

# PID

## Process Industries Division Newsletter

Arun Muley, Editor

Fall 2001

### Chair's Message



David Pratt

The year 2000-2001 has been an exciting and dynamic time for the Process Industry Division (PID) of ASME. Our committee activities have been rejuvenated, our membership basis has been

expanded, our conference presence has been increased and our future is only limited by our imagination. Our committees have been extremely successful this year. They have held meetings in conjunction with conferences, attended executive board meetings, participated in TEC and chaired 5 sessions at IMECE. Additionally, the committees were present at the International Joint Power and Generation Conference in June at New Orleans. At this conference, PID manned a booth promoting technologies associated with our committees as well as chair a panel session.

While our conference presence and our executive committee activities are increasing we are looking ahead to various future potentials. As Nobel Prize winner Anatole France stated, "To accomplish great things, we must not only act, but also dream; not only plan, but also believe." So we go forth. Our dreams are expressed in our vision that of leading the promotion of the art, science, and practice of Mechanical Engineering as related to the Process Industry in the areas of cryo-

genics, compressor applications, heat exchangers and water technology. Our acts are in the fulfillment and expansion of that dream. We are looking to increase the number of committees while successfully carrying out the missions associated with those previously established.

Our beliefs for the future are expressly formulated in our strategic plan that has been successfully advocated to the Manufacturing Group and the COE. In this plan we map our future. Inclusive therein are our thoughts on increasing our information technology base. This will be accomplished by infusing ASME's server with a dynamic and interactive PID Web site that contains current events, newsletters, publications, information, technologies and upcoming activities as well as our strategic plan, vision, mission, and organization. This will be the prime source of process industry information and a touchstone for all Process Industry Division activities.

The Process Industry Division is acting to fulfill our dream that we believe is established in our plan.

David Pratt  
PID Chair

### Editor's Note

Process Industries Division and its technical committees have actively participated in numerous conferences and meetings held in the last couple of years. We could achieve this success due to earnest involvement of PID members. It has been my honor to serve as your newsletter editor for the last couple of years. I appreciate the tremendous help provided by technical and executive committee members and ASME staff, especially Carol Griffin. However, it is time for a change of the guard, and I would like to welcome Naresh Amineni as our new Information Technology representative. Naresh is the incoming newsletter editor and he will be managing our website as well. As chair of the Compressor Applications Committee, he has been instrumental in PID's successful participation in numerous conferences. Please send your comments and suggestions regarding our newsletter & website to Naresh Amineni.

Arun Muley

Visit our website:

<http://www.asme.org/divisions/pid/>  
for additional information about PID  
and other useful resources.

## Towards Better Reliability Management

Reliability is like safety —everybody is in favor of it, but not everybody practices it. Safety professionals know that solid achievement rests on the need to change an existing culture, replacing it with a radically different one. Cultural changes do not come easy.

The development of lasting reliability improvements is almost certain to require similar changes in the prevailing mindsets. These changes are being resisted because the implementation of reliability improvement measures costs money and the resulting bottom-line cost savings are not as immediately evident as, say, laying off 15% of your work force. The trouble is, of course, that savings due to reduced payrolls are typically short-lived, whereas savings due to tangible improvements in reliability performance are generally more permanent.

All too often, future savings realized through improved equipment reliability are not being calculated because accurate data is either not available or difficult to obtain. That need not be the case, because a competent consulting engineer may have data that closely approximate your situation. Use of this data may well allow you to work up a solid cost justification which management would find difficult to ignore.

Cost justifications are typically based on anticipated savings in maintenance labor and materials cost, and also the value of avoided downtime. However, other cost savings exist and should be considered. These include the financial value of assigning employees now no longer busy with remedial tasks to the performance of proactive failure avoidance tasks elsewhere in the plant.

A well thought-out cost justification would also include the value of avoided fire damage. One refinery statistic indicates that one out of every 1000 pump failures results in a \$1,300,000 fire. Hence, if a well-planned pump reliability improvement program were to increase the mean-time-between-failures (MTBF) at your plant from previously 2.5 years to the 7.5 years now actually achieved at some US refineries, imagine how much money you could easily justify spending to achieve these results!

