EHP

Consulting, Inc.

Asarco El Paso Smelter Review and Comments

April 9, 2007

Prepared by
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TCEQ

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1.0 INTRODUCTION

Eric Partelpoeg of EHP Consulting, Inc. ("EHP") has, at the request of TCEQ reviewed the operating condition of the air quality control equipment and related practices at the Asarco El Paso Smelter (the "Smelter"). Additionally, EHP was asked to comment on whether the Smelter could be restarted and operated in accordance to industry standards and practices. This review is intended to assist TCEQ with its assessment of any terms and conditions that may be applied to a renewal of an operating permit for the Smelter. This report documents this effort which is based on a January 3-4, 2007 visit to the Smelter and a review of documents that outline the Smelter's operating and maintenance program. The report is presented in the following sections:

1. Introduction (this page),
2. EHP Qualifications,
3. Scope of work,
4. Executive Summary,
5. A summary of site observations during the January 3-4 visit,
6. A summary of the documents and data that have been reviewed, and
7. Discussion.

During the site visit EHP was accompanied by Asarco and TCEQ staff. Both Asarco and TCEQ have been reviewing a number of legal and technical issues associated with the renewal of an operating permit to a level of detail and for a period of time that greatly exceeds the scope of this review. Accordingly, this report is limited in scope and is intended as a source of general comments and non-binding recommendations for TCEQ's consideration.

This report is based on the best information available to Eric Partelpoeg during the review. The material in it reflects his best judgment in light of the information available to him at the time of preparation. Specifically, it is based on information supplied by Asarco and TCEQ representatives, a review of reports, tours of parts of the facility, and his professional background and experience in the industry. He has prepared this report using information provided and shall not be responsible for conditions arising from information or facts which were not fully disclosed to him, or for conditions which can only be confirmed through sampling or monitoring.

This report was prepared by EHP Consulting, Inc. (Eric Partelpoeg) for the Texas Commission of Environmental Quality to aid in their decision-making with respect to renewing an operating permit to the Asarco El Paso Smelter. Any use of, or reliance or decision based on this report by any third party is the sole and exclusive responsibility of such third party.

2.0 SUMMARY OF CREDENTIALS

Dr. Partelpoeg received his Ph.D in Metallurgy from the University of Arizona in 1985. His Bachelor of Engineering and Masters of Engineering were earned at McGill University in Montreal Canada in 1977 and 1980 respectively. His smelter experience includes direct operations involvement in smelters in Finland, Canada, and the United States. He has participated in smelter projects in Australia, Asia (China, India, and Thailand), Africa, Europe, and South America (Brazil, Chile, and Peru). These projects include due diligence reviews associated with mergers and acquisitions, problem-solving, computer modeling, failure analysis, and review of serious accidents. His pollution control experience includes project design, management, construction, and operation of baghouses, electrostatic precipitators, scrubbers, and sulfuric acid plants. With respect to plant shutdowns and startups, Partelpoeg has studied and reported on the mothball and start-up procedures of a major metallurgical facility (confidential review carried out in 2001). Dr. Partelpoeg was retained by two international agencies in 2006 to assist with the assessment of air quality equipment and operating practices of smelters. One of these smelters is located in South America, the other in Europe. EHP's qualifications are detailed in Appendix 1. EHP's comments in this report are technical opinions regarding the Asarco El Paso Smelter. Some of these comments may not be directly relevant to the permit requirements of the El Paso Smelter; the relevance of these comments to the permitting process will be determined by TCEQ.

3.0 SCOPE OF REVIEW

The complete scope of the review is included in Appendix 2. This scope, as well as comments related to the scope, are summarized in the following table.

#	Scope Item	EHP Comment
1	Determine the condition of all air quality control equipment and the predicted control effectiveness of: (a) the equipment and (b) the related practices at the Smelter.	In most cases the condition of equipment was determined by inspection of the equipment externals. The design of the equipment and past operating performance was also considered in the evaluation. The related practices at the Smelter were evaluated by reviewing Distributed Control System (DCS) screens and operating and maintenance procedures.
2	Review all air quality control equipment in comparison with all requirements of Asarco's existing Air Quality Permit No. 20345 pursuant to Ordering Provision 3 of the Interim Order.	EHP has interpreted this scope item as an assessment of whether the equipment cited in the Draft permit 20345 is in the appropriate condition (or can be put into the appropriate condition) to achieve the stated control efficiencies. For the purposes of this report, this review is identical to Scope item #1 (above).
3	Review and determine whether the Smelter could be operated in accordance with industry standards and practices. In order to accomplish this, Consultant shall review commissioning or start-up plans ("Plans") for their adequacy and may make recommendations for changes to the Plans to meet industry standards and practices.	The "Plans" (Appendix 3) are a brief outline of the start-up plans. Discussions with Asarco (held with TCEQ present on January 3-4) indicate that the Smelter operating and maintenance procedures are an integral part of the start-up (both for training new employees and maintaining proper procedures). Accordingly, these procedures are considered as in integral part of the "Plans".
4	Recommend post commissioning or start-up activities, such as testing, observation, procedures or practices, as deemed appropriate for the Smelter start-up.	Only limited comments on this scope item are provided. Detailed recommendations can be provided once the start-up plans have been developed to a greater level of detail.
5	Review the condition of the air quality equipment that can be categorized as fixed and permanent equipment for which Asarco has no plans to change prior to smelter start-up. Review Asarco plans for refurbishment of air quality equipment.	This scope item identifies a few specific items that are reviewed. In general, this scope item is reviewed collectively with Scope Items #1 and #2.

