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(SEE SECTION II.D.2 ON PAGES 4 AND 5 OF THE PETITION, PAGES 1 AND 3 OF EXHIBIT A, AND SECTIONS 6, 9 AND 12 OF EXHIBIT B)

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STATE OF ILLINOIS
Pollution Control Board

CONFIDENTIAL BUSINESS INFORMATION

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	AS 03-05
Petition of Cromwell-Phoenix, Inc.	)	**(Adjusted Standard)**
for an Adjusted Standard from 35	)	
Ill. Adm. Code Subpart F, Section 218.204 (c)	)	
(the "Paper Coating Rule")	)	

PETITION FOR ADJUSTED STANDARD

CROMWELL-PHOENIX, Inc. ("CROMWELL"), through its attorneys, Quarles & Brady LLC, pursuant to 35 Ill. Adm. Code Subpart D, Section 104.400 et seq., and Section 28.1 of the Illinois Environmental Protection Act, 415 ILCS 5/28.1 (the "Act"), respectfully submits this Petition for Adjusted Standard ("Petition") to the Illinois Pollution Control Board (the "Board") seeking an adjusted standard from the VOM content limitations of 35 Ill. Adm. Code Subpart F Section 218.204(c) as those rules apply to the emissions of volatile organic material ("VOM") from CROMWELL's corrosion inhibiting ("CI") packaging materials production facility in Alsip, Cook County, Illinois.

I. PROCEDURAL HISTORY

CROMWELL began production at its Alsip facility in early 2001. Following an inspection by the Illinois Environmental Protection Agency ("IEPA") and an exchange of correspondence, IEPA issued Violation Notice A-2001-00265 dated November 20, 2001. Among other things, the Violation Notice alleged that CROMWELL had failed to demonstrate compliance with the reasonably available control technology ("RACT") emission limitations set forth in 35 Ill. Adm. Code 218, Subpart F, applicable to paper coating operations.

PETITIONER'S EXHIBIT
AS 3-5 BPU 8-7-03

This filing is submitted on recycled paper

PETITIONER'S EXHIBIT 1

CROMWELL held telephonic meetings with representatives of the Illinois Environmental Protection Agency ("IEPA") to discuss the Violation Notice, and submitted its Compliance Commitment Agreement to IEPA on February 19, 2002. The Compliance Commitment Agreement explained that the VOM in CROMWELL'S products acts as more than a mere carrier for active ingredients. The VOM acts as a paper softener, improves paper folding qualities, dissolves and retains corrosion inhibitor compounds and facilitates their gradual migration to the customer's wrapped metal parts over a prolonged period of time. Thus while CROMWELL advised IEPA that it was attempting to find coating formulations that would comply with the applicable RACT standards, it also advised that reformulation was likely to impair product quality and could, because of the need to utilize dryers to drive off added water, ironically have the undesirable effect of increasing emissions of VOM. CROMWELL noted, additionally, that because it prints on the majority of its products before applying the corrosion inhibiting solutions, its printing/coating operations are regulated by 35 Ill. Adm. Code Subpart H, Section 218.401 governing printing.

IEPA responded by issuing its Notice of Intent to Pursue Legal Action on March 19, 2002. CROMWELL held another telephonic meeting with IEPA and strongly urged that a representative of IEPA visit its facility so that the agency could view first hand the operations in question. Mr. David E. Bloomberg, a coatings specialist with IEPA's Air Quality Planning Section, visited the facility on May 9, 2002. Following the facility visit and subsequent discussions with IEPA, both parties agreed that CROMWELL would file this Petition.

CROMWELL submitted a Clean Air Act Permit Program ("CAAPP") application to IEPA on March 29, 2002. That application demonstrates that CROMWELL is a true minor source. CROMWELL has requested that IEPA issue a lifetime air operating permit. The CAAPP application currently is under review at IEPA.

II. 35 ILL. ADM. Code Section 104.406

A. Standard From Which Relief Is Sought (Section 104.406(a))

CROMWELL requests that the Board grant CROMWELL an adjusted standard from 35 Ill. Adm. Code Subpart F, Section 218.204(c) (the "Paper Coating Rule") as this rule applies to the emissions of VOM from CROMWELL'S operations in Alsip, Cook County, Illinois. These rules became effective on August 16, 1991.

The Paper Coating Rule from which CROMWELL seeks and adjusted standard requires paper coaters to utilize coating materials containing no more than 2.3 pounds of VOM per gallon of coating applied (excluding water). In the alternative, the source may utilize a capture system and control device which achieves an 81% reduction in the overall emissions of VOM from the coating line, and a 90% reduction of the captured VOM emissions, or achieve VOM reductions that are equivalent to the limitations of 35 IAC 218.204. See 35 Ill. Adm. Code Subpart F, Section 218.207.

As will be demonstrated herein, CROMWELL cannot use compliant coatings, and the approved control technologies will work only at unreasonable costs and with nominal VOM reduction benefit; as such, they are not RACT for CROMWELL.

B. Nature of Regulation of General Applicability (Section 104.406(b))

The regulations from which CROMWELL seeks an adjusted standard were among those promulgated to implement Section 182(d) of the Clean Air Act, 42 U.S.C. 7401 et seq. which, among other things, requires individual states with severe ozone non-attainment areas to adopt RACT regulations applicable to sources of VOM within the non-attainment area.

As mandated by the Clean Air Act, the Board established the requirements described in the Paper Coating Rule.

The Chicago-area severe ozone non-attainment area includes sources located in Cook, DuPage, Kane, Lake, and Will counties, Oswego Township in Kendall County, and Aux Sable and Goose Lake Townships in Grundy County. CROMWELL is located in Cook County which is part of the Chicago-area designated severe ozone non-attainment area.

CROMWELL is a minor source and is seeking a lifetime air operating permit.

C. Level of Justification (Section 104.406(c))

The regulations of general applicability from which CROMWELL seeks an adjusted standard do not specify a level of justification for an adjusted standard.

D. Facility and Process Description (Section 104.406(d))

1. General Information

CROMWELL is an Illinois corporation located in Alsip, Cook County, Illinois. CROMWELL employs 31 people and operates in a 98,000 square foot building. The building was constructed in 1965; CROMWELL began operations in the building in early 2001. CROMWELL'S equipment is approximately 40 years old. CROMWELL believes that it is the only manufacturer of corrosion inhibiting packaging materials in Illinois.

2. Process Description

CROMWELL produces corrosion inhibiting packaging materials by

In most cases various images are printed on the kraft paper prior to the application of the CI solutions. These images include the CROMWELL logo, lot number, product usage instructions, and graduated lines for measurement purposes. The images are applied using an in-line flexographic printing cylinder and water based flexographic inks.

3. Description of Emissions

The only emissions of regulated pollutants from the production of the corrosion inhibiting packaging materials are the relatively low emissions of VOM. None of the VOM compounds used are defined as Hazardous Air Pollutants under Section 112(b) of the Clean Air Act. CROMWELL selects the impregnation coating and carrier constituents based upon their ability to be retained in the product for a prolonged period of time. Therefore, the emissions of VOM are very low by design. Low vapor pressure VOM carrier compounds are utilized, and the finished packaging material is rewound on a cylindrical core immediately after the solutions are applied, thereby physically encapsulating the product and further impeding the volatilization of the liquid fraction components.

In addition, the vast majority of the packaging products are produced without using dryers. Less than 10% of CROMWELL'S products require the use of infra-red ("IR") dryers. IR drying is required when the CI solution contains a greater percentage of water. The excess water must be driven off using the IR dryers. It is important to note that since both water and VOM will be driven off concurrently, VOM emissions will increase as the amount of drying that is required increases. Gravimetric tests have been performed to determine the weight loss and emissions from the CI packaging production processes, including storage. In the most recent tests, the weight of the virgin paper used, CI solution applied, and the final products produced were determined over periods that represent their typical holding times in the CROMWELL facility.

The gravimetric data demonstrate that the overall VOM emissions are less than 5% of the weight of CI solution applied. This emission factor assumes that the VOM losses are proportional to their composition in the liquid fraction of the CI solution. In fact, the water will likely preferentially volatilize relative to the VOM components due to its higher vapor pressure. Therefore, the VOM emission factors used by CROMWELL can be considered worst case. It is clear that the VOM emissions from the CI solution are very low due to their low volatility and their effective retention in the paper substrate.

Based on these emission factors, total VOM emissions from the CROMWELL facility were no more than approximately 5 to 6 tons per year for calendar years 2001 and 2002. Typical hours of operation are approximately 2900 hours per year. Projecting operations to 8760 hours per year, and continuous full web width maximum operation of all production units, potential emissions from the facility are less than 25 tons per year, including ancillary mixing and handling operations. Therefore, the CROMWELL facility is a simple minor source.

CROMWELL has been working on CI solution reformulations in an attempt to reduce the as-applied VOM content (less water) to as great a degree as practicable, while still providing sufficient solids dissolution, retention, and migration. However, as the amount of water in the solutions is increased, so does the need to utilize the IR dryers to drive off the excess water. Along with the increased evolution of water will be an associated proportionate increase in VOM emissions for the equivalent CI product produced. This is counterproductive to the goal of VOM emissions reduction.

4. Pollution Control Equipment

CROMWELL does not employ the use of any pollution control equipment in its operations.

5. Permit Status

At the request of IEPA, CROMWELL submitted a Clean Air Act Permit Program ("CAAPP") application on March 29, 2002. Although a CAAPP application was submitted, CROMWELL is a minor source. Accordingly, in its CAAPP application CROMWELL requested that a lifetime air operating permit be issued for the CROMWELL facility. The CAAPP application is under review within IEPA. During the course of discussions between IEPA and CROMWELL concerning the CAAPP application and Notice of Violation A-2001-00265, IEPA and CROMWELL agreed that CROMWELL should submit this Petition for Adjusted Standard. It is CROMWELL's understanding that its air operating permit will be issued upon the Board's issuance of its Opinion and Order on this Petition.