But, there are still many misconceptions about the value of reliability, or the relationship between maintenance effort and reliability results. For instance, many engineers would think that higher maintenance outlays produce higher equipment reliability. Industry statistics show otherwise. The plants with the highest maintenance outlays are also the least reliable. Exploring the reasons will have to be postponed until another time.

A number of texts explain what the leading companies are doing (see ISBN 0-88415-661-3). The common thread among the leaders is that they both empower and enable key individuals to effect change. The common thread among the less profitable companies is that they sometimes empower without enabling, use able individuals but refuse to empower them, or practice wishful thinking and neither empower nor enable their reliability professionals.

That leaves us with the question: What can you personally do to become a successful reliability professional and, if you are a manager, how can you train and retain individuals that are interested in becoming reliability/maintenance professionals? Here are the key elements:

- Develop and agree upon a well-defined role statement
- Perform and insist on cost justifications based on life cycle cost calculations
- Consider rotational assignments for your professional employees
- Institute cooperation, communication and consideration among the three groups that will influence equipment reliability: Operations, maintenance and technical
- Before empowering, enable!
- Teach and insist on the execution of a structured and repeatable failure analysis and troubleshooting approach
- Have a firm, well thought-out, mutually acceptable training plan. Modify it only by mutual consent between manager and employee

Likewise, how do you establish a culture similar to safety? Just as you subscribe to the notion that all accidents are preventable, adopt the belief that all failures are preventable and that repeat failures are unacceptable! Remember four basic concepts and four indispensable ingredients that will lead to success:

- Give clear direction and support; do so consistently, not sporadically.
- Provide adequate and appropriate training.
- Give due recognition and tangible reward.
- Treat your employees with empathy.

Try this formula and enjoy your success!

By Heinz P. Bloch, P.E.  
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For a list of Process Industries Division's technical sessions at IMECE2001 in New York, NY, please visit us on the web at <http://www.asme.org/divisions/pid/events/index.html>

## Events

The following events may be of interest to members of the Process Industries Division  
[www.asme.org/divisions/events](http://www.asme.org/divisions/events)

- **International Mechanical Engineering Congress & Exposition**, November 11–16, 2001, New York, NY
- **IHMT-ASME Conference**, December 31, 2001 – January 2, 2002, India
- **Sixteenth National Heat and Mass Transfer Conference and Fifth ISHMT/ASME Heat and Mass Transfer Conference**, January 3–5, 2002, Science City, Calcutta, India
- **1st International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics**, April 8–10, 2002, Skukuza Restcamp, Kruger National Park, South Africa
- **ASME TURBO EXPO 2002 – Land, Sea & Air**, June 3–6, 2002, Amsterdam RAI International Exhibition & Congress Centre, Amsterdam, The Netherlands
- **International Joint Power Generation Conference & Exposition**, June 24–26, 2002, Phoenix, AZ

# Report on PID Technical Committee Activities

## Industrial Water Treatment

Last year this committee was formed by the Process Industries Division with the strategic plan to promote and disseminate information to the engineering community on new and improved technologies for producing high and ultra-pure water for process industries.

Our first committee meeting was held in November, 2000, at the International Mechanical Engineering Congress and Exposition (IMECE) in Orlando, Florida. The initial objective of this kick-off meeting was to define the overall emphasis of the committee. It was agreed that the committee expertise and interest was focused on water treatment for industrial uses which require high and ultra-pure water, i.e. semi-conductors, bio-pharmaceuticals, petrochemicals, power generation, and other process industries. It was decided that municipal water treatment was well covered by AWWA and would not be the focus of our committee.

At this meeting, we also established the following short term goals:

1. To recruit new members to the committee and encourage ASME conference participation.

Since our kick-off meeting at IMECE 2000, the Industrial Water Treatment Technical Committee has grown from the two (2) members attending the congress (Vice-Chair Leo T. Meire and myself) to over thirty (30) members. The interest continues to grow every week. We are very pleased that our committee is represented by a wide range of vocations in industrial water treatment, which include facility engineers and operators, equipment manufacturers and designers, water treatment consultants, water treatment chemical suppliers, and university faculty. The various ASME publications, along with the prestige of the ASME organization, have clearly been a great encouragement to promoting committee interest. We are anticipating good attendance and participation at our next committee meeting at IMECE 2001.