4.0 EXECUTIVE SUMMARY

The major air quality control equipment at the Asarco El Paso Smelter was inspected to the extent possible during the site visit. Asarco start-up plans were reviewed as well as Asarco's training documents and Standard Operating Practices (SOPs). The overall conclusions of this review are:

1. Except as noted below, minor repairs and refurbishments will suffice to prepare the equipment for a smelter startup and operation in accordance with industry standards and practices. These repairs and refurbishments are typical of what is expected following a long shutdown. During the refurbishment period, detailed inspection of equipment is recommended to supplement the observations made during the January 2007 site visit.
2. 1998 emission data from the acid plants and the main baghouses (concentrate dryer baghouse and converter aisle building ventilation baghouse) confirm that the equipment is capable of performing to the level required by the permit.
3. The Asarco start-up plan addresses all of the major issues that are associated with a smelter start-up. The current start-up plan is a high level summary; updates should include a more detailed description of the following subject matter:
    a. Inspection protocol of equipment for corrosion damage, particularly to corrosion damage that is not evident from an external inspection.
    b. Employee training program. I would expect that a significant percentage of new employees should be trained by hands-on training at an operating smelter. The Asarco Hayden Smelter in Arizona can be used to train employees with the skills required to operate air quality control equipment such as baghouses, scrubbers, acid plants, electrostatic precipitators. Hands-on training with hot metal processing is also recommended.
4. Corrosion damage to the drying and absorption towers in Acid Plant #1 must be addressed prior to start-up and operation. In lieu of repairs, Asarco may elect to replace the towers based on cost considerations.

5. The instrumentation control system ("ICS")[1] in smelter areas associated with the Contop modernization project are controlled by a Foxboro DCS (Distributed Control System). While the vintage of the DCS may warrant an upgrade, Asarco has stated that Foxboro still supports the technology and accordingly, it is suitable for a smelter startup.

6. Some of the ICS at the acid plant are 1970s vintage analog and have not been updated to digital. The acid plant ICS (and the acid plants as a whole) were functioning effectively prior to the smelter shutdown—acid plant tail-gas was consistently below 300 parts per million SO_2 for the November 1998 data period that was reviewed. While the ICS proved effective prior to the shutdown, in my opinion, the ICS is not up to "industry standards and practices." Modern ICS technology does more than control valve positions and tank levels. They operate as integrated data collection systems which facilitate the collection of data in a digital format that is conducive to data analysis. I credit the low emissions from Asarco's acid plants in the 1990s not on their instrumentation and controls but on what must have been a dedicated and experienced work force that understood the nuances of valve positions and temperature setpoints on acid plant operation. Asarco may well be able to rehire the dedicated employees; however if new employees are hired, they could be more easily trained if the acid plant was equipped with a digital ICS.

[1] In this report I refer to instrumentation control systems as "ICS". While this is not a common abbreviation, it provides a clear distinction between air pollution control systems and instrumentation control systems.

5.0 SITE OBSERVATIONS

A site visit was carried out on January 3, 2007. Joining EHP on this tour were representatives of TCEQ and Asarco (Archie Clouse and Dois Webb of the TCEQ and Lairy Johnson and Alan Brutcher of Asarco). Rodman Johnson (attorney for Asarco) joined this group in meetings prior to and subsequent to the tour. A follow-up visit to the #2 Acid Plant was carried out on January 4, 2007 (EHP accompanied by Archie Clouse and Mr. Carlos Alvarado of Asarco).

The Smelter operations were suspended in 1999 and the plant was put on a care and maintenance program. A tour of a smelter that has been idled for six years can offer the following indication of the condition of the equipment and the smelter:

1. If corrosion is occurring on the interior of process equipment, the tour can identify if the corrosion has been severe enough to result in failure that is evident from an external inspection. When process plants (particularly copper smelter and acid plants) are shut down for extended periods, corrosion damage to the interior of process equipment is a concern for equipment reliability reasons. Corrosion beginning on the external surfaces of process equipment is typically only a cosmetic issue and does not materially impact the reliability of the equipment.
2. The general condition of the smelter infrastructure (concrete, structural steel, electrical conduit, piping systems, lighting, etc.).
3. The vintage of process and pollution control equipment, including evidence of equipment upgrades.
4. The quality of the ICS and the extent of electronic data retention.

A smelter tour of the type reflected in this report cannot provide an indication of the extent of corrosion that is occurring within process equipment (except for severe corrosion cases noted above) or the operability of equipment (e.g. the condition of bearings, motors, instrumentation, etc.). All of these parameters would be identified and addressed appropriately during the normal course of commissioning equipment prior to a start-up.

5.1 SMELTER FEED SYSTEM

The smelter feed system area consists of the following general areas: (a) concentrate receiving, (b) concentrate conveying to the concentrate storage area, (c) concentrate storage and reclaiming, and (d) conveying of reclaimed concentrate to the smelter area. Within these general areas are numerous "Emission Points" as listed in the emission sources table of Permit No. 4151. It should be noted that Asarco has decided against a periodic rotation of fans, blowers, and pumps. The replacement of bearings in rotating equipment may be required as part of the commissioning plan.

In general, this area of the plant was clean and all major equipment appeared to be in relatively good condition. Particulate emission control from the conveyor system is attained in part by maintaining 10% moisture in the concentrate. During the tour both Asarco and TCEQ stated that when the smelter operated, there were no issues associated with particulate losses from the conveying system.

5.2 CONCENTRATE DRYING

Concentrate is dried in a fluid bed dryer prior to feeding to the Contop smelting furnace. The majority of the dried concentrate is separated from the dryer off-gas by cyclone separators. The cyclone underflow (containing the bulk of the concentrate) feeds a pneumatic conveying system that delivers the concentrate to dry concentrate storage bins. These bins are vented by small baghouses, one of which is shown to the right. These baghouses appear to be in serviceable condition. During the commissioning of the smelter, the condition of the baghouse internals will be checked. The diaphragms of the solenoid valves may have to be replaced. EHP was informed by Asarco that the bags have already been removed and replacement bags will be installed prior to start-up.

