that this is not a suitable subject for a demonstration project

3 ***Reducing hydrocarbon emissions from the paint shop***

This subject was of special interest to LAZ management, as they are aware that at some point emission limits will be imposed At today's production volumes, there does not appear to be a large annual amount of emissions

The discussion centered on how the U S has met strict emission limits It was explained that in the U S , each plant is restricted as to the amount of emissions permitted In most cases in the U S , the plants are required to use paint materials which are considered "waterborne equivalent" This equates to a paint which has a solvent content of 2 8 lbs per gallon There are three methods which have been used to meet these limits, and are also applicable to any other plant These methods are

- Use paint materials with lower solvent content (high solids, waterborne paints or electrophoretic application of primers)
- Apply the paints in a much more efficient manner (high transfer efficiency)

With higher transfer efficiency, there is less paint used, thus less waste material, thus lesser emissions Various means of increasing transfer efficiency are available, such as automatic application, electrostatic application and robotic application

- Capture emissions from higher emitting zones of spray booths or paint ovens and burning the heavier solvent-laden exhausted air in a thermal incinerator

In the U S all three methods have been used, and some applications are listed below

1 Electrophoretic application of primers is universal in all car plants,

2 A second waterborne primer-surfacer is usually applied automatically and is usually applied electrostatically,

3 Topcoats (many of which were lacquers in the past) have been replaced with high solids enamels (applied at 50% volume solids level),

4 Widespread use of electrostatic applicators using automatic machines or robots has become a way of life in all car-producing plants, and

5 Whenever material changes or transfer efficiency improvements will not meet the limitations, then thermal incineration may be necessary Usually incineration is the more expensive option, and is used only when all other methods have failed to meet the requirements

The LAZ technical personnel stated they were using high solids paints (40-50% volume solids) as received from their supplier However, it is necessary to add more solvent to allow the paint to flow when applied in their low temperatures Accordingly, the plant did not want to pursue the option of changing materials The second option (increasing transfer efficiency) as well as the third option (thermal incineration) was considered to be too expensive and not feasible

4 Cleaning paint overspray from grates and walls of spraybooths

This subject was found to be of great interest to the Bus Plant, since they have many large spray booths in the paint shop The floors of these booths consist of steel gratings The paint overspray builds up on these grates, and over a period of time becomes very heavy, even to the point of restricting the flow of air through the grates The present practice is to remove this overspray by mechanically chipping and scraping the grates This is a very inefficient and difficult job The Plant expressed interest in some alternative method to remove the paint buildup

One method widely used in the U S is to use a high pressure water spray to knock off all the overspray quickly and easily A high pressure pump is used to build up the

water pressure to a range of 8,000 to 9,000 psi This high pressure is applied either through a hand held wand, or in the case of floor grates, by a lawn mower type of mechanism This device is guided over the grates, and the water is sprayed down below a housing and knocks the paint buildup off the grates This method is very efficient and is widely used throughout the U S plants

Brochures and catalogs from the U S supplier of this type of equipment (National Liquid Blasting – called NLB Corporation) will be given to the plant In addition, two videotapes supplied by the NLB Corporation will be forwarded to LAZ (See Appendix)

5 ***Reducing the escape of powders from the Power application booth***

Many of the seat components which are made of round-stock pipe weldments, are ideally suited to receiving electrostatically charged powder onto all surfaces This part then passes through a very hot oven (180°C) where the powder is sintered onto the part

The powder is applied through a pair of spinning applicators which create a cloud of powder (electrostatically charged) The powder is attracted to all areas of the part, a very efficient application method

The problem with the powder application operation is that a certain amount of the powder escapes from the booth and collects on the surrounding ledges and floor The loose powder is swept manually and introduced into the booth powder tank This is a very inefficient method, which can introduce dirt into the system

In discussion with the LAZ personnel, we were informed that when the booth was first installed, (by LAZ personnel) it worked much better and they did not experience so much lost powder

In our discussions, it was stressed that there are two very important factors to minimize powder loss These are (1) close silhouettes to minimize powder loss, and (2) proper air balance, so the air movement in the booth is negative, i e gently flowing into the booth, rather than out of the booth It appears that the first action should be to restore the conditions which existed when the system was new Perhaps with a minimum of maintenance, the system has deteriorated to the point where the system is operating at less than maximum efficiency

Another question was brought up on how to pick up the escaped powder and reintroduce it into the system It was suggested the plant could attach a vacuum hose to some of the internal blower motors on the system on the negative side, and pick up the loose powder with the vacuum hose On many systems in the U S , the new powder is added to the system by such a vacuum hose which is placed in the powder

container This works quite well and should serve to vacuum up any loose powder as well

6 *Optimum Paint System*

LAZ personnel asked for a recommendation of the optimum paint system for their product which follows