6. General Description of the Local Non-Attainment Area

CROMWELL is located in an industrial area in Alsip, Illinois on Ridgeway Avenue. The nearest school or residential area is approximately 1 mile from the CROMWELL facility. The city of Alsip is located in Cook County, Illinois, which is part of the Greater Chicagoland Severe-17 Ozone non-attainment area designated under 40 CFR 81.314, as defined by USEPA pursuant to Section 107 of the Clean Air Act.

E. Cost of Compliance and Compliance Alternatives (35 IAC 104.406(e))

Achieving compliance with the applicable limitations of 35 IAC Part 218 Subpart F requires that either the VOM content of the CI Solutions be reduced, or that add-on controls be applied. The technical and economic feasibility of these two options for the CI packaging production operations at CROMWELL are discussed below.

1. CROMWELL's Operations Were Not Contemplated by Applicable Rules

Achieving the VOM content levels in the CI coatings that are called for in the applicable section of 35 IAC Part 218 Subpart F (35 IAC 218.204(c)) is not practicable for functional, environmental, and economic reasons.

Unlike conventional coating operations, where VOM solvents are used as carriers of pigments and other solids, and the VOM solvents are intended to be evaporated, the VOM components in CROMWELL'S CI solutions are intended to remain in the CI packaging products in order to perform their essential corrosion inhibiting functions. As such, CROMWELL has inherent economic and product performance incentives to ensure that the VOM components are retained in the product and not emitted. Therefore, the high molecular weight, low volatility VOM components in the CI Solutions are selected by CROMWELL to enhance retention in the product, and not be emitted, by design.

It is important to note that the 35 IAC Part 218 Subpart F paper coating standards are based on the Control Techniques Guideline (CTG) titled "Control of Volatile Organic Emissions from Existing Stationary Sources -- Volume II: Surface Coating of Cans, Coils, Paper, Fabric, Automobiles & Light Duty Trucks" dated May 1977 (EPA-450/2-77-008). In Section 5.0 of this document (Paper Coating), it describes the paper coating process as follows (Page 5-1): "In organic solvent paper coating, resins are dissolved in an organic solvent or solvent mixture and this solution is applied to a web (continuous roll) of paper. ***As the coated web is dried, the solvent evaporates and the coating cures.***" (Emphasis added). Clearly, for conventional coaters, the purpose of the solvent is to act as a carrier for the pigments and resins. In such a case the intent is for the solvent to be evaporated, leaving the solids to dry and/or cure as the surface coating on the paper substrate. In the case of CROMWELL, the liquid organic components are intended to be impregnated into and remain with the paper product. They are intended to become an integral component of the product. This type of product clearly was not contemplated at the time the CTG for paper coating was developed.

Further, on page 5-13 of the paper coating CTG, it describes how the vast majority of solvents used in conventional paper coating operations are evolved during the application, drying, and curing steps. "Many plants report that 96 percent of solvent introduced to the coating line is recovered. Part of the solvent remains with the finished product after it has cured in the oven. Some coaters estimate that 2 or 3 percent of solvent remains in the product." This again differentiates the conventional coating operations contemplated by the paper coating CTG from the type of CI packaging production operation at CROMWELL. CROMWELL applies the CI solution to the kraft paper substrate with the intent that the vast majority of the CI solution constituents will remain in and become an integral part of the final product. While conventional coating operations drive off 96 percent or more of the solvent applied, the CI packaging materials produced by CROMWELL retain over 95% of the organic liquids applied, since these organic liquid components are an integral part of the product. It is clear that CROMWELL'S type of operation and their products were not contemplated in the CTG for the paper coating industry.

It is important to understand that the presence of the VOM components in the CI solutions and CI products provides an essential corrosion inhibiting function. These VOM components are themselves corrosion inhibiting, and they serve to facilitate the gradual migration of other corrosion inhibiting solids present in the CI packaging products onto the customer's wrapped metal parts over a prolonged period of time.

In addition, it is undesirable for the CI products manufactured by CROMWELL to contain excess water, as the presence of residual water in the CI products promotes corrosion. Excess water also causes unacceptable expansion of the paper fibers resulting in the product becoming wrinkled and welted, as well as the cut sheets becoming curled. This makes the products very difficult to handle by

CROMWELL personnel and their customers, and results in the inability to achieve a good wrap on the metal items that are being protected by the CI papers. Therefore, if additional water was utilized in lieu of some of the VOM components in the CI solution, additional supplemental heated drying operations would be required in order to drive off the excess water. Not only would additional energy be consumed in doing this, but additional VOM would be evolved in the process. The VOM would evaporate along with the excess water, thus increasing the net overall emissions from the facility. CROMWELL asserts that this would result in a detriment to the environment, and would negatively impact the economic viability of the CI production operations.

A projection of VOM emissions changes was made in order to approximate the emissions impact resulting from a reformulation of the CI solutions to the 2.3 lbs VOM per gallon level required under 35 IAC 218.204(c). The emissions projection was based on an extrapolation of the VOM emissions factor established at the current CI solution VOM contents, vapor pressures and ambient operating conditions, and applying the increased constituent vapor pressures at the elevated temperatures, and the decreased VOM contents of the CI solutions. Based on heating the substrate to a minimum of 54°C (129°F), the VOM emissions of the reformulated CI solutions are projected to increase by a factor of approximately 7.8 times above that of the current formulations. In such a case, annual VOM emissions would increase from the current 5 or 6 tons per year, up to approximately 39 tons per year, or higher. Actual substrate temperatures will likely need to be considerably higher than 54°C, probably in excess of 65°C (150°F), in order to sufficiently drive off the excess water. Therefore, VOM emissions would accordingly be even higher. Again, it is important to emphasize that the intent of the CI solution impregnation process is to retain the VOM constituents in the substrate. The use of elevated process temperatures is counterproductive to this goal.

2. Add-On Controls Are Not Economically Reasonable

CROMWELL'S consultant, ERM, Inc., analyzed the technical and economic feasibility of the application of add-on control devices to CROMWELL'S CI coating operations. See Reasonably Available Control Technology ("RACT") Analysis by ERM, Inc. at Exhibit A attached hereto. The technically feasible control options were determined to be oxidation and a combination carbon adsorption/oxidation system.

As can be seen in the RACT analysis in Exhibit A, the costs of installing add-on oxidation or carbon adsorption/oxidation controls at CROMWELL are excessive. Table 2 of Exhibit A summarizes the annualized costs associated with the application of these control technologies. The annual cost per ton of VOM controlled for each of these options ranges from approximately $25,000 to $70,000. This is well above the level that would be considered reasonable under a conventional RACT demonstration. Also, these costs do not consider the costs associated with compliance demonstration testing, which likely would be on the order of $40,000 to $50,000. In addition, while the annualized costs are themselves excessive, the initial capital outlay would also be prohibitive and the ongoing annual cost of the controls would be on the order of $375,000 to $560,000. These costs are clearly excessive, given that the actual level of VOM emissions to be controlled is on the order of 5 or 6 tons per year.

F. Proposed Adjusted Standard (35 IAC 104.406(f))

CROMWELL proposes the following adjusted standard for adoption by the Board:

CROMWELL may continue to operate its corrosion inhibiting packaging materials production operations as long as:

1. The total actual VOM emissions from the CROMWELL facility do not exceed 25 tpy.

2. The Versil Pak wax laminating coatings continue to meet the applicable VOM content limitations under 35 IAC Part 218 Subpart F.

3. The web fed and sheet fed CI coating and printing lines use only Corrosion Inhibiting solutions whose as-applied VOM contents do not exceed 8.3 lbs VOM per gallon, less water.

4. CROMWELL shall operate in full compliance with all other applicable provisions of 35 IAC Part 218 Subpart F.

5. CROMWELL shall continue to investigate viable reduced VOM content CI coatings and, where practicable, shall substitute such coatings as long as such substitution does not result in a net increase in VOM emissions. An annual report summarizing the activities and results of these investigatory efforts will be prepared by CROMWELL and submitted to the IEPA.

6. CROMWELL shall operate in full compliance with the Clean Air Act.

7. CROMWELL shall continue to report all annual emissions to the IEPA.

G. The Quantitative and Qualitative Impact of CROMWELL'S Activity (35 IAC 104.406(g))

Due to the nature of the VOM components used in the CI solutions at CROMWELL, less than 5 tons of actual VOM per year are emitted from that portion of their production operations. Approximately 5 to 6 tons per year of actual VOM are typically emitted from the entire plant, including the Versil Pak wax laminating operations. This is a relatively small contribution to the local air shed when compared to the hundreds of thousands of tons of VOM emitted each year in the Chicagoland Nonattainment Area.

In addition, if CROMWELL were to attempt to utilize reduced VOM content CI coatings, VOM emissions would actually increase. As previously described, if water were utilized in the CI solutions in lieu of some of the VOM components, additional supplemental heated drying would be required in order to drive off the excess water. This would result in an increase in VOM emissions for the same product produced, since there would be additional VOM driven off along with the excess water. Also, there would be additional energy consumption required to perform the increased supplemental drying.

As described in Exhibit A at page 9, if the most economical add-on controls were applied to the CI coating operations at CROMWELL, the associated energy and environmental impacts would be substantial in comparison to the small net reduction in VOM emissions. In order to control the 15.21 tons per year of potential VOM emissions from the CI coating operations, approximately 13.5 million cubic feet of natural gas will be burned, resulting in emissions of over 800 tons of CO_2 (a greenhouse gas), 0.67 tons of NO_x (an acid rain precursor, criteria pollutant, and an ozone precursor), and 0.57 tons of CO (an acute toxic and criteria pollutant). In addition, over 120,000 kWhr of electricity would be consumed annually.

Therefore, the deleterious energy and environmental impacts would be substantial, while the benefits of VOM reduction would be minimal.