The off-gas from the cyclone separators reports to the main dryer baghouse. It consists of a series of five modules operated in parallel and shown below. This baghouse appears to have been designed appropriately and neither Asarco nor TCEQ indicated that this control equipment has

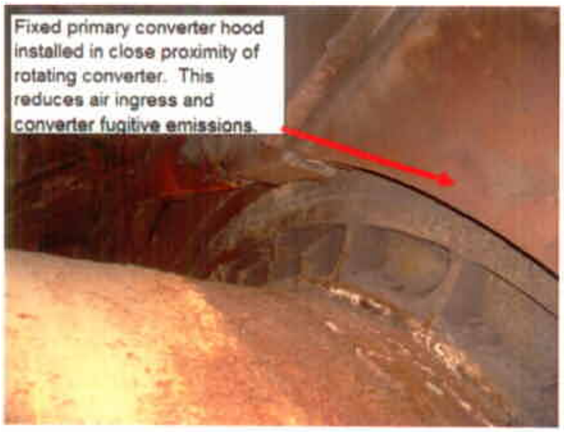
historically been a problem with respect to excess emissions. This baghouse is designed to process 110,000 acfm of dryer off-gas. The air to cloth ratio of the baghouse is approximately 4. This value is appropriate for this application and is low enough to allow for the operation of four of the five modules, if one module is taken off-line for maintenance.

5.3 CONTOP SMELTING PROCESS

The Contop smelting process produces molten copper matte (a combination of copper, iron, and sulfur), molten slag (primarily oxides of iron and silica), and an SO_2 rich off-gas. A detailed inspection of the Contop system was not carried out as the effectiveness of this vessel's ability to operate without fugitive emissions cannot be determined until normal operations resume. I believe that, subsequent to normal commissioning, the equipment associated with the Contop process can achieve the smelting efficiency that was proven prior to the 1999 shutdown.

5.4 CONVERTERS

The converters process the 57% copper matte produced by the Contop process. During the converting process, air is blown into the matte to oxidize the iron and sulfur from the matte. Silica flux is added to the converter to combine with the iron oxides and form slag. Sulfur is oxidized to SO_2 most of which is collected in the primary converter hood. The primary hoods at the Smelter are installed in close proximity to the rotating converter as shown in the following photo. This is an example of good design practice—a closely coupled primary hood maximizes the capture of primary gases (which are processed through the acid plant).



Off-gases not captured by the primary hoods are collected by a secondary system. Gases not captured by the secondary system escape into the converter aisle building. The converter aisle at the Smelter are captured and treated in a baghouse. The collection and treatment of all converter aisle building gases is an effective design feature to prevent the converter aisle from becoming a source of fugitive emissions. EHP is not aware of any other smelter that captures all of the gases from a converter building.

5.5 CONVERTER BUILDING FUGITIVE GAS CAPTURE

The Smelter converter building is vented through the converter building baghouse (shown to the left). The design flow through the baghouse is 540,000 acfm. The baghouse is a shaking type baghouse and is designed with an air to cloth ratio of 2.7. The design operating temperature of the baghouse is 140°F. I never toured the Smelter when it operated, but during my tenure at the Chino Smelter (see CV, Appendix 1) I had been informed (on an anecdotal basis by people who had visited the El Paso Smelter) that the working conditions within the Smelter building could at times be extremely hot. For this reason, during my January, 2007 visit I requested the overall dimensions of the converter building. I was informed that the building is approximately 278 feet long, 96 feet wide and 64 feet high. Based on the design flow and these dimensions, the converter building has approximately 19 air changes per hour. Based on my familiarity with air changes this appears to be a reasonable design value and I conclude that the baghouse is sized appropriately. If actual building temperatures are recorded in a range that is objectionable to workroom hygiene and health experts, Asarco could consider any number of steps to reduce the exposure of employees to high temperatures.

The overall condition of the baghouse is good. The photo on the left shows one of the external shaking mechanisms. It appears that cleaning and lubrication is all that is required to bring this system to normal operating condition. An inspection door was opened to enable an inspection of the interior of the baghouse. The photo on the right shows that the bags are still in this baghouse. If Asarco intends on using these bags, a certain percentage of the bags should be removed and sent to a bag testing laboratory to confirm the condition of the bags. A qualitative inspection of the bags suggests that there is a reasonable likelihood that most of these bags are in serviceable condition.

There is some corrosion of the baghouse shell as evidenced by the photo on the left that shows the bottom of the baghouse outlet plenum. The photo on the right shows a view of the outlet plenum. There is evidence of warpage and paint damage. The corrosion damage must be repaired. The paint damage and warpage may be linked to high operating temperatures that are discussed earlier.

5.6 ACID PLANT GAS PROCESSING

The process gas from the smelting furnace and the converters is cooled, cleaned, and scrubbed prior to entering the acid plant. This pretreatment of process gases, is not in my opinion directly related to the air quality permits of the Smelter. The pretreatment conditions the gases to a quality that is adequate for acid production. If this conditioning is not adequate, the acid plant catalyst would foul prematurely. Asarco indicated to me that catalyst screening frequency occurred on an annual basis. This frequency indicates that the acid plant gas processing adequately cleans the process gas as an annual catalyst screening frequency is typical in copper smelters. If the gas processing system was inadequate, catalyst screening would occur at a higher frequency and the emissions associated with the shutdown and startup of the acid plant would occur at a corresponding higher frequency.