2. To organize our first technical session for IMECE 2001, November 11-16, in New York.

In preparation for IMECE 2001, the committee drafted its first Call for Papers which was published in the January issue of Mechanical Engineering magazine and on the ASME International Webpage at <http://www.asme.org/conf/congress01>. The committee will have one Technical Session

at IMECE 2001. For further information please go to [www.asme.org/division/pid/events](http://www.asme.org/division/pid/events). To date, we have received 24 abstracts that have been reviewed and approved for presentation at the congress. For a detailed listing, please go to the ASME PID web site at: [www.asme.org/divisions/pid/](http://www.asme.org/divisions/pid/).

3. To prepare an article regarding the future of manufacturing of water treatment equipment for ASME NEWS.

In the March 2001 issue of ASME NEWS there is an excellent article entitled "Technical advances need water that is even cleaner than drinking water." This article was written by Leo T. Meire, Vice-Chair of the Industrial Water Treatment Technical Committee. Reprint of this article is provided below.

4. To encourage and develop interaction with other technical committees in other divisions and organizations.

Our committee has been in contact with the Water Technologies Subcommittee of the ASME Research and Technology Committee on Water and Steam in Thermal Power Systems. This subcommittee, which limits its work to water treatment for power generation, is currently working on a number of technical documents on boiler system lay-up, sampling, and HRSG feedwater/boiler water guidelines. A representative from our committee has been invited to attend the next meeting of the Water Technologies Subcommittee scheduled for April. Likewise, a representative from the Water Technologies Subcommittee has expressed interest in attending our next meeting at IMECE 2001. Every effort will be made to establish positive interaction between our committees without overlapping our efforts.

The Industrial Water Treatment Technical Committee is looking forward to excellent participation at IMECE 2001. If interested in serving on the committee or presenting a paper at future ASME conferences, please contact one of the following:

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## Cryogenics

The Cryogenic Technical Committee is an emerging task force dedicated to providing an expert knowledge base to the industry for issues concerning low-temperature applications. The challenge is to recognize the limitations of our technical field since, for all practical reasons, very low entropy is not a common state, nor is it a steady state in our daily environment. Yet for more than a century, the industry has recognized the need to lower the entropy of a fluid, for the purpose of liquefying it or simply to decrease the energy level in the environment around it.

The Process Industry Division's executive conference held in Orlando FL, last November, was the first opportunity for our Cryogenic Technical Committee to get together. The committee meeting included Dr. Bob Rudland, Chairman, Nils Tellier, Vice-Chairman, and Dr. Anastas Lazaridis, committee member. During the meeting, we discussed the ramifications of our involvement in the industry, from software to helium slush to air separation plants to super-conductors. On the academic side, we recognized the importance of continuous education, since cryogenics is not a common university curriculum.

Our current goals for the year 2001 include re-defining our committee vision and mission, as well as improving members participation and increasing membership. Our agenda includes participation to the IJPGC-2001 in New-Orleans (June 4 - 7) and to the IMECE-2001 in New York next November.

During IJPGC-2001, we will participate in the ASME's PID booth and we will hold a panel session on the "Benefits of small co-generation for air separation plants". We hope to capture the participation of compressor and turbine manufacturers and the attention of the air separation industry.

The Cryogenic Technical Committee will also participate in the IMECE-2001 with a technical session that will have five papers. Please visit the PID website for further information or contact:

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## Committee Activities

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### Compressor Applications

IMECE 2000 was one of the most successful conferences for the compressor application committee yet. We organized five technical sessions (including a Highlight/Industry session) with 21 high quality papers. All sessions were very well received with lively discussions made possible by the record-breaking attendance. All the papers have been published in a bound volume titled "Challenges and Goals in Industrial and Pipeline Compressors", PID-Vol. 5. My thanks to all the authors, the session organizing committee and the compressor application committee members for their efforts and support in making the Industrial Compressor Sessions a success at IMECE 2000.