H. **Justification (Section 104.406(h))**

As previously described, the Paper Coating Rule did not contemplate the issues pertaining to manufacturers of CI materials when the rule was promulgated. Moreover, compliance with the Paper Coating Rule would undermine the quality and efficacy of CROMWELL's products. Compliance would necessitate the addition of water to CROMWELL's formulae. As residual water is, obviously, undesirable for CROMWELL's products, CROMWELL would be forced to use supplemental IR dryers to drive off the excess water. This extra step in the manufacturing process would have the unintended and unwanted effect of driving off additional VOM and increasing the net overall emissions from the facility. Thus, CROMWELL's compliance with the RACT standards is not feasible without incurring extraordinary cost and expense, compromising product quality and functionality, and increasing the overall VOM emissions from the facility. The RACT adjusted standard proposed by CROMWELL is justified because it is technically feasible, economically reasonable, and will have no significant adverse impact on the ambient air quality in the Greater Chicagoland Nonattainment Area.

I. **Consistency with Federal Procedural Requirements (Section 104.406(i))**

1. <u>Consistency with Federal Law</u>

By granting the proposed adjusted standard, the Board will not violate any provisions of the Clean Air Act. CROMWELL's operations and the appropriate RACT requirements applicable to CROMWELL are subject to this proceeding. Pursuant to the Act and the Clean Air Act, the Board is empowered to determine what constitutes RACT for CROMWELL. Accordingly, under its authority to adopt RACT regulations, the Board may grant the requested relief consistent with federal law.

2. Federal Procedural Requirements

Under federal law, the Board's grant of the adjusted standard requested by CROMWELL will be submitted to the USEPA for inclusion as a RACT rule specific to CROMWELL in the State Implementation Plan for Illinois. As such, the adjusted standard will comport with federal procedural requirements.

J. Hearing (Section 104.406(j))

CROMWELL requests a hearing in this matter before the Board.

K. Supporting Documents (Section 104.406(k))

Supporting documents cited in this Petition are attached hereto as Exhibits A and B.

III. SECTION 28.1(C) FACTORS

Under Section 28.1(c) of the Act, 415 ILCS 5/28.1, the Board may grant individual adjusted standards upon adequate proof that: 1) the factors relating to the petitioner are substantially and significantly different from the factors relied upon by the Board in adopting the general regulation applicable to the petitioner; 2) the existence of those factors justifies an adjusted standard; 3) the requested standard will not result in environmental or health effects substantially and significantly more adverse than the effects considered by the Board in adopting the rule of general applicability; and 4) the adjusted standard is consistent with any applicable federal law.

A. The Factors Relating To CROMWELL Are Substantially and Significantly Different

CROMWELL'S operations are unique in Illinois. Examination of the CTG published for the paper coating industry demonstrates clearly that CROMWELL'S operations are distinct from those that the IEPA sought to regulate when it promulgated 35 Ill. Adm. Code, Subpart F, Section 218.204 (c). Thus the factors relating to CROMWELL are substantially and significantly different than those pertaining to typical paper coaters.

B. The Existence of Those Factors Justifies an Adjusted Standard

As discussed fully in this Petition, CROMWELL has investigated a number of compliance options. The compliance alternatives investigated include experiments with reformulated CI coatings and the installation of add-on controls. These alternatives have not proven to be technically feasible or economically reasonable. Under the circumstances, the requested adjusted standard is technically and economically justified as the only means available.

C. The Adjusted Standard Will Not Result in an Adverse Environmental Impact or Health Effect

As discussed previously in this Petition, the requested adjusted standard will not have an adverse environmental impact or health effect. CROMWELL is a minor source, and, based upon information and belief, is the only CI material manufacturing facility located in Illinois. By definition, CROMWELL's emissions will have only a minor impact on air quality within the Greater Chicagoland Nonattainment Area.

D. The Proposed Standard is Consistent with Applicable Federal Law

The proposed adjusted standard is consistent with federal law as discussed in this Petition. The granting of the adjusted standard will not violate any provision of the Clean Air Act because no federal RACT standards have been established that are applicable to CROMWELL's specific operations as a manufacturer of CI materials.

IV. CONCLUSION

CROMWELL requests that the Board grant the proposed adjusted standard as an alternative to the RACT regulations adopted by the Board in the Paper Coating Rule. To require CROMWELL to comply with the requirements of 35 Ill.. Adm. Code Subpart F, Section 218.204(c) et seq. would result in substantial economic hardship to CROMWELL with no corresponding environmental benefit. It is not technically feasible to comply with the Paper Coating Rule as compliant coatings do not meet CROMWELL's product efficacy standards, and because compliance could have the reverse effect of creating increased emissions and environmental detriment. Finally, add-on controls are unreasonably expensive, provide little environmental benefit, and have associated significant adverse ancillary environmental impacts.

Pursuant to 35 Ill. Adm. Code 104.406, CROMWELL submits the technical report prepared by Environmental Resources Management, Inc. (Exhibit A), and the Affidavit of CROMWELL (Exhibit B) to verify the facts asserted in this Petition.

WHEREFORE, Cromwell-Phoenix, Inc. respectfully requests that the Board grant CROMWELL the proposed adjusted standard from 35 Ill. Adm. Code, Subpart F, Section 18.204(c) as those rules apply to the emissions of VOM from Cromwell-Phoenix, Inc.'s operations in Alsip, Cook County, Illinois.

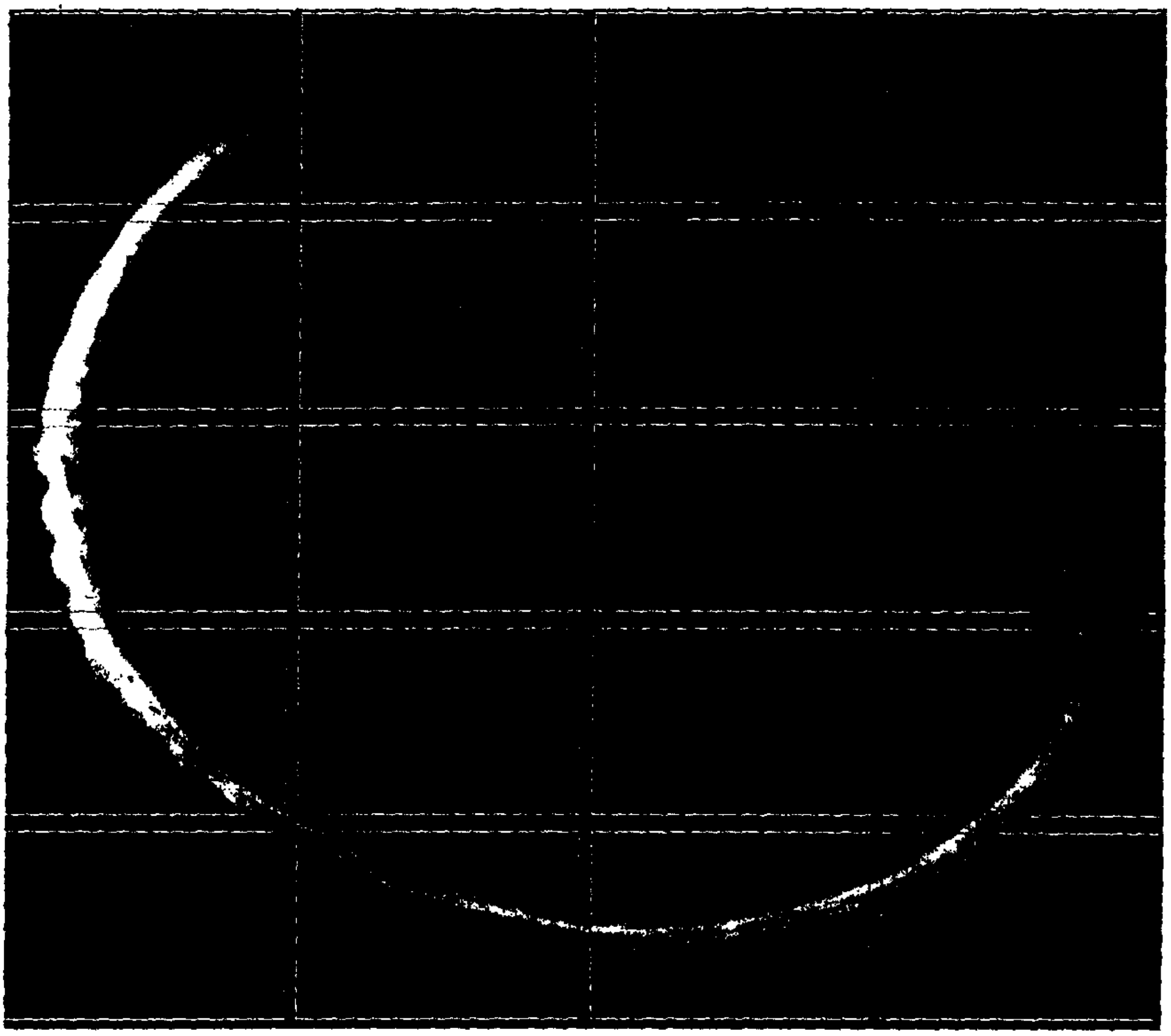
CROMWELL-PHOENIX, INC.

By: Janine Landow-Esser

Janine M. Landow-Esser
QUARLES & BRADY LLC
500 W. Madison Street
Suite 3700
Chicago, Illinois 60661
312.715.5055

May 29, 2003

EXHIBIT A



Reasonably Available Control Technology (RACT) Analysis

Illinois EPA ID No. 031 003 ADP

May 2003

Cromwell-Phoenix, Inc.
Alsip, Illinois

TRADE SECRET
(SEE PAGES 1 AND 3)

ERM

Delivering sustainable solutions in a more competitive world

Reasonably Available Control Technology (RACT) Analysis

A source specific RACT analysis is presented herein in support of a demonstration of technological and economic feasibility of add-on pollution controls at the Cromwell-Phoenix, Inc. (Cromwell-Phoenix) manufacturing facility in Alsip, Illinois. RACT is defined as "the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility" (44 FR 53761, September 17, 1979).