After initial cooling in waste heat boilers, the acid plant gas processing includes the following steps:

1. Injection of water mist into the process gas. This both lowers the gas temperature and increases the moisture content of the gas. The converter gases are cooled slightly, from approximately 250°F inlet (to the water injection point) to approximately 230°F. The Contop process gases are cooled from approximately 420°F to 385°F. The purpose for the water injection is to reduce the resistivity of the particulates in the gas stream. This improves the efficiency of removing particulates from the electrostatic precipitators (the unit operation downstream of the water injection step).
2. Removing particulates from the gas in a Cottrell. A Cottrell is a brand of electrostatic precipitator. The Smelter operates two Cottrells in parallel; one for the converter gases and one for the Contop gases. These units are old and pre-date the Contop process and the downstream acid plants. The Contop Cottrell is shown on the right—the converter Cottrell is in the background (top left of photo). The units normally operate under a slight vacuum. Under this condition, if there is a crack or hole in the shell of the Cottrell air would leak in. It may be possible that the units periodically operate under a slight pressure. Under this condition, the Cottrells would be a source of fugitive emissions. Due to the age of these units and the extended shutdown of the Smelter, it is possible that the shells of the Cottrells have suffered some extent of corrosion damage. Before the reliability of these units can be confirmed, an extensive

inspection of the Cottrell must be carried out. As part of the commissioning and start-up procedures, the reliability of these units should be confirmed. While no holes or cracks were observed during the visit, the nature of the visit and the size of the Cottrells did not allow for a detailed inspection.

3. Following the Cottrells, the process gas is scrubbed and cooled in packed towers. The walk-by of these units did not indicate any problem with towers. It is possible that the packing may have to be replaced prior to a smelter start-up, in fact this has been identified by Asarco as a possible start-up task.

4. The gas progresses from the packed towers to the wet precipitators. These units remove acid mist from the gas and remaining particulates from the process gas. Without efficient mist precipitators, the catalyst in an acid plant can foul prematurely. One of my concerns prior to the site visit was the quality of wet precipitator electronic controls. These concerns were allayed when I inspected the control equipment. While the precipitators were installed prior to the development of electronic controls, Asarco has upgraded the control system with updated controls. These controls (shown below) optimize the

operation of the precipitators and contribute to the efficient operation of the acid plant. As noted earlier, Asarco informed me that acid plant catalyst screening is limited to an annual frequency. This is typical in smelters and indicates that the Asarco mist precipitators operate efficiently.

5.7 ACID PLANTS

Two acid plants are installed to process Contop and converter gases. The Acid Plant #1 primarily processes converter gases and the Acid Plant #2 primarily processes Contop process gases. As I understand the process ducting, process gases from the converters can also be directed towards the #2 Acid Plant and Contop process gases can be directed to the #1 Acid Plant.

5.7.1 Acid Plant #1

The towers of Acid Plant #1 are in poor condition and repairs (or replacement) of these units are required prior to start-up. The photo on the left shows the shell of the drying tower of Acid Plant #1.

The highlighted area of the photo shows that the shell of the tower has split. The tower is brick-lined but it is clear that residual acid from the tower has seeped through the brick and caused corrosion of the shell. This tower must be repaired before it can be put in service. The primary absorption tower is also showing evidence of corrosion damage. The highlighted area of the photo on the right shows that the shell is bulging. I recommend a re-building or replacement of this tower prior to a start-up. Acid plant corrosion is typically higher when the plant is shut down. The primary reason for this is that 95-98% sulfuric acid (the concentration of acid that circulates through an operating acid plant) does not corrode steel or cast iron at high rates. When an acid plant is shut down, ambient air can enter the system. There are numerous possible sources of air ingress. One area noticed during the tour is the acid pump tank. The photo on the top of the following page shows a few holes in top of the dry tower pump tank of #1 Acid Plant. Moisture in air will dilute the residual 95-98% acid that remains

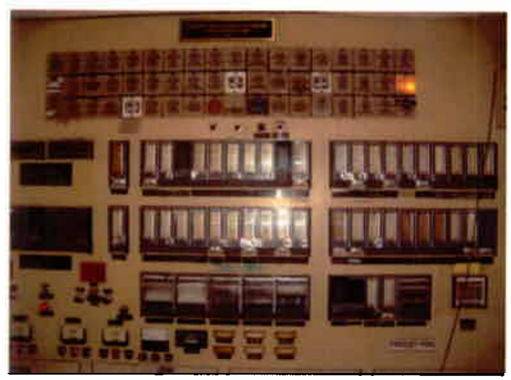
in the acid plant--the diluted acid is more corrosive than high strength acid. Holes such as the ones shown on the photo can enter the system and dilute the strength of any residual acid.

The concern regarding corrosion damage within the acid plant goes beyond the units where external damage is evident. Prior to smelter start-up all acid plant equipment must be carefully inspected for internal corrosion damage. Such inspections and the subsequent repair of any damage are typical for acid plant equipment. Normally, these inspections and repairs occur during annual maintenance outages.

5.7.2 Acid Plant #2

Acid Plant #2 appears (from the external inspection that is possible with a walk-by tour) to be in better condition than Acid Plant #1. As I recall, the photo on the left is the top of the final absorption

tower. Corrosion damage at the top area of the tower is evident. In addition to the main equipment of the acid plants, the instrumentation and control systems must have high reliability. The acid plant ICS (Instrument Control System), shown below, is outdated. While certainly this system



can be inspected and repaired as necessary to operate properly, I believe that Asarco should consider replacing the control system with a more modern system. A new control system will be more reliable, and will enable improved collection and interpretation of process data than the existing system. I did, however review operating data from prior to the smelter shutdown and the acid plant emissions were well within the permitted levels.