- The product is a welded, bare steel assembly Two side galvanized steel is the material presently used on essentially all car bodies This provides the ideal surface to resist corrosion

- A cathodic electrophoretic primer coat would be an excellent approach to apply primer to all surfaces of the body This equipment would be quite expensive, especially at the low volumes involved

- The use of a primer-surfacer applied after the electrophoretic primer would provide a fine surface for sanding and preparation for the first coat of topcoat

Note WEC consultant, Donald G Hamaker, discussed painting systems with NLB Corporation and learned that they are doing some work near Moscow, in conjunction with the Haden Corporation who is an international paint equipment supplier The NLB European area sales manager is Ken Dronchi (248-624-5555, ext 162)

The consultant was informed by NLB Corporation that LAZ Bus Manufacturing Plant could install a high pressure water blasting unit for $70,000 to $100,000 USD This would be a basic unit for grate cleaning The unit would consist of a basic high pressure generating unit, two hand held wands and nozzles, plus a lawnmower type spray unit for cleaning grates in position in the booths

Mr Hamaker recommends LAZ work closely with two or more international paint companies and request the companies to submit proposals LAZ could then evaluate each proposal as to economics, suitability and other criteria

Appendix A

Business Cards

THE LVOV BUS PLANT

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MARIYA MYKHALOVNA

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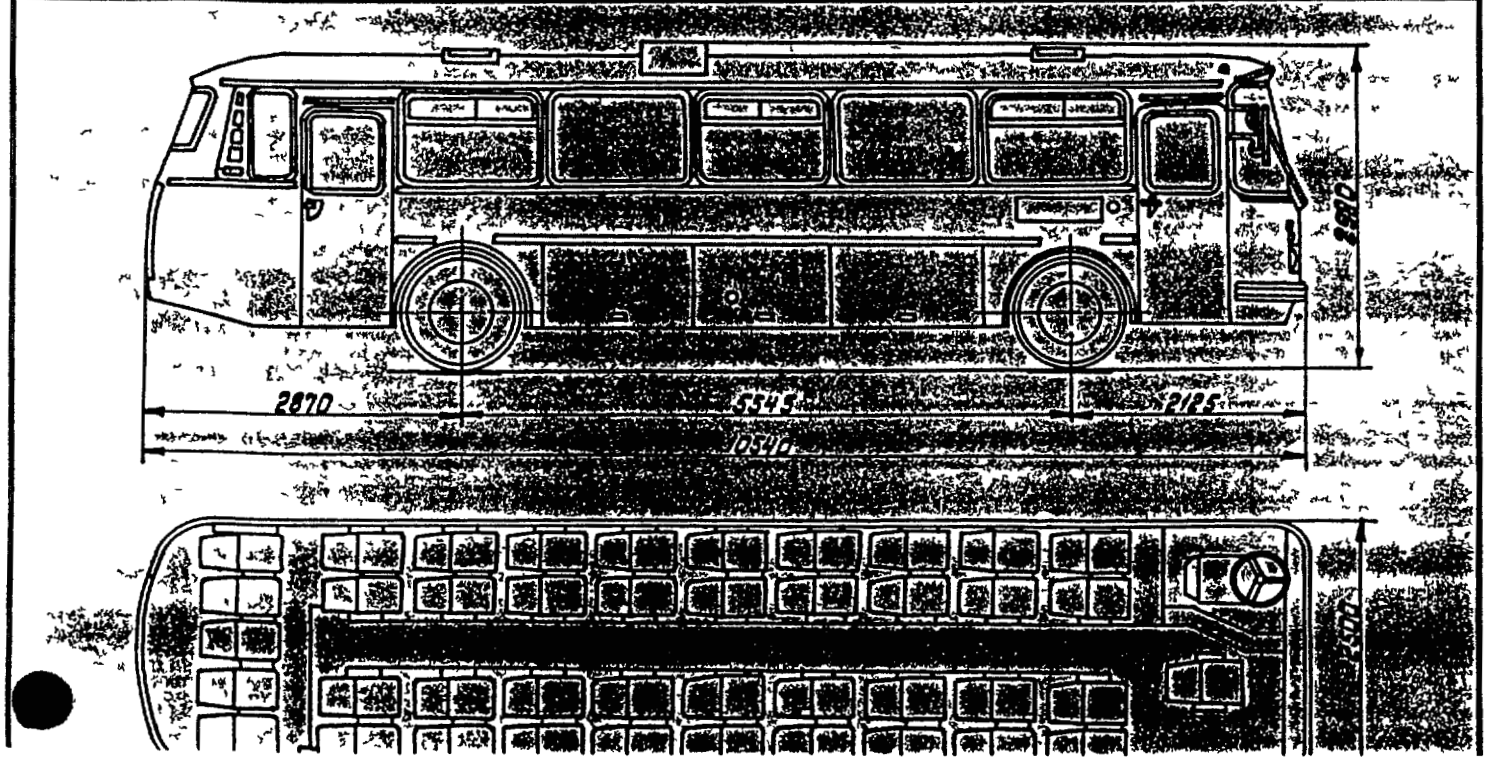
Appendix B