Cromwell-Phoenix is a manufacturer of corrosion inhibiting packaging materials for the metal parts industry. The corrosion inhibiting packaging materials are produced by impregnating kraft paper with corrosion inhibiting (CI) solutions.

The first step in the RACT analysis is to determine for the pollutants in question applicable control technologies that have practical potential for this type of manufacturing operation. The control technologies are ranked in order of overall control effectiveness. If it can be shown that the most stringent level of control is infeasible on the basis of technical and economic factors, then the next most stringent level of control is identified and similarly evaluated. This iterative process continues until the RACT level under consideration is not eliminated by technical and economic factors.

This RACT analysis generally follows the "top-down" BACT analysis process described in the USEPA's Office of Air Quality Planning and Standards (OAQPS) guidance documents, and is summarized as follows:

- Applicable emission control technologies are identified that have practical potential for application to the above described manufacturing operations.
- An efficiency level is proposed for add-on controls that would constitute RACT.
- Technically infeasible control options are eliminated.
- The remaining control technologies are ranked in the order of overall control effectiveness.
- The most effective control technology options are evaluated considering economic impacts.
- The most effective control option not eliminated is selected as RACT.

Each of the above steps is detailed in the following sections.

A. *Identification of Applicable VOC Control Technologies*

1. Condensation

Condensation is a basic separation technique in which a gas stream containing VOCs is first brought to saturation and then the VOCs are condensed to a liquid. The conversion of a vapor phase VOC to its liquid phase can be accomplished by sufficiently lowering the gas stream temperature and/or by increasing its pressure. The most common approach is to reduce the temperature of the gas stream at constant pressure.

Condensation systems are effective only for gas streams containing high concentrations of high molecular weight VOCs (e.g. heavy oils). The minimum VOC concentration achievable at the outlet of a condensation system is the saturation concentration for that particular VOC. Water is the most common and cost effective coolant. Therefore, even moderate VOC removal efficiencies (>50%) are not achievable unless the vapors will condense at relatively high temperatures.

The exhaust stream at Cromwell-Phoenix contains very low concentrations of relatively low molecular weight (75 - 145 lbs/lb-mole) VOCs which condense only at very low temperatures. Such temperatures are achievable only by energy-intensive mechanical refrigeration of the exhaust gas stream. Therefore, condensation is not a technically feasible option.

2. Adsorption

Adsorption is a process by which compounds such as VOCs are retained on the surface of a solid. Physical adsorption is a phenomenon where gaseous or liquid compounds adhere to the surface of a bed of solid adsorbent particles that are highly porous and have very large surface to volume ratios. Activated carbon is one of the most effective and most common adsorbents used for removal of gaseous VOCs from industrial exhaust streams. VOC adsorption onto activated carbon is a physical process based upon attractive forces known as Van der Waals forces. The magnitude of these attractive forces is primarily a function of the surface area of the gaseous molecules and the amount of surface area of the solid that is available for adsorption. Other intermolecular forces of attraction also affect adsorption ability. At equilibrium, the quantity of gas that is adsorbed onto activated carbon is a function of the adsorption temperature and pressure, the VOC being adsorbed, and the carbon characteristics such as particle size and pore structure. Activated carbon is a particularly effective adsorbent for gaseous VOCs due to its extremely high surface area to weight ratio, and its pronounced capillary action.

Carbon adsorption removal systems are most effective for VOCs having molecular weights between approximately 60 and 180. The molecules need to be "large" enough to develop sufficient Van der Waals forces with the adsorbing media, yet they can't be so large that the Van der Waals forces are so great that the molecule cannot be removed during the desorption cycle. Therefore, higher molecular weight compounds are too difficult to desorb while lower molecular weight compounds experience little to no adsorption. The majority of VOCs used by Cromwell-Phoenix have molecular weights in this range, therefore they would be amenable to effective adsorption and desorption.

Also, given the variety of the materials utilized at Cromwell-Phoenix, it is not practical to recover the solvents for reuse. Solvent recovery and reuse is most feasible for single solvent systems. Also, it is not feasible to recover such a solvent mixture via decantation since the solvents are water soluble. Therefore, the only technically feasible control option would be to utilize an activated carbon adsorption system as a pre-concentrator, and then thermally desorb the solvents, directing the concentrated stream to a thermal oxidizer for VOC destruction. In such a scenario, the volumetric flow rate of the desorption stream is typically 10% of the volumetric flow rate of the adsorption stream.

While the limitations described above will reduce the effectiveness of a carbon adsorption system and will present some safety hazards, a carbon adsorption concentrator in conjunction with a thermal oxidation control device, for the purpose of this RACT analysis, will be considered a technologically feasible control option that will be further evaluated.

3. Liquid Absorption

The process of absorption generally refers to the intimate contact of a mixture of gases with a liquid sorbate (typically aqueous) so that a part of one or more of the constituents in the gas stream will dissolve in the liquid. These devices are referred to generally as wet scrubbers and they include packed bed, plate, counter current and cross-current designs.

The most effective transfer result for an infinite scrubber column is to achieve equilibrium between the gas-phase and liquid-phase compounds. While the VOCs used at Cromwell-Phoenix are soluble in an aqueous sorbate, their exhaust concentrations are so low that the scrubber would exhibit a very low transfer efficiency of the gaseous VOCs into the liquid sorbate.

Also, given the polar nature of the organic materials at Cromwell-Phoenix, these compounds would not be readily separable from the sorbate liquid for purposes of recovery. Therefore, the only practical means of disposal would be discharge to the sewer, where some or most of the VOCs that were absorbed may re-volatilize en route to or at the POTW. For these reasons, it is concluded that gas absorption is not a technically feasible control option.

4. Oxidation

Complete oxidation converts gaseous VOCs to carbon dioxide, water and other various products of combustion. Oxidation systems include direct combustion flares, as well as two types of commercially available oxidation control systems - catalytic and thermal. These systems are described separately below.

a. Flares

A flare is a direct combustion device in which air and the combustible gases in the exhaust stream react at the burner. Combustion must occur instantaneously since there is no residence combustion chamber. The principal factors affecting flare combustion efficiency are the exhaust gas heating value, flammability limits, density and effectiveness of flame zone mixing. If the concentration of VOCs in the exhaust is at or above the lower flammability level, then utilization of a flare may be appropriate. For this reason, flares are typically used only in the steel, petroleum and petrochemical industries, as they are inappropriate for most other industries due to lower hydrocarbon concentrations. Since the expected exhaust stream VOC concentrations at Cromwell-Phoenix will be very low (roughly 10 - 15 ppmv), flares are not a technically feasible option.

b. Catalytic Oxidation

Catalytic oxidation devices employ a catalyst bed that initiates oxidation reactions at relatively low temperatures. The exhaust stream is heated to approximately 650°F and passed through the catalyst bed where the oxidation reactions are initiated without alteration of the catalyst itself. For the catalyst to be effective, the active sites upon which the VOCs react must be accessible, and the catalyst must be active. The build up of non-combustible particles, polymerized materials, or reaction of the catalyst with certain elements can either "mask" or "poison" the catalyst, thus making it unavailable for initiating oxidation reactions.

While it would be difficult to impossible to design a catalytic oxidation system to preclude the possibility of the catalyst being masked or poisoned, it is unlikely that the materials utilized by Cromwell-Phoenix would render a catalytic control device ineffective. However, given the low concentrations of VOCs in the exhaust stream, the temperature rise across the catalyst bed (ΔT) would be so low that a poisoned or masked catalyst would likely go undetected, since there may not be a significantly discernible change in the ΔT. Therefore, the ongoing performance of a catalytic oxidation system could not be effectively ascertained. Despite these technical concerns, and for purposes of completeness, catalytic oxidation will be considered a technically feasible control option that will be further evaluated.

c. Thermal Oxidation

Thermal oxidation is a reliable and effective control technology that converts gaseous VOCs to carbon dioxide, water and various other products of combustion at relatively high temperatures, typically 1350 - 1800°F. The exhaust gases are preheated in a heat exchanger and then directed into the high temperature combustion chamber where the VOCs are oxidized. In the case of Cromwell-Phoenix, the VOC concentration will be well below the level that is necessary to provide any appreciable degree of self-sustained combustion. Therefore, a supplemental fuel burner system must be utilized.

Primary heat exchangers can be used to raise the inlet temperature of the exhaust stream, thus reducing the amount of supplemental fuel required.

Two categories of thermal oxidizers are generally used: Recuperative and Regenerative. A recuperative thermal oxidizer uses either a shell-and-tube or a plate-to-plate heat exchanger for heat recovery, while a regenerative thermal oxidizer uses a ceramic medium that is usually stored in two or more separate chambers. Some regenerative thermal oxidizers employ a single bed design with a mobile high temperature oxidation zone. The recuperative-type thermal oxidizers operate with a heat exchanger effectiveness of up to 70%, while regenerative thermal oxidizers employ heat exchangers having an effectiveness of up to 95%.

Both of these types of thermal oxidizers are technologically feasible for application at Cromwell-Phoenix. Since the exhausts will contain low concentrations of VOCs at ambient temperatures, the regenerative thermal oxidizer will likely be the more appropriate control option from an economic stand point. This is due to its greater energy recovery capability. However, both recuperative and regenerative control systems will be further evaluated as technologically feasible options. Also, the recuperative system will be evaluated for use in conjunction with the carbon adsorption pre-concentrator.