6.0 DOCUMENT / DATA REVIEW

In order to address all of items in the assigned scope (see Section 3), I requested additional documentation and data. The documents that I requested and have reviewed include:

1. Documentation that relates to employee training and "SOPs"—Standard Operating Procedures.
2. Documentation to indicate the effectiveness of pollution control equipment prior to the smelter shutdown in 1999, and related to this issue, the design data for the major smelter baghouses and the nominal design gas flowrate and composition to the acid plants.
3. Information regarding the DCS (distributed control system), in particular details to how pollution control equipment is monitored and controlled by the DCS.

6.1 SOP DOCUMENTATION

One of the challenges that Asarco will face with a start-up is the hiring and training of employees to operate and maintain the facility to the extent that former employees are no longer available for re-hiring. This challenge would have been even more difficult if Asarco had not adequately invested in the preparation of SOPs to explain how to carry out critical tasks. While the SOPs must be supplemented by additional classroom instruction and hands-on training in the field, they provide a solid foundation for the overall training program. I have reviewed the SOPs that Asarco has provided and conclude they are adequate to serve as a component of new (and returning) employee training.

6.2 EFFECTIVENESS OF POLLUTION CONTROL EQUIPMENT

Upon review of the vintage of acid plant instrumentation and controls (discussed early), I requested emission data from the acid plants to determine if, prior to the smelter shutdown, the acid plants were operating properly. Based on my review of November, 1998 operating data, the acid plant tail-gas was operated properly at levels consistently below 300 parts per million SO_2. This level of emissions is approaching the maximum efficiency that is possible from the double absorption acid plants operated by Asarco. The opacity of the concentrate dryer baghouse and the converter aisle building baghouse also were consistently in the single digits. This level of performance is typical of a baghouse that is operating properly.

As part of my review of these potentially major sources of emissions, I reviewed the design of the acid plants and the two major baghouses discussed above. The baghouse design has been discussed earlier (Section 5.2 and Section 5.5). Acid Plant #1 is designed to process up to 60,000 scfm of process gas (with an average SO_2 inlet concentration of 6%). Acid Plant #2 is designed to process 90,000 scfm of gas that is up to 6% SO_2.

6.3 SMELTER DCS SYSTEM

Asarco is maintaining a skeleton staff at the smelter to maintain the smelter control system. During the January visit, I was reassured that the version of the Asarco DCS system is still being supported by the manufacturer. Asarco provided snapshot printouts of their DCS screens—some of these screens monitor and control air pollution control equipment. The DCS system does not control the complete smelter. As discussed earlier, the acid plant is controlled from a 1970s vintage instrumentation panel. A DCS upgrade should be considered by Asarco in their start-up plans.

7.0 DISCUSSION

During my January, 2007 visit both Asarco staff and TCEQ acknowledged that the start-up of the smelter will require a considerable effort by Asarco. Based on my understanding, TCEQ would be monitoring the start-up to ensure that emissions are minimized in accordance with permit requirements. Both Asarco and TCEQ have the history of previous smelter operations by which to gauge the success of the start-up. Asarco has identified the tasks that must be accomplished to ensure a successful start-up. These tasks have been listed in their outline of the start-up plans and include:

1. Hiring competent and experienced personnel as front-line supervisors in the key areas of the Smelter operation and maintenance areas.
2. Contracting with the appropriate manufacturer's representatives for specialized areas (e.g. oxygen plant, DCS, acid plants, powerhouse turbines, boiler, etc.).
3. Hiring and training operating and maintenance personnel.
4. Carrying out de-mothballing activities in each area as appropriate.

Asarco has acknowledged that their startup plan is a work in progress and, as the high-level document cannot be expected to comprehensively address all issues associated with the startup. I have pointed out areas of the plant that have suffered from corrosion damage since the smelter shutdown. While the Asarco startup plan does not specifically address repairs to these areas of the plant, this omission is likely due to the inherently obvious nature of the necessity of these repairs. Asarco may want to consider adding a blanket line item to their startup list that encompasses the complete inspection of all vessels, equipment, and ducts for corrosion damage. They may want to consider contracting out the non-destructive testing of all areas of the smelter that may have been impacted by corrosion since the shutdown. This would include the Cottrells, the baghouses, heat exchangers, ducts, and acid towers.

During the January, 2007 meetings, TCEQ noted that Asarco is legally bound to properly re-condition the smelter to a condition that ensures compliance with all air permit requirements (as well as other permits and requirements). Asarco acknowledged this responsibility. Accordingly, it is reasonable to assume that before the smelter is started up Asarco will develop a detail check-list of tasks to ensure that the smelter is prepared for start-up. I believe that the TCEQ is fully capable of any oversight required to ensure compliance with permit requirements and that additional third party involvement is not required.

In the current start-up plan, Asarco indicates that hiring and training of employees and preconditioning smelter equipment will be carried out during the three-month period prior to smelter start-up. To ensure that employees are properly trained, Asarco should consider hands-on training for employees at their Hayden Arizona Smelter. This training would have to be staged to avoid burdening the Hayden Smelter staff with trainees. Three months may not be sufficient time to rotate the new El Paso employees through the Hayden Smelter; I expect this issue will be resolved as Asarco develops more detailed start-up plans.

APPENDIX 1

EHP QUALIFICATIONS

Eric Partelpoeg, Ph.D.