Typical Product of LAZ Bus Plant

ЛЬВІВСЬКИЙ
АВТОБУСНИЙ ЗАВОД
LVIV
BUS PLANT

ЛАЗ 699 Р



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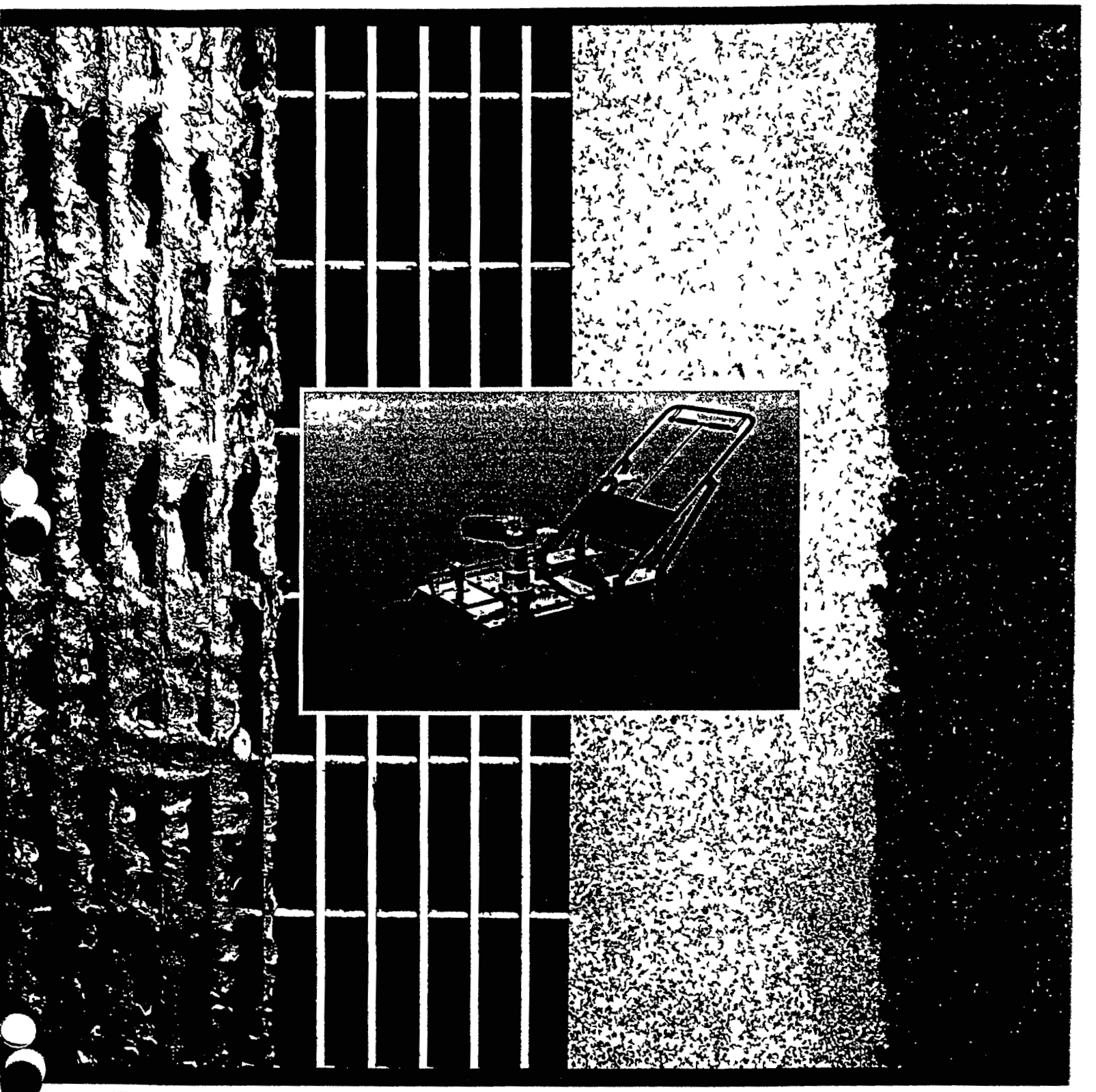
Appendix C

High Pressure Water Blast

SPIN JET® High-Pressure Grate & Floor Cleaning



NLB Corp. *The Leader in High-Pressure Water-Jet Technology*

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