B. Proposed Efficiency Level of Add-on Controls Which Constitute RACT

Based on the majority of RACT determinations, and on the control device efficiency requirements of 35 IAC Part 218 Subparts F and H, a minimum 90% VOC control efficiency will be required of an add-on control device. In addition, a minimum overall control efficiency of 81% is required to meet the Subpart F RACT requirements, therefore the capture efficiency should be at least 90% (Overall Control Efficiency (81%) = Capture Efficiency (90%) x Control Device Efficiency (90%)). To ensure the achievement of a minimum 90% capture efficiency, a permanent total enclosure (PTE) would likely need to be established for the three coating operations, and perhaps also to include the mixing tank. The costs for such an enclosure are included in order to present a complete RACT cost analysis. An approximation of the cost to fabricate a Permanent Total Enclosure is $137,000. For purposes of this RACT analysis, it is assumed that a control device efficiency of 90% with 100% VOC capture efficiency are achieved, and the costs of fabricating and exhausting a Permanent Total Enclosure are included.

C. Elimination of Technically Infeasible VOC Control Options

On the basis of the criteria described above in Section C, the following VOC control options have been determined to be technically infeasible:

1. Condensation
2. Liquid Absorption
3. Flares

Therefore, these control options will not be further evaluated.

D. Ranking of Remaining Control Technologies

The remaining three control technologies are ranked below in Table 1 in the order of control effectiveness:

Table 1

Pollutant	Technology	Range of Control Efficiency (%)	Control Level for RACT Analysis %
VOC	Recuperative Thermal Oxidation	90 - 99	≥ 90
VOC	Regenerative Thermal Oxidation	90 - 98	≥ 90
VOC	Catalytic Oxidation	90 - 98	≥ 90
VOC	Carbon Adsorption Concentrator with Thermal Oxidation Control	90 - 98	≥ 90

E. Evaluation of the Most Effective Control Technologies Not Eliminated

The most effective remaining control options were evaluated relative to energy, environmental and economic impacts.

1. Economic Impacts

The economic impacts of the above control options were evaluated in accordance with the USEPA's OAQPS Control Cost Manual, by William M. Vatavuk. Economic analyses were calculated using the most current (1999) version worksheets provided by Mr. Vatavuk. The economic analysis anticipates the installation of a single control device for all controlled processes since this is the most cost effective means of control. It should be noted that, while a single control device will exhibit the lowest economic costs for add-on controls on a $/ton of pollutant controlled basis, such a configuration poses potential problems from an operational standpoint. For example, it would be unacceptable to have to shut down all of the controlled operations if the control device requires preventive maintenance, or should it malfunction. Also, some costs such as ductwork are more substantial for a central unit than for multiple control devices. Ductwork costs have not been included in this RACT analysis. Therefore, while a single central device is the most cost effective configuration, operational and ancillary factors need to be considered for an overall feasibility determination. Given the outcome of this report, such further in-depth analysis is not warranted at this time.

Total annual costs were determined for the purchase, installation and operation of each of the control devices considered. The total exhaust air flow rate is based on the sum of the exhaust requirements of each of the controlled sources. The annual cost calculations for each of the control technologies evaluated are included herein.

The results of the economic cost analyses for the control options evaluated are summarized below in Table 2. The annual costs for the control devices are based on an expected life of 10 years and an annual interest rate of 7.0%. All analyses are based on 90% control of the allowed (potential) VOC emissions that were reflected in the March 2002 CAAPP permit application (Exhibit 200-1) for the CI coating operations, including the flexo inks and mixing tanks (Total = 16.9 tpy). Therefore, the annual controlled amount of VOCs is calculated at 15.21 tons.

Table 2
RACT Analysis – Overall Plant

Control Option	Total Annual Cost ($)	Annual Cost per Ton of VOC Controlled ($)
Recuperative Thermal Oxidizer	1,075,713	70,724
Regenerative Thermal Oxidizer	468,412	30,796
Catalytic Oxidizer	558,670	36,730
Carbon Adsorber Concentrator with a Thermal Oxidizer	376,942	24,783

Based on the annual costs per ton of VOCs controlled for each of the control options described above, none of the control options are deemed to be economically feasible. Including the costs for the installation of ductwork and compliance demonstration of the control device and the total enclosures would only add to the economic infeasibility of each option. Therefore, the actual costs per ton of implementing any of the above control options will be even higher. Finally, as was stated earlier, while the utilization of a single centrally-located control device is the most economically feasible option, it may not be operationally feasible due to both anticipated and unanticipated shut downs of the control device. If only a single control device were employed, normal preventive maintenance requirements or an equipment malfunction would require the shutdown of all CI coating operations. Clearly, this would not be acceptable from a production and customer requirement standpoint. Therefore, for operational purposes, multiple control devices would have to be employed whose costs will be higher than the lowest cost option described above.

2. Environmental and Energy Impacts

To accomplish the annual control of the 15.21 potential tons of VOCs using the most economical control option, approximately 13.5 million cubic feet of natural gas will be burned, resulting in emissions of over 800 tons of CO_2 (a greenhouse gas), 0.67 tons of NO_x (an acid rain precursor, criteria pollutant and an ozone precursor) and 0.57 tons of CO (an acute toxic and criteria pollutant). In addition, over 120,000 kWhr of electricity will be consumed annually. Therefore, the deleterious energy and environmental impacts would be substantial, while the benefits of VOC reduction would be minimal.

F. Selection of the Most Effective Control Option Not Eliminated

All of the most effective control technology options not technically eliminated have been shown to be economically infeasible since the total annual costs for the installation and operation of the least costly option is approximately $25,000 per ton of VOC controlled. It should be recalled that this cost does not include the cost of ductwork nor does it reflect compliance demonstration costs (which could approach $40,000 - $50,000) or operationally necessary multiple control devices. Therefore, the actual control costs will be considerably higher. In addition, the initial capital cost and the substantial annual operating costs would put Cromwell-Phoenix at a serious economic competitive disadvantage. Therefore, the application of such add-on controls would be detrimental to the viability of this plant. Finally, there are substantial environmental impacts from even the least energy intensive control option, including substantial emissions of CO_2 from the combustion of the natural gas fuel and VOCs.

G. Alternative Strategy to Achieve RACT

Since the use of add-on controls has been shown to be economically infeasible, it is proposed to minimize VOC emissions by continuing to use CI coatings that contain the lowest levels of VOM possible, while still achieving product functionality and quality, and minimizing VOM emissions from supplemental drying. The use of non-VOC solvents such as water, acetone and methyl acetate will be used to the greatest degree practicable.

Company Name: Cromwell-Phoenix, Inc.
Location: Alsip, Illinois
Process: CI Paper Coating Operations

TOTAL ANNUAL COST SPREADSHEET PROGRAM -- RECUPERATIVE THERMAL OXIDIZERS

Describes the annual operating costs for purchasing, installing and operating a recuperative thermal oxidizer to control the above process.

COST BASE DATE: April 1988 [1]

VAPCCI [2]	3rd Quarter 2001	107.8

INPUT PARAMETERS

-- Gas flowrate (scfm):	20000
-- Reference temperature (oF):	77
-- Inlet gas temperature (oF):	80
-- Inlet gas density (lb/scf):	0.0739
-- Primary heat recovery (fraction):	0.70
-- Waste gas heat content (BTU/scf):	0.061
-- Waste gas heat content (BTU/lb):	0.83
-- Gas heat capacity (BTU/lb-oF):	0.255
-- Combustion temperature (oF):	1600
-- Preheat temperature (oF):	1144
-- Fuel heat of combustion (BTU/lb):	21502
-- Fuel density (lb/ft3):	0.0408

DESIGN PARAMETERS

-- Auxiliary Fuel Reqrmnt (lb/min):	10.842
(scfm):	265.7
-- Total Gas Flowrate (scfm):	20266

CAPITAL COSTS

Equipment Costs ($):		
-- Incinerator:		
	@ 0 % heat recovery:	0
	@ 35 % heat recovery:	0
	@ 50 % heat recovery:	0
	@ 70 % heat recovery:	254,639
PTE Containment or other capital costs		
Total Equipment Cost--base:		254,639
' ' ' --escalated:		343,344
	Instrumentation:	0
	Sales Tax:	10,300
	Freight:	17,167
Purchased Equipment Cost ($):		405,145
Direct Installation Costs:		
	Foundations & Supports:	32,412
	Handling & Erection:	56,720
	Electrical:	16,206
	Piping:	8,103
	Ductwork and Insulation:	4,051
	Painting:	4,051
	Direct Installation Cost:	121,544
	Site Preparation:	0
	Buildings or PTE:	137,000
	Total Direct Cost:	663,689

Indirect Installation Costs:	
Engineering:	40,515
Field Expenses:	20,257
Contractor Fees:	40,515
Start-Up:	8,103
Performance Test:	4,051
Contingencies:	12,154
Total Indirect Cost:	**125,595**
Total Capital Investment ($):	789,284

ANNUAL COST INPUTS

Operating factor (hr/yr):	8760
Operating labor rate ($/hr):	16.48
Maintenance labor rate ($/hr):	18.13
Operating labor factor (hr/sh):	0.5
Maintenance labor factor (hr/sh):	0.5
Electricity price ($/kwh):	0.069
Natural gas price ($/mscf):	6.00
Annual interest rate (fraction):	0.070
Control system life (years):	10
Capital recovery factor:	0.1424
Taxes, insurance, admin. factor:	0.04
Pressure drop (in. w.c.):	19.0

ANNUAL COSTS

Item	Cost ($/yr)	Wt. Factor	W.F.(cond.)
Operating labor	9,023	0.008	----
Supervisory labor	1,353	0.001	----
Maintenance labor	9,925	0.009	----
Maintenance materials	9,925	0.009	----
Natural gas	838,016	0.779	----
Electricity	45,387	0.042	----
Overhead	18,136	0.017	0.045
Taxes, insurance, administrative	31,571	0.029	----

Capital recovery	112,376	0.104	0.134
Total Annual Cost	1,075,713	1.000	1.000

[1] Original equipment costs reflect this date.
[2] VAPCCI = Vatavuk Air Pollution Control Cost Index (for thermal incinerators) corresponding to year and quarter shown. Original equipment cost, purchased equipment cost, and total capital investment have been escalated to this data via the VAPCCI and control equipment vendor data. Latest indexes included herein.