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Education: Ph.D. Metallurgical Engineering, Minor in Mineral Economics, University of Arizona, 1985

M.Eng. Metallurgical Engineering, McGill University, Montreal, Canada, 1980

B.Eng. Metallurgical Engineering, McGill University, Montreal, Canada, 1977

Affiliations: TMS, AIME

Publications: Flash Smelting, Analysis, Control, and Optimization, W.G. Davenport, co-author, Pergamon Press 1987 (Second Edition published by TMS in 2001),

Process Control and Automation in Extractive Metallurgy, D.C. Himmesoete, co-editor, TMS 1989,

Numerous papers dealing with Phelps Dodge smelter subjects authored and co-authored during 1985-1995 (rotary drying, slag fluidity, smelter improvements, etc.).

Over 25 years of combined operations management and technical consulting expertise. Experience includes acid plant technology, process gas handling, all aspects of copper smelting, and experience with other processes including molybdenum, aluminum, zinc, iron, and gold. Operating responsibilities have included the operation and upgrades of modern copper smelting facilities, including their affiliated acid plants. Due diligence experience includes evaluations of process operations in Europe, China, Australia, North America and South America. Expert witness testimony has included issues ranging from the failure of process equipment to the review of accidents and process plant explosions.

Project experience includes:

Confidential Projects
(litigation, negotiations with government agencies, due diligence, development of new technologies).

- Expert witness testimony and reviews of accidents and process plant failures.
- Boiler corrosion study and expert witness testimony.
- Electrostatic precipitator corrosion failure, expert witness report.
- Expert review of smelter design.
- Independent Project Review (IPR) of process plant upgrade project, with a focus on gas handling issues (waste heat boiler and electrostatic precipitator)
- Process review/audit of zinc roasting, acid plant operations, and oxide leaching and electrowinning

- Due diligence and economic evaluation of copper smelters in Europe, Asia, and South America.
- Due diligence review of a new copper smelter feasibility study.
- Detail review of process plant mothballing costs.
- Review of alumina plant and aluminum smelters.
- Review of furnace off-gas quenching technology.
- Review of the impact of radioactive feed sources to copper smelters.
- Emission modeling of molybdenum roasters and gas scrubbers.
- Review of cement kiln emissions (CO, NO_x)
- Development of detailed mass and heat balances, project management (new copper technology).
- Due diligence review of direct reduced iron technology.
- Project management of a feasibility study to construct a metal production plant in China.
- Technical review on behalf of an international agency and a South American federal government of a metallurgical complex (copper, lead, zinc) with a focus on modernization plans, evaluation of emission control equipment, and emission reduction programs.
- Technical evaluation of an Eastern Europe smelter privatization program on behalf of an international agency.
- Feasibility Study for a molybdenum roasting facility.

Process Modeling / Process Control Models
(to support confidential and process plant projects)

- Flash smelting furnace model (including off-gas system through scrubbing)
- Copper converter computer modeling
- ISA-furnace process model
- Roaster Modeling
- Sulfuric Acid Plant Models
- Electric Furnace Models
- Process Emission Estimating Model
- Vacuum evaporation process model
- Acid Dew Point modeling / prediction.
- Direct reduced iron heat/mass balance model.
- Hydrogen reduction furnaces (molybdenum).
- Copper sulfate crystallization model.

Process Plant Design / Optimization

- Project manager and principal process engineer for the replacement of the Inco Furnace settling chamber with a quench tower and a new scrubbing system. Responsibilities included process engineering, design review, commissioning, and operation.
- Project manager and principal process engineer for the design, construction, and commissioning of a 350,000 acfm fugitive gas baghouse.
- Lead process engineer for the re-design of electric furnace cooling system.
- Lead process engineer for a feasibility study evaluating the conversion of a metallurgical-gas acid plant to sulfur-burning mode.

- Acid plant upgrades (pump tanks, replacement towers, replacement heat exchangers)
- Limestone gas scrubbing optimization.
- Molten sulfur pumping and piping project.
- Autoclave scrubbing system study.
- Mercury scrubbing system review.
- Smelter fugitive gas improvement project (feasibility study including computer flow model)
- Pre-feasibility study to evaluate the burning of supplemental sulfur in an acid plant processing metallurgical gases.
- Acid plant gas scrubbing system optimization studies.
- Acid plant trouble-shooting.
- Boiler optimization.
- Feasibility study to evaluate SO_2 neutralization options and costs.
- Limestone gas scrubbing optimization
- Refinery gas scrubbing projects.
- Process design development for chemical by-products in the metallurgical industry (process flow diagrams, capital and operating cost estimates).
- Anode off-gas baghouse project (feasibility study, operating and maintenance manual and commissioning)
- VOC scrubber review / concentrate dryer emission minimization.
- Concentrate drying system process / energy optimization.
- Review of smelter and acid plant process control systems.
- Vacuum evaporation system troubleshooting and optimization.
- Project management, molybdenum roasting and ancillary operations.
- Copper converter operation optimization
- Copper sulfate production modeling and optimization

EMPLOYMENT HISTORY

EHP Consulting, Inc.	2002 - Date
Jacobs Engineering Group	2001 - 2002
The Winters Company	1996 - 2001
Phelps Dodge Chino Smelter	1988 - 1996
Phelps Dodge Hidalgo Smelter	1981 - 1988
Inco Metals Company	1977 - 1978

APPENDIX 2

SCOPE OF REVIEW

SCOPE OF SERVICES

Consultant shall determine the condition of all air quality control equipment and the predicted control effectiveness for the operation of the equipment and related practices located at the ASARCO LLC ("ASARCO") Copper Smelter located in El Paso, Texas, pursuant to Ordering Provision 3 of the Texas Commission on Environmental Quality Interim Order dated March 10, 2006 ("Interim Order").

Consultant shall also review all air quality control equipment in comparison with all requirements of ASARCO's existing Air Quality Permit No. 20345 pursuant to Ordering Provision 3 of the Interim Order.