To continue the good work, we have set the wheel in motion for the IMECE 2001 to be held at New York, NY. A new session organizing committee was formed and it has already issued a call for papers. The details of the call for papers and the IMECE 2001 can be found at <http://www.asme.org/conf/congress01>. The session organizing committee has received 12 abstracts so far and judging by the abstracts, the papers at IMECE 2001 are promising to be of extraordinary technical merit. The session organizing committee has informed me that they are accepting abstracts even at this late date, so please submit your abstract to one of the organizing committee member at the earliest. Even if you do not plan to write a paper this year, please plan to attend the conference and benefit from the presentation while supporting our efforts. It is my strong belief that our collaborative effort will make the Industrial Compressor sessions at the IMECE 2001 as successful as they were at IMECE 2000.

The compressor application committee's efforts to organize a session at the IJPGC and IGTI co-located conference at New Orleans, LA, did not materialize due to both time and topic conflicts with some of the sessions being organized by the IGTI. However, we plan to participate in this conference as part of the Process Industries Division (PID) exhibit. Please plan to visit our booth to learn more about the PID and the compressor application committee activities.

I welcome one and all to attend and participate in our efforts both at the IJPGC/IGTI co-located conference and at the IMECE 2001.

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### Heat Exchangers

The IMECE 2000 held in Orlando FL, was the first opportunity for a new and enlarged Heat Exchanger Technical Committee to get together. The committee meeting included Dr. Peter Toma, Chair, Professor William Janna, Vice-Chairman, as well as more than fifteen active members of the committee. A summary of the technical discussion and Committee goals is outlined in this document. Our immediate goals include re-defining our committee vision and mission, as well as improving members participation and increasing membership. Accordingly, During IJPGC-2001, the Heat Exchanger Technical Committee, together with other PID committees, participated in the ASME's PID booth. Power shortages have caused re-examining of the issues associated with design, applications, distributed generation—interconnection policy, limits on operations, gas tariffs, net metering and a plethora of lesser issues.

### Vision of the Heat Exchangers Committee

The Heat Exchanger Technical Committee fosters and encourages an exchange of knowledge related to heat transfer equipment between universities and research organizations and a group of industries, which include energy and hydrocarbon production, transportation, environment, chemical, electronics and HVAC&R, among others.

Heat Exchanger engineering is an "old art" re-visited by new markets needs and by technology driven constraints. Increasing energy cost, efforts to suppressing and reduce pollution, more stringent safety standards, availability of new materials, and miniature-size trends imposed by the electronic industry drive improvement in heat exchanger science and technology. This is a broad platform of technologies where several wants to be locally dissipated in microelectronic circuits are as critical as 500,000 KW transferred in large water purification systems sized at more than 10,000 m<sup>2</sup>/unit where boiling and condensation are effectively used to maximize the heat recovery and minimize the equipment size. The ongoing effort to reduce capital and operation expenditures and to increase the heat flux while improving the system energy /conversion efficiency poses challenging problems. Design criteria based on minimizing capital-operational costs and finding "acceptable" wall-fluid temperature gradients are being re-visited to include the new energy high-costs conditions and carbon dioxide reducing conditions through improving the global process efficiency. Key emerging applications that can be benefited from advances in heat exchanger technology development are:

- Miniaturization of the electronic, communication and computer industry poses new, previously unheard of topics to heat exchanger specialists, who cannot use average heat flux conventional methods to evaluate "point dissipation" constraints

and assess miniature complex structures.

With these changes, the potential for distributed and improved generation has grown significantly. It is quite clear that PID and Heat Exchanger technical committee should play an important and significant role in defining and shaping up those issues. This opportunity helped our committee to establish solid networking, recruit new members and explore new potential areas for heat exchanger applications. In addition, our presence was vital to promote ASME to the power industry. The committee is organizing a technical session "insert session title here" in the upcoming IMECE-2001. The proposed session include broad range of topics, such as natural convection, fuel cell transport phenomena, etc., see complete paper title list in accompanying PID IMECE program.

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and assess miniature complex structures.

- Resurrection of nuclear and coal is expected for covering the energy global and local needs. Old concepts (1940 -1965) using feasibility, safety and rapid deployment as major constraints are still in use today. High efficiency, total safety and zero pollution are now imposing new design constraints. Improving existing multiphase and heat transfer knowledge is now possible only through a new wave of sustained industrial R&D effort and use of new, available technologies including a new generation of sensors and control systems.

- The need for water is global. Large evaporation systems using renewable sources of energy and advanced heat recovery are under design right now. Reducing the negative effect relating to fouling requires an in-depth knowledge of multi-component fluids flow, boiling and separation.