RACT Cost Summary Table	Costs for 20000 scfm system
1 Purchased Equipment Cost (PEC)	405,145
2 Total Direct Cost (includes PEC)	663,689
3 Total Indirect Cost	125,595
4 Total Capital Investment (= 2+3)	789,284
5 Annual Direct Operating Costs	913,630
6 Annual Indirect Operating Costs	49,707
7 Annual Capital Recovery Costs	112,376
8 Total Annual Costs (= 5+6+7)	1,075,713

Oxidizer VOC Control Efficiency		90	%
Annual VOC Input to the Control Device		16.9	tons
Annual VOC Emissions Controlled		15.21	
Annual VOC Emissions after Controls		1.69	
Annual Cost of Control Device	$	70,724	$/ton Controlled

Company Name: Cromwell-Phoenix, Inc.
Location: Alsip, Illinois
Process: CI Paper Coating Operations

TOTAL ANNUAL COST SPREADSHEET PROGRAM--REGENERATIVE THERMAL OXIDIZER (RTO)

Describes the annual operating costs for purchasing, installing and operating a regenerative thermal oxidizer to control the above process.

COST BASE DATE: December 1988 [1]

VAPCCI [2]	3rd Quarter 2001	110.8

INPUT PARAMETERS

-- Gas flowrate (scfm):	20000
-- Reference temperature (oF):	77
-- Inlet gas temperature (oF):	80
-- Inlet gas density (lb/scf):	0.0739
-- Primary heat recovery (fraction):	0.95
-- Waste gas heat content (BTU/scf):	0.061
-- Waste gas heat content (BTU/lb):	0.83
-- Gas heat capacity (BTU/lb-oF):	0.255
-- Combustion temperature (oF):	2000
-- Heat loss (fraction):	0.01
-- Exit temperature (oF):	176
-- Fuel heat of combustion (BTU/lb):	21502
-- Fuel density (lb/ft3):	0.0408

DESIGN PARAMETERS

Auxiliary Fuel Requirement (lb/min):	1.966
(scfm):	48.2
Total Gas Flowrate (scfm):	20048

TOTAL CAPITAL INVESTMENT ($) (3)
(Cost correlations range: 5000 to 500,000 scfm)

PTE Containment or other capital costs	137000
@ 85 % heat recovery--base:	0
' ' ' --escalated:	0
@ 95 % heat recovery--base:	1,016,304
' ' ' --escalated:	1,368,558

ANNUAL COST INPUTS

Operating factor (hr/yr):	8760
Operating labor rate ($/hr):	16.48
Maintenance labor rate ($/hr):	18.13
Operating labor factor (hr/sh):	0.50
Maintenance labor factor (hr/wk):	1.00
Electricity price ($/kwh):	0.069
Natural gas price ($/mscf):	6.00
Annual interest rate (fraction):	0.070
Control system life (years):	10
Capital recovery factor:	0.1424
Taxes, insurance, admin. factor:	0.04
Pressure drop (in. w.c.):	20.0

ANNUAL COSTS

Item	Cost ($/yr)	Wt. Factor	W.F.(cond.)
Operating labor	9,023	0.019	----
Supervisory labor	1,353	0.003	----
Maintenance labor	943	0.002	----
Maintenance materials	943	0.002	----
Natural gas	151,939	0.324	----
Electricity	47,260	0.101	----
Overhead	7,357	0.016	0.042
Taxes, insurance, administrative	54,742	0.117	—

Capital recovery	194,852	0.416	0.533
Total Annual Cost	468,412	1.000	1.000

[1] Base total capital investment reflects this date.
[2] VAPCCI = Vatavuk Air Pollution Control Cost Index (for regenerative thermal oxidizers) corresponding to year and quarter shown. Base total capital investment has been escalated to this date via VAPCCI and control equipment vendor data. Latest indexes included herein.
[3] Source: Vatavuk, William M. ESTIMATING COSTS OF AIR POLLUTION CONTROL. Boca Raton, FL: Lewis Publishers, 1990.

COMPARISON OF REECO/DUPONT, CO$T-AIR, AND MANUAL RTO COSTS: (1st Qtr. '91 $)

Flow (scfm)	REECo ($)	Manual ($) [a]	Manual/REECo	CO$T-AIR ($) [b]	C-A/REECo
2,000	340,000	371,061	1.09	640,305	1.88
5,000	425,000	423,946	1.00	713,363	1.68
10,000	500,000	512,087	1.02	835,125	1.67
25,000	850,000	776,511	0.91	1,200,413	1.41
50,000	1,500,000	1,217,217	0.81	1,809,225	1.21
100,000	2,850,000	2,098,629	0.74	3,026,850	1.06

[a] Escalated from April. '88 to 1st quarter '91 and multiplied by installation factor of 1.416 (1.2*1.18).
Range of correlation: 10,000 to 100,000 scfm.

[b] Escalated from Dec. '88 to 1st quarter '91. Costs pertain to 95% heat recovery units.
Range of correlation: 5,000 to 500,000 scfm.

RACT Cost Summary Table for RTO	Costs for 20000 scfm system
1 Total Capital Investment	1,368,558
2 Annual Direct Operating Costs	211,461
3 Annual Indirect Operating Costs	62,099
4 Annual Capital Recovery Costs	194,852
5 Total Annual Costs (= 2+3+4)	468,412

Oxidizer VOC Control Efficiency		90	%
Annual VOC Input to the Control Device		16.9	tons
Annual VOC Emissions Controlled		15.21	
Annual VOC Emissions after Controls		1.69	
Annual Cost of Control Device	$	30,796	$/ton Controlled

Company Name: Cromwell-Phoenix, Inc.
Location: Alsip, Illinois
Process: CI Paper Coating Operations

TOTAL ANNUAL COST SPREADSHEET PROGRAM--CATALYTIC INCINERATORS (FIXED)

Describes the annual operating costs for purchasing, installing and operating a Catalytic Oxidizer to control the above process.

COST REFERENCE DATE: April 1988 [1]

VAPCCI [2]	3rd Quarter 2001	109.8

INPUT PARAMETERS

-- Gas flowrate (scfm):	20000
-- Reference temperature (oF):	77
-- Inlet gas temperature (oF):	80
-- Inlet gas density (lb/scf):	0.0739
-- Primary heat recovery (fraction):	0.70
-- Waste gas heat content (BTU/scf):	0.061
-- Waste gas heat content (BTU/lb):	0.83
-- Gas heat capacity (BTU/lb-oF):	0.248
-- Combustion temperature (oF):	650
-- Preheat temperature (oF):	479
-- Fuel heat of combustion (BTU/lb):	21502
-- Fuel density (lb/ft3):	0.0408

DESIGN PARAMETERS

-- Auxiliary Fuel Reqrmnt (lb/min):	3.870
(scfm):	94.9
-- Total Gas Flowrate (scfm):	20095
-- Catalyst Volume (ft3):	38.9

CAPITAL COSTS

Equipment Costs ($):	
-- Incinerator:	
@ 0 % heat recovery:	0
@ 35 % heat recovery:	0
@ 50 % heat recovery:	0
@ 70 % heat recovery:	344,811
-- Other (auxiliary equipment, etc.):	0
Total Equipment Cost--base:	344,811
' ' ' --escalated:	409,261
Instrumentation	40,926
Sales Tax	12,278
Freight	20,463
Purchased Equipment Cost ($):	**482,928**
Direct Installation Costs:	
Foundation & Supports	38,634
Handling & Erection	67,610
Electrical	19,317
Piping	9,659
Ductwork & Insulation	4,829
Painting	4,829
Buildings or PTE:	137,000
Total Direct Cost:	**764,807**
Indirect Installation Costs:	
Engineering	48,293
Field Expenses	24,146
Contractor Fees	48,293
Start-Up	9,659
Performance Test	4,829
Contingencies	14,488
Total Indirect Costs:	**149,708**

Total Capital Investment ($):	914,514

ANNUAL COST INPUTS

Operating factor (hr/yr):	8760
Operating labor rate ($/hr):	16.48
Maintenance labor rate ($/hr):	18.13
Operating labor factor (hr/sh):	0.0
Maintenance labor factor (hr/sh):	0.5
Electricity price ($/kwh):	0.069
Catalyst price ($/ft3):	650
Natural gas price ($/mscf):	6.00
Annual interest rate (fraction):	0.07
Control system life (years):	10
Catalyst life (years):	2
Capital recovery factor (system):	0.1424
Capital recovery factor (catalyst):	0.5531
Taxes, insurance, admin. factor:	0.04
Pressure drop (in. w.c.):	21.0

ANNUAL COSTS

Item	Cost ($/yr)	Wt. Factor	W.F.(cond.)
Operating labor	0	0.000	----
Supervisory labor	0	0.000	----
Maintenance labor	9,925	0.018	----
Maintenance materials	9,925	0.018	----
Natural gas	299,160	0.535	----
Electricity	49,742	0.089	----
Catalyst replacement	15,110	0.027	----
Overhead	11,910	0.021	0.057
Taxes, insurance, administrative	36,581	0.065	—
Capital recovery	126,317	0.226	0.292

Total Annual Cost	558,670	1.000	1.000

[1] Original equipment costs reflect this date.

[2] VAPCCI = Vatavuk Air Pollution Control Cost Index (for catalytic incinerators) corresponding to year and quarter shown. Original equipment cost, purchased equipment cost, and total capital investment have been escalated to this date via the VAPCCI and control equipment vendor data.