Consultant shall review and determine whether the Copper Smelter could be operated in accordance with industry standards and practices. In order to accomplish this, Consultant shall review commissioning or start-up plans ("Plans") for their adequacy and may make recommendations for changes to the Plans to meet industry standards and practices.

Consultant shall recommend post commissioning or start-up activities, such as testing, observation, procedures or practices, as Consultant deems appropriate to determine, evaluate or validate the above.

Specific tasks to be conducted by Consultant shall include the following:

(1) A review of the condition of the condition of the air quality equipment that can be categorized as fixed and permanent equipment for which ASARCO has no plans to change prior to smelter start-up. Examples of these include:

a. The control systems of hot and wet electrostatic precipitators (to ensure that each field operates at maximum power input);

b. The condition of major ducting that is not scheduled for repairs prior to start-up; and

c. The condition of baghouse components not planned for repairs / replacements prior to start-up.

(2) A review of ASARCO's plans for commissioning air quality equipment prior to smelter start-up. Examples of these could include:

a. Replacement of bags in baghouses;

b. Replacement of scrubber packing;

c. Planned maintenance activities to ducts, blowers, heat exchangers, etc.; and

d. Review of plans to train new employees to operate and maintain control equipment.

Upon completion, Consultant shall provide a draft report of his findings to TCEQ and ASARCO for review and comment prior to preparing a final report. Any comments received from TCEQ or ASARCO may be, but are not required to be, included in Consultant's final report. Consultant shall at a minimum, however, consider such comments in formulating and finalizing his independent review and determinations. To the extent Consultant can not accomplish any of the above items, Consultant's final report may make recommendations for additional activities to address such deficiencies.

Consultant shall exercise his independent professional judgment in conducting the review and in preparing the Final Report. Consultant is advised that TCEQ staff will consider and rely on the Final Report in preparing its own independent opinion and conclusions. Because Consultant's services are intended to be an independent professional review, it is not contemplated that either ASARCO or TCEQ will be bound to agree with Consultant's conclusions, and nether ASARCO's nor TCEQ's agreement or disagreement with the conclusions of Consultant's report shall be considered evidence of compliance with, nor a breach of, this agreement. Consultant's services under this contract shall be limited to the services described herein (as they may be modified from time to time in accordance with all requirements of this Contract).

Because Consultant is performing an independent review, and making a Final Report to the TCEQ Executive Director, ASARCO and TCEQ intend that all direction and communication to Consultant under this Agreement be made jointly by TCEQ and ASARCO. ASARCO and Consultant therefore agree to communicate with each other only in the presence of a TCEQ (physical or by teleconference) representative, to copy TCEQ on all written or electronic communications, and to provide TCEQ with reasonable notice and (if applicable) planned agendas for all *meetings, conference* calls, and similar activities. Further, no modifications or explanations of the Work under this Agreement shall be made or binding unless communicated in accordance with this paragraph as well as any other relevant provisions of this Agreement relating to contract modification. Consultant shall not proceed under any modification, explanation, or director regarding the Work under this contract unless it has been communicated in accordance with this paragraph as well as any other relevant provisions of this Agreement relating to contract modification.

Compensation to Consultant shall be on a time and materials basis not to exceed $25,000 unless agreed to by ASARCO and Consultant in writing. Consultant shall retain all documents collected, received or maintained in the course of execution of this agreement, including drafts, and shall maintain them as confidential for the duration of this agreement. At the conclusion of the agreement, all such documents shall be the property of, and delivered to, ASARCO. Upon request, Consultant shall provide information identified under Article 15 to TCEQ under a claim of confidentiality by ASARCO and subject to the limitations imposed by Section 15. Consultant and ASARCO acknowledge that all such information may be subject to public release by the TCEQ as may be provided for under the Texas Public Information Act. Consultant shall refer any requests for such information from parties other than ASARCO or TCEQ to the TCEQ, with notice to ASARCO; Consultant shall not release such information to anyone other than the TCEQ or ASARCO except as provided for under exceptions (a) through (d) of Article 15.

Consultant shall be available at a minimum for weekly conference calls or e-mail communication with ASARCO and TCEQ. If Consultant needs to communicate outside these calls with ASARCO and TCEQ on any issue related to this contract, Consultant shall advise the parties in writing and include the general nature of the issue. E-mail is acceptable. Contacts for all direction and communications shall be:

For ASARCO:

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For TCEQ:

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APPENDIX 3

ASARCO START-UP PLANS

Nov 11, 1998
Revised: May 19, 1999
Revised: Apr 20, 2006
Revised: Sept 18, 2006

El Paso Copper Smelter Startup Plans

This outline is intended to be an overview of what will take place during the startup of the El Paso Plant.

During the smelter shutdown in 1999, the entire Plant, including rotating equipment, flues, tanks, bins, and electronics, was carefully cleaned and placed in a mothballed state applicable to each individual piece of equipment. Startup will entail reversing much of what was performed in the mothballing operation as well as inspecting the equipment on a piece by piece basis to uncover any portions of the equipment that will have to be repaired prior to actual operation.

The first step will be to hire competent and experienced personnel who will function as front-line supervisors in each key area of the Plant:

- Acid Plant
- RCC Plant
- Oxygen Plant
- Powerhouse
- Contop Boiler
- Contop Furnace
- Converters
- Anodes
- Cottrells
- Unloading
- Machine and Boilermakers Shops

In addition, a key supervisor will be hired for the following crafts:

- Mason
- Electrical
- Instrumentation
- Master Mechanic

To supplement the experience hired in each area, manufacturing service representatives will be contracted, including:

- RCC Plant (RCC)
- Alhstrom Boiler (Contop)
- Oxygen Plant (BOC)
- Powerhouse Turbines (GE)
- Distributed Control System (Foxboro)
- Acid Plants (Monsanto or Koch)

In order to perform startup preconditioning of the equipment a contractor crew of varying size and skill will be employed. As permanent employees are hired and trained for the plant startup, these individuals will be used in place of contractors to the extent possible. It is expected to take three months to hire and train the production and maintenance workforce required for the startup. Simultaneously with this hiring training period will be inspections and preconditioning of the equipment.