- "Direct contact" boiling and condensation equipment are slowly introduced, mainly due to instability observed at partial loads. This is another area of great potential.

- New materials and multi-layer procedures aiming at reducing conductive temperature drop and achieving high stability to fouling, deposition and corrosion are in great need.

- New-old heat exchanger concepts include the plate heat exchanger, enhanced surface tubing, use of EHD technologies. New gasket materials and design solutions to balance equipment cost, power exchanged and fluids pressure drop are continuously adopted by industry but not reached full maturity as yet.

The challenge is to recognize and support the need for R&D to produce new rather than incrementally improved technology. Is our industry capable of such an effort before an energy crisis will be imminent? Our Committee should help to make it possible.

# The Future of Manufacturing Technology in the Process Industry Division

Alan R. Levine, Director of Operations, Concepts NREC

Eddy Crain, ABB Lummus Global America

David M. Pratt, Technical Advisor, Structures Division, AF Research Laboratory

The Process Industries Division's (PID) position within the ASME's Technical groups and divisions is unique. Since its organization in 1934 it has fostered new technologies which have developed into larger ASME divisions. Our members are industry based engineers who share general interests in applications, chemical and hands-on type presentations. They have interests in management, plant engineering and maintenance, pressure vessels and piping, design engineering, power and heat transfer. The wide diversity of new technologies plus a practical approach for mechanical engineering applications make the PID a stimulating division of ASME. PID is primed for the infusion of future manufacturing technologies in the areas of high speed machining for turbomachinery and advanced techniques in water treatment.

## High Speed Machining Of Turbomachinery Components

Turbomachinery components have been machined using 5-axis milling machines for many years. Components made with machining processes offer closer accuracies and better material properties than those made with casting. High-speed machining techniques have been developed in recent years to further improve the quality of machined parts and to reduce the cost of machined components. The machining process includes milling machines, computational software to generate cutter paths, cutters, and fixtures to hold the workpiece to the milling machine. Both the machine tools and software systems have seen continual technology improvement, dramatically reducing the costs of machine parts. The turbomachinery products that have resulted have improved operational performance, closer performance to prediction, increased life, and smaller but more assured safety margins.

High-speed machining has applied newly available technologies to improve cutting performance in the areas of machine tool design, cutter materials, cutting process, and software strategies. Machine tool design improvements stem from the incorporation of computer analysis and simulation of machine structures as well as hardware and materials advancements in high-speed spindles, linear guide ways, direct-drive motors for rotary tables and coated carbide cutters. These advances have resulted improved component parts as shown in the figure below. This figure shows a compressor, jointly developed by Concepts NREC and Makino. The result of having improved

cutter vector selection was a cycle time reduction of 30% and an improved surface finish. Programmed federates, with continuous 5-axis motion, were as much as 4000 mm/min. The benchmark component on the left was machined to very aggressive standards.

Current development in CAM software systems is focused toward the compatibility of cutter paths for high-speed machining processes. Point-milling algorithms (free cutter vector) use the high-speed machining considerations as an additional constraint in the selection of cutter vectors. And new output formats, including NURBS and other high-order polynomial functions provide the possibility for much less cutter path data and better control over both cutter path position and direction.

## Industrial Water Treatment

The Industrial Water Treatment Technical Committee is concerned with the production of high purity water for industrial uses, primarily in semiconductor manufacturing, biopharmaceutical preparation, and power generation, but including other process industries such as chemical, petroleum, consumer products, food, paper, or aerospace. The clear trends are towards higher purity specifications, 100% system availability, faster construction schedules, and lower running costs. The selection of a set of unit processes for assembly into an operating plant will be driven by these considerations which will impact the future of water treatment equipment manufacturing.

The modern water treatment plant is normally grouped into pre-treatment, make-up, polishing, and distribution sections. Pre-treatment equipment varies the most because it depends upon the feed water source. Water from a municipal plant will require less pre-treatment than a surface source. The make-up section often employs reverse osmosis and deionization to remove the bulk of the contaminants, with the polishing plant using deionization and ultrafiltration to remove the last traces. The distribution system must maintain water purity until it reaches the point of use. Materials of construction are critical. Water treatment equipment manufacturers and users must uti-



lize materials which will not contaminate the product and will withstand exposure to the chemicals or high temperatures used for sanitization.