RACT Cost Summary Table

1 Purchased Equipment Cost (PEC)	482,928
2 Total Direct Cost (includes PEC)	764,807
3 Total Indirect Cost	149,708
4 Total Capital Investment (= 2+3)	914,514
5 Annual Direct Operating Costs	383,863
6 Annual Indirect Operating Costs	48,491
7 Annual Capital Recovery Costs	126,317
8 Total Annual Costs (= 5+6+7)	558,670

Oxidizer VOC Control Efficiency (%)		90	%
Annual VOC Input to the Control Device		16.9	tons
Annual VOC Emissions Controlled		15.21	tons
Annual VOC Emissions after Controls		1.69	tons
Annual Cost of Control Device	$	36,730	per ton controlled

Company Name: Cromwell-Phoenix, Inc.
Location: Alsip, Illinois
Process: CI Paper Coating Operations

TOTAL ANNUAL COST SPREADSHEET PROGRAM-- CARBON ADSORBER CONCENTRATOR w/THERMAL OXIDIZER

This spreadsheet describes the annual operating costs for a carbon adsorption concentrator system operating in conjunction with a recuperative thermal oxidizer controlling the 10% desorption stream.

STAGE I VOC REMOVAL - CARBON ADSORBER CONCENTRATOR

COST BASE DATE: Third Quarter 1989 [2]	
VAPCCI [3] 3rd Quarter 2001	105.7
INPUT PARAMETERS:	
-- Inlet stream flowrate (acfm):	20000
-- Inlet stream temperature (oF):	80
-- Inlet stream pressure (atm):	1
-- VOC to be condensed:	Propylene Glycol
-- Inlet VOC flowrate (lb/hr):	3.86
-- VOC molecular weight (lb/lb-mole):	76.10
-- VOC inlet volume fraction:	1.665572E-05
-- VOC inlet concentration (ppmv):	16.7
-- VOC inlet partial pressure (psia):	0.0002
-- Required VOC removal (fraction):	0.950
-- Freundlich isotherm equation constants for VOC (see Table 1 below):	
VOC number (enter Table 1 # or zero, i	1011
K:	0.412
M:	0.389
-- Yaws isotherm equation constants (see Table 2 below):	
VOC number (enter Table 2 #or zero, if	84
	1.40474
	0.18738
	-0.02663
-- Adsorption time (hr):	8.0
-- Desorption time (hr):	4.0
-- Number of adsorbing vessels:	2
-- Superficial carbon bed velocity (ft/min):	75
-- Carbon price ($/lb):	3.00

-- Material of construction (see list below): [4]	1.3
DESIGN PARAMETERS:	
-- Carbon equilibrium capacity--Freundlich (lb VOC/lb	0.0162
" " "	0.3926
-- Carbon working capacity (lb VOC/lb carbon):	0.0081
-- Number of desorbing vessels:	2
-- Total number of vessels:	4
-- Carbon requirement, total (lb):	7611
-- Carbon requirement per vessel (lb):	1903
-- Gas flowrate per vessel (acfm):	10000
-- Adsorber vessel diameter (ft):	13.029
-- Adsorber vessel length (ft):	4.476
-- Adsorber vessel surface area (ft2):	449.87
-- Carbon bed thickness (ft):	0.476
-- Carbon bed pressure drop (in. w.c.): [5]	1.609
CAPITAL COSTS	
Equipment Costs ($):	
-- Adsorber vessels	163,333
-- Carbon	22,833
-- Other equipment (condenser, decanter, etc.)	135,321
Total equipment cost ($)--base:	290,259
' ' ' ' --escalated:	340,246
Instrumentation:	34,025
Sales Tax:	10,207
Freight:	17,012
Purchased Equipment Cost ($):	401,490
Direct Installation Costs:	
Foundations & Supports:	32,119
Handling & Erection:	56,209
Electrical:	16,060
Piping:	8,030
Ductwork and Insulation:	4,015
Painting:	4,015
Direct Installation Cost:	120,447

	Site Preparation:	
	Buildings or PTE Constr:	137,000
	Total Direct Cost:	**658,937**
Indirect Installation Costs:		
	Engineering:	40,149
	Field Expenses:	20,074
	Contractor Fees:	40,149
	Start-Up:	8,030
	Performance Test:	4,015
	Contingencies:	12,045
	Total Indirect Cost:	**124,462**
Total Capital Investment ($):		783,399
" " " ($/acfm):		39.2

ANNUAL COST INPUTS:

Operating factor (hr/yr):	8760
Operating labor rate ($/hr):	16.48
Maintenance labor rate ($/hr):	18.13
Operating labor factor (hr/sh):	0.5
Maintenance labor factor (hr/sh):	0.5
Electricity price ($/kWhr):	0.069
Recovered VOC value ($/lb):	0.0000
Steam price ($/1000 lb):	7.50
Cooling water price ($/1000 gal):	0.20
Carbon replacement labor ($/lb):	0.05
Overhead rate (fraction):	0.6
Annual interest rate (fraction):	0.070
Control system life (years):	10
Capital recovery factor (system):	0.1424
Carbon life (years):	5
Capital recovery factor (carbon):	0.2439
Taxes, insurance, admin. factor:	0.04

ANNUAL COSTS:

Item	Cost ($/yr)	Wt. Factor	W.F. (cond.)
Operating labor	9,023	0.045	----
Supervisory labor	1,353	0.007	----
Maintenance labor	9,925	0.050	----
Maintenance materials	9,925	0.050	----
Electricity	3,785	0.019	----
Steam	887	0.004	----
Cooling water	81	0.000	----
Carbon replacement	6,107	0.031	----
Overhead	18,136	0.091	0.244
Taxes, insurance, administrative	31,336	0.158	----
Capital recovery	107,973	0.544	0.702
Sub-Total Carbon Adsorber Annual Costs	198,531	1.000	0.964
Recovery credits	0		
Carbon Adsorber Annual Costs (w/credit)	198,531		
($/million acf)	18.89		

Notes:

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[1] This program has been based on data and procedures in Chapter 4 of the OAQPS CONTROL COST MANUAL (5th edition).

[2] Base equipment costs reflect this date.

[3] VAPCCI = Vatavuk Air Pollution Control Cost Index (for carbon adsorbers) corresponding to year and quarter shown. Base equipment cost, purchased equipment cost, and total capital investment have been escalated to this date via the VAPCCI and control equipment vendor data.

[4] Enter one of the following: carbon steel--'1'; 316 stainless steel--'1.3'; Carpenter 20 (CB-3)--'1.9'; Monel-400--'2.3'; Nickel-200--'3.2'; titanium--'4.5'.

[5] This is the carbon bed pressure drop ONLY. There will be additional pressure drop through the ductwork . For estimating ductwork pressure losses, see Chapter 10 of the OAQPS CONTROL COST MANUAL (5th edition).

Table 1. Freundlich Constants for Selected Compounds [6]

VOC	VOC number	K	M	Temperature (F)	Correlation Range (psia) Minimum	Maximum
Benzene	1001	0.597	0.176	77	0.0001	0.05
Chlorobenzene	1002	1.05	0.188	77	0.0001	0.01
Cyclohexane	1003	0.508	0.210	100	0.0001	0.05
Dichloroethane	1004	0.976	0.281	77	0.0001	0.04
Phenol	1005	0.855	0.153	104	0.0001	0.03
Trichloroethane	1006	1.06	0.161	77	0.0001	0.04
Vinyl chloride	1007	0.200	0.477	100	0.0001	0.05
m-Xylene (low-pressure	1008	0.708	0.113	77	0.0001	0.001
m-Xylene (high-pressur	1009	0.527	0.0703	77	0.001	0.05
Acrylonitrile	1010	0.935	0.424	100	0.0001	0.015
Acetone	1011	0.412	0.389	100	0.0001	0.05
Toluene	1012	0.551	0.110	77	0.0001	0.05

[6] These constants fit the following equation:

Q = K(P)^M

where: Q = equilibrium adsorption capacity (lb/lb carbon)
P = VOC partial pressure (psia at 1 atm & listed temperature)

Table 2. Correlation Constants for Yaws Isoth Correlation Ranges (ppmv)

VOC	VOC number	A	B	C	Minimum	Maximum
Phosgene	6	-0.64469	0.60428	-0.02986	10	10000
Carbon tetrachloride	9	1.07481	0.28186	-0.02273	10	10000
Chloroform	11	0.67102	0.36148	-0.02288	10	10000
Formaldehyde	18	-2.48524	0.69123	-0.00375	10	10000
Methyl chloride	21	-1.91871	0.62053	-0.00549	10	10000
Carbon disulfide	35	-0.18899	0.47093	-0.01481	10	10000
Tetrachloroethylene	39	1.40596	0.20802	-0.02097	10	10000
Vinyl chloride	55	-0.98889	0.66564	-0.04320	10	10000
1,1,2-Trichloroethane	59	1.17163	0.27791	-0.02746	10	10000

Acetonitrile	60	-0.79666	0.63512	-0.02598	10	10000
Methyl isocyanate	61	-1.07579	0.85881	-0.06876	10	10000
Acetaldehyde	69	-1.17047	0.62766	-0.02475	10	10000
Ethylene glycol	84	1.40474	0.18738	-0.02663	10	121
Ethyl mercaptan	87	0.00552	0.40506	-0.01802	10	10000
Acrylonitrile	93	0.07669	0.49986	-0.03500	10	10000
Acrolein	97	-0.29632	0.49437	-0.02471	10	10000
1,3-Butadiene	168	-0.03359	0.34764	-0.01297	10	10000
Methyl ethyl ketone	194	0.46525	0.37688	-0.02801	10	10000
n-Butane	213	0.03071	0.34304	-0.01596	10	10000
1,2,4-Trichlorobenzene	331	1.68304	0.09456	-0.00998	10	566
Chlorobenzene	336	1.02705	0.30619	-0.03353	10	10000
Nitrobenzene	340	1.64859	0.06109	0	10	329
Benzene	341	0.81119	0.28864	-0.02378	10	10000
Phenol	345	1.45599	0.10349	-0.01086	10	10000
Toluene	466	1.11466	0.20795	-0.02016	10	10000
m-Cresol	469	1.61982	0.04926	0	10	149
o-Toluidine	474	1.58104	0.05475	0	10	339
Styrene	528	1.35701	0.13495	-0.01451	10	8044
m-Xylene	533	1.31522	0.14019	-0.01457	10	10000
o-Xylene	534	1.33404	0.13931	-0.01494	10	8722
p-Xylene	535	1.31115	0.14069	-0.01458	10	10000

[7] Constants fit the following equation: Q = 0.01*10^(A + B(log(y)) + C(log(y))^2)
where: Q = equilibrium adsorption capacity (lb/lb carbon)
y = VOC concentration (ppmv at 77 F, 1 atm)

Source: Yaws, Carl L. et al., "Determining VOC Adsorption Capacity," Pollution Engineering, February 1995, pp. 34-37.