In each of the areas of the plant the following general startup procedure will be use:

1.) The electric systems, including lights, substations, and circuit breakers will be turned on and inspected for proper working condition.

2.) Start and operate the Plants 90psi air compressor systems.

3.) De-mothball all gearboxes and other rotating equipment. This will primarily entail draining, rinsing, and refilling gearboxes throughout the plant to replace the special mothballing additives that were put into the appropriate equipment.

4.) Operate or turn, all rotating equipment to insure that bearings and lubrication systems are working properly. Replace any bearings as appropriate.

5.) Inspect all flues and expansion joints for integrity. Insure that each damper is able to move through its entire range of motion.

6.) Inspect all baghouse bags for integrity. Determine strength and porosity conditions of the bags in each baghouse by running pull and porosity tests. Replace bags as necessary.

7.) Turn on, individually, all cooling water systems and insure that flow is adequate and normal. Replace any valves that show indications of leaking or undue stiffness.

8.) Recalibrate all instrumentation field-measuring transmitters. Insure that distributive control systems are working properly and that all transmitter data is being received, archived, and displayed properly.

9.) Turn on individually all natural gas systems. Insure that all pilot lights are lit and working properly. Insure that all regulator diaphrams are intact and that the regulators are functioning properly.

10.) Operate all burners individually. Insure that all fail-safe systems are functioning properly.

11.) Check specific and general environmental permit conditions and insure that all conditions are being properly met.

There are several area-specific instructions for startup as follows:

-Contop Furnace, Converters, and Anode Furnaces

1.) Inspect all furnace brick and test for integrity. Use manufacturer's expertise for brick testing. Rebrick as appropriate.

2.) Load test and perform required crane inspections.

3.) If funding and time permits, install settling furnace modification (shortening) in order to decrease natural gas consumption.

4.) Screen anode casting gas reformer catalyst and test catalyst using manufacturer's recommended procedure.

-Powerhouse

1.) Reinstall turbines and test using manufacturer's service representative.

2.) Inspect and then operate marine boilers. [coordinate boiler inspections with the rest of the boilers in the Plant]

3.) Review new low-pressure converter air blower controls and insure that they operate properly.

4.) If time permits, complete and startup new superheater and de-aerator system.

5.) Insure that new plant water system is working properly. This system was installed after the Plant shutdown in 1999 as part of the new stormwater system. As such they have not been tested during actual Plant operations.

-Acid Plants

1.) Remove sealing blinds in contact sections of acid plant.

2.) Screen catalyst in all beds of the converters. Test catalyst reactivity.

3.) Reinstall packed scrubber packing, or install new packing if the stored plastic packing shows signs of deterioration.

4.) Inspect and replace cast iron piping in contact section of acid plant as appropriate.

5.) Inspect bricking lining in acid contact towers and repair as appropriate.

6.) Inspect, using manufacturer's service representative, the mist eliminators in the final and drying towers of both Plants. Replace or repair as appropriate.

7.) Test mist precipitator rectifiers and replace any star wires as appropriate.

-<u>RCC Plant</u>

1.) Inspect boilers [coordinate with Powerhouse boiler inspections]

-<u>Cottrells</u>

1.) Test cottrell rectifiers. Operate vibrators and replace any wires as appropriate.

-<u>Contop Boiler</u>

1.) Inspect Ahlstrom boiler with manufacturer's vendor. Inspect boiler in coordination with Powerhouse boiler inspections.

-<u>Instrumentation</u>

1.) Investigate the need to upgrade software for the distributed control system in order to be supported properly by Foxboro.

2.) Investigate the need to upgrade the contop modicon control system in order to be supported properly by Modicon.

-<u>Oxygen Plant</u>

1.) Utilize manufacturer's service representative to provide procedures for removing the nitrogen blanket in the cold tower, tanks, and associated equipment.

2.) Utilize main blower manufacturer's service representative to inspect and balance blower turbine stages.

3.) Startup and operate oxygen plant to produce liquid oxygen and fill storage tanks prior to Contop startup.

-<u>Unloading Department</u>

1.) Reinstall section of 10 belt that was removed during the removal of the sinter plant baghouse after 1999.

a.) If funding and time permits, decrease the number of conveyors to reduce conveyor transfer points (environmental) and decrease maintenance costs.

2.) Operate and inspect all conveyor belts. Replace conveyor belting as appropriate.

General Startup Guidelines:

1.) Prior to Contop startup insure that all major ancillary equipment is operation:

a.) RCC Plant
b.) Powerhouse and boiler systems
c.) Plant water and compressed air systems
d.) Oxygen Plant
e.) Cottrell and baghouse systems

2.) Utilize a contractor (Hotworks) to preheat settling furnace. During this 5-day period, preheat converters, anodes, and acid plants to operating temperature.

3.) Startup contop concentrate drier and begin filling up dry bins approximately 4 hours before reactors are to start.

4.) Startup 1st contop reactor when furnace and all ancillary operations are ready. If all systems are operating properly, start the second contop reactor in approximately 1 hour.

5.) Begin matte tapping and converter operations within 8 hours of initial reactor startup.

6.) Operate anode and anode casting system when converters have provided enough feed material.