Monitoring and controlling water plants is a critical function. Economical operation mandates robust, reliable supervisory control and data acquisition systems. Statistical process controls, failure modes and effects analyses, and probabilistic risk assessments will become more prominent. The measurement of contaminants in the parts per billion or even parts per trillion range places severe demands on instrumentation. Ion chromatography, mass spectrometry, and specialized methods for individual species such as total organic carbon, silica, or dissolved oxygen mean a substantial investment in terms of capital expenditure and running cost. Maintaining equipment while ensuring uninterrupted production is always a challenge. Even apparently simple jobs can have economic implications to the process resulting in large losses if not well controlled. Taken together, these considerations enhance the value and importance of training to the overall operation; untrained or under-trained individuals cannot keep the plant running at the high levels of purity and reliability necessary.

Control of biological organisms in water is important to the semiconductor industry, but absolutely crucial in the biopharmaceutical industry. Standards for compendial waters, ingredients constituted into a finished drug intended for human use, are set out in the U. S. Pharmacopoeia / National Formulary, and enforced by the Food and Drug Administration. Not only live organisms, but endotoxins and their associated pyrogenicity must be evaluated and reduced

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## The Future of Manufacturing Technology in the PID

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or eliminated. Many different clean-in-place techniques are used in the food and biopharmaceutical industries to control microorganisms, but require plant equipment to be taken off line. Ultraviolet sterilization and the use of ozone are possible in an operating plant.

In addition to regulatory requirements, various industries set their own standards for water. The Electric Power Research Institute, Semiconductor Equipment and Materials International, the Institute of Nuclear Power Operations, and the American National Standards Institute are all active in developing water quality specifications, tailored to their particular industries. The challenge to the Industrial Water Treatment Technical Committee is to provide assistance to industry so it can better meet the requirements for purity, regulatory compliance, and economic operations.

A major chemical plant's hazardous waste incineration operation needed to be upgraded to meet new stringent EPA Maximum Achievable Control Technology (MACT) regulations. Working with Croll Reynolds, CITY, STATE, plant engineers decided to replace its existing air pollution control system with a combination of technologies incorporating quenching, scrubbing and wet electrostatic precipitation to achieve gas cooling, acid gas absorption and sub-micron particulate control. The installation resulted in 99.9% efficiency for all regulated pollutants at lower pressure drop with minimal maintenance.

The wastes generated at this facility are primarily high BTU organic materials that can be effectively managed through combustion. The incineration facility burns approximately 2000 different waste streams in total quantities exceeding 100 million lb/yr. The wastes include hazardous and non-hazardous liquids, sludges, containerized solids, and bulk solids.

To dispose of these wastes, the company operates several incineration units, including a liquid chemical destructor

and two rotary kilns. The existing liquid chemical destructor consisted of a horizontal furnace, heat recovery boiler, quench chamber, packed-bed scrubber, high-energy venturi with demister and two induced draft fans in series. The liquid destructor only accepted pumpable liquids and had a thermal rating of 50 M Btu/hr.

The previous rotary kilns consisted of a rotary kiln furnace, heat recovery boiler, quench chamber, high-energy venturi scrubber with demister and an induced draft fan. The two rotary kiln units share a common waste storage and operations building, a common water recirculation and blowdown system, and a common stack. Pumpable liquids are fed through liquid nozzles/burners mounted at the front face of the kiln. Solid hazardous wastes in various size containers are also disposed in the kilns. Non-hazardous solids in the form of general plant trash and loose bulk solids are also fed to the kilns via vibrating shaker conveyors.

The incineration units met current RCRA standards but were deemed insufficient to meet the new MACT standards for hazardous waste combustors. (See chart for MACT standards) Additionally, available space was limited, throughput capacity had to be increased, maintenance downtime minimized and energy usage was limited due to existing fan capacity.

The project team investigated a number of retrofit options with respect to probable emissions performance, capital cost, operating and maintenance cost, residue disposal requirements, reliability and constructibility. The project team decided to remove the waste heat boilers due to secondary formation of dioxins/furans and maintenance issues and to replace the existing twenty year-old scrubber system. They selected Croll-Reynolds Clean Air



Technologies proposed APC system that included a quench, scrubber, and wet electrostatic precipitator.