TOTAL ANNUAL COST OF THERMAL OXIDIZER FOR DESTRUCTION OF VOCs IN CONCENTRATED DESORPTION EXHAUST STREAM

STAGE II VOC DESTRUCTION - RECUPERATIVE THERMAL OXIDIZER

COST BASE DATE: April 1988 [1]

VAPCCI [2] 3rd Quarter 2001	107.8

INPUT PARAMETERS

-- Gas flowrate (scfm):	2000
-- Reference temperature (oF):	77
-- Inlet gas temperature (oF):	150
-- Inlet gas density (lb/scf):	0.0739
-- Primary heat recovery (fraction):	0.70
-- Waste gas heat content (BTU/scf):	0.061
-- Waste gas heat content (BTU/lb):	0.83
-- Gas heat capacity (BTU/lb-oF):	0.255
-- Combustion temperature (oF):	1600
-- Preheat temperature (oF):	1165
-- Fuel heat of combustion (BTU/lb):	21502
-- Fuel density (lb/ft3):	0.0408

DESIGN PARAMETERS

-- Auxiliary Fuel Reqrmnt (lb/min):	1.047
(scfm):	25.7
-- Total Gas Flowrate (scfm):	2026

CAPITAL COSTS

Equipment Costs ($):
-- Incinerator:

@ 0 % heat recovery:	0

@ 35 % heat recovery:	0
@ 50 % heat recovery:	0
@ 70 % heat recovery:	143,178
Other Capital Costs	
Total Equipment Cost--base:	143,178
' ' ' --escalated:	193,054
Instrumentation:	0
Sales Tax:	5,792
Freight:	9,653
Purchased Equipment Cost ($):	208,499
Direct Installation Costs:	
Foundations & Supports:	16,680
Handling & Erection:	29,190
Electrical:	8,340
Piping:	4,170
Ductwork & Insulation:	2,085
Painting:	2,085
Direct Installation Cost:	62,550
Site Preparation:	
Other (Specify):	
Total Direct Cost:	271,048
Indirect Installation Costs:	
Engineering:	20,850
Field Expenses:	10,425
Contractor Fees:	20,850
Start-Up:	4,170
Performance Test:	2,085
Contingencies:	6,255
Total Indirect Cost:	64,635
Total Capital Investment ($):	335,683

ANNUAL COST INPUTS

Operating factor (hr/yr):	8760
Operating labor rate ($/hr):	16.48
Maintenance labor rate ($/hr):	18.13
Operating labor factor (hr/sh):	0.0
Maintenance labor factor (hr/sh):	0.5
Electricity price ($/kwh):	0.069
Natural gas price ($/mscf):	6.00
Annual interest rate (fraction):	0.070
Control system life (years):	10
Capital recovery factor:	0.1424
Taxes, insurance, admin. factor:	0.04
Pressure drop (in. w.c.):	19.0

ANNUAL COSTS

Item	Cost ($/yr)	Wt. Factor	W.F.(cond.)
Operating labor	0	0.000	----
Supervisory labor	0	0.000	----
Maintenance labor	9,925	0.056	----
Maintenance materials	9,925	0.056	----
Natural gas	80,893	0.453	----
Electricity	4,537	0.025	----
Overhead	11,910	0.067	0.178
Taxes, insurance, administrative	13,427	0.075	----
Capital recovery	47,794	0.268	0.343
Total Annual Cost for Thermal Oxidizer	178,411	1.000	1.000

[1] Original equipment costs reflect this date.
[2] VAPCCI = Vatavuk Air Pollution Control Cost Index (for thermal incinerators) corresponding to year and quarter shown. Original equipment cost, purchased equipment cost, and total capital investment have been escalated to this data via the VAPCCI and control equipment vendor data.

TOTAL ANNUAL COST: CARBON ADSORBER CONCENTRATOR w/ THERMAL OXIDIZER

Sub-Total Annual Cost Carbon Adsorber Concentrator		198,531
Sub-Total Annual Cost Thermal Oxidizer VOC Control		178,411
Total Annual Cost Carbon Adsorber/Thermal Oxidizer	$	376,942

RACT Cost Summary Table	Costs for One 20000 scfm system
1 Purchased Equipment Cost (PEC)	609,989
2 Total Direct Cost (includes PEC)	929,985
3 Total Indirect Cost	189,096
4 Total Capital Investment (= 2+3)	1,119,082
5 Annual Direct Operating Costs	146,366
6 Annual Indirect Operating Costs	74,809
7 Annual Capital Recovery Costs	155,767
8 Total Annual Costs (= 5+6+7)	376,942

Oxidizer VOC Control Efficiency		90	%
Annual VOC Input to the Control Device		16.9	tons
Annual VOC Emissions Controlled		15.21	
Annual VOC Emissions after Controls		1.69	
Annual Cost of Control Device	$	24,783	$/ton Controlled

EXHIBIT B

TRADE SECRET
(SEE SECTIONS 6, 9 AND 12)

CONFIDENTIAL BUSINESS INFORMATION

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	**AS ______**
Petition of Cromwell-Phoenix, Inc.	)	**(Adjusted Standard)**
for an Adjusted Standard from 35	)	
Ill. Adm. Code Subpart F, Section 218.204 (c)	)	
(the "Paper Coating Rule")	)	

AFFIDAVIT OF FRANCIS HOULIHAN IN SUPPORT

OF CROMWELL-PHOENIX, INC.'S

PETITION FOR AN ADJUSTED STANDARD

I Francis Houlihan, declare under penalty of perjury that the following is true and correct:

1. I am the President of CROMWELL-PHOENIX, INC. ("CROMWELL").

2. I have served in that capacity since CROMWELL was formed.

3. CROMWELL is an Illinois corporation located in Alsip, Cook County, Illinois.

4. CROMWELL employs 31 people at this location.

5. CROMWELL is a manufacturer of corrosion inhibiting ("CI") packaging materials for the metal parts industry.

6.

7. CROMWELL believes that it is the only manufacturer of corrosion inhibiting packaging materials in Illinois.

8. CROMWELL produces CI packaging materials by impregnating kraft paper with corrosion inhibiting solutions.

19. Achieving the VOM content levels in the CI coatings that are called for in 35 IAC Part 218 Subpart F (35 IAC 218.204(c)) is not practicable for functional, environmental, and economic reasons.

20. In CROMWELL'S CI solutions, VOM components are intended to remain in the CI packaging products in order to perform their essential corrosion inhibiting functions. The VOMs are themselves corrosion inhibitors and they facilitate the gradual migration of other corrosion inhibiting solids present in the CI packaging products onto the customer's wrapped metal parts over a prolonged period of time. Therefore, CROMWELL has economic and product performance incentives to ensure that the VOM components are retained in the product and not emitted.

21. CROMWELL has experimented with reformulated coatings in an attempt to achieve a coating which approximates the 2.3 pounds VOM per gallon required under 35 IAC 218.204 (c). Such reformulations would require the substitution of water for some of the VOM.

22. It is undesirable for the CI products to contain excess water, as the presence of residual water in the CI products promotes corrosion of the customer's metal parts. Excess water also causes unacceptable expansion of the paper fibers resulting in the CI paper product becoming wrinkled and welted, as well as the cut sheets becoming curled. This makes the CI paper very difficult to handle and results in the inability to achieve a good wrap on the metal items that are being protected by the CI papers.

23. If additional water is substituted for some of the VOM compounds in the CI solution additional heated drying operations would be required in order to drive off excess water. This would require additional energy consumption, and would increase VOM emissions above those currently produced by CROMWELL. It would also reduce the efficacy of CROMWELL'S CI packaging material by driving off CI constituents intended to be retained in the CI paper.

24. CROMWELL has calculated that use of a compliant CI solution would result in VOM emissions approximately 7.8 times greater than those associated with the current formulations. CROMWELL'S emissions would rise from the current approximately 6 tons per year to 39 tons per year or more.

25. CROMWELL also analyzed the technical and economic feasibility of add-on control devices to CROMWELL'S CI coating operations.

26. The technically feasible control options were determined to be oxidation and a combination carbon adsorption/oxidation system. CROMWELL'S consultant, ERM, Inc., determined that the annual cost per ton of VOM controlled for each of these options is well above the level that would be considered reasonable under a conventional RACT demonstration. As a small business, CROMWELL cannot afford the initial capital outlay and annual operating costs associated with add-on control devices.

27. CROMWELL reported air emissions of 5.4 tons in 2001 and 6.03 tons in 2002.

28. CROMWELL cannot use compliance coatings and such use would actually increase rather than decrease emissions from the facility. In addition, the approved control technologies will work only at an unreasonable cost and with nominal VOM reduction benefit.

29. Therefore CROMWELL requires an adjusted standard.

Francis Houlihan, President
Cromwell-Phoenix, Inc.

Signed and sworn to before me
this 27 day of May, 2003.

Loretta F. Schultz
Notary Public

"OFFICIAL SEAL"
LORETTA F. SCHULTZ
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 9/4/2005

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