Under worst case conditions (DEFINE), the new APC system successfully demonstrated performance compliance to all RCRA and MACT standards for particulate, chlorine, low-volatile metals (Chromium), semi-volatile metals (lead), Mercury, and Dioxins/Furans (PCDDs) when operated at design conditions. Performance efficiencies were in excess of 99.9% for all pollutants.

The system designed embraces the philosophy of "incremental pollution control", where each component of the APC train has a specific function but, in addition, contributes to the reduction of all pollutants generated in the combustion process.

The jet venturi quench rapidly reduces the combustion gas temperature to saturation, thus limiting the time for dioxin/furan formation reactions to occur. The quench also removes large particulate matter and serves as the first stage acid gas scrubber.

Gas flows from the quench to the condenser/absorber scrubber, which is a multiple rod deck design. Scrubber water is recirculated through a heat exchanger before distribution at the top of the column, which results in the gas being sub-cooled to well below saturation temperature. Particulate greater than 2 um and HCl are both removed at 99+% efficiency in this

device. The sub-cooling of the gas removes condensable organics and metals, and results in the growth of sub-micron particles.

The cooled gas flows from the scrubber to a two-stage wet precipitator system. The wet ESPs achieve 99% collection of sub-micron particulate and heavy metals, readily meeting the MACT standards. This allows considerable flexibility for metals feed rates due to the high overall removal efficiencies provided.

**New EPA MACT Standards for Hazardous Waste Combustors**

| Pollutant    | U of M  | Incinerators | Cement Kilns | LWA Kilns | Old Standards |
|--------------|---------|--------------|--------------|-----------|---------------|
| Particulate  | gr/sdcf | 0.015        | 0.03         | 0.022     | 0.08          |
| HCL, CL2     | Ppm     | 170          | 120          | 43        | 1% of feed    |
| Hg           | Ug/Nm3  | 40           | 72           | 47        | NA            |
| LVM          | Ug/Nm3  | 55           | 63           | 37        | NA            |
| SVM          | Ug/Nm3  | 100          | 670          | 76        | NA            |
| Dioxins/Fura | Ug/Nm3  | 0.20         | 0.20         | 0.20      | NA            |

## PID'S BOOTH AT IJPGC 2000

The Cryogenic Technical Committee supported the Process Industry Division (PID) during the whole conference with a panel session and with our participation in the PID booth. It was a success!

ASME's PID was represented by: David Pratt, PID Chair Edison Aulestia and Carol Griffin, ASME staff Samuel Sami, PID secretary, Peter Toma, Chair of the Heat Exchanger Committee and myself, Vice-Chair of the Cryogenics Technical Committee.

First and foremost, I would like to express our gratitude to Edison and Carol for their fantastic support, ingenuity, hard work, responsiveness and the flawless organization that resulted. Edison and Carol can help our Committee in many ways, from facilitating conference calls to publishing a newsletter to performing market research. With these two, the sky is the limit!

The conference timing was in perfect synch with California's energy crisis so the emphasis was on stationary power plants. There was also a strong crowd of visitors from overseas (Europe, Russia, Asia, South America). Our booth was among zillions of gas turbine (and related product) exhibitors.

The art work in the background of our booth ("smoking" cryo pumps, air separation plant, heat exchangers, compressors etc) drew a fair amount of attention among the visitors and other exhibitors. We were constantly answering questions, discussing new ideas or issues and networking with professionals from the power industry.

The panel session ("Air separation plants: an opportunity for small co-generation") was very well received by the attendees. It was not a big crowd, though. My lesson there is that marketing a presentation is as important as the presentation itself. The attendees included air separation plant owners/operators and expansion turbine manufacturers. At least we got "the ball rolling" with a new idea.

We left IJPGC-2001 with a big smile and look forward to next year's meeting.

Two things on the thumbs-down side: there were two separate organizers for the conference (both from ASME!), the International Gas Turbine Institute and IJPGC. This means two separate and different programs and conference/exhibition brochures; as a result, whoever had one program missed out on the other's activities. Next on the list is the absence of participation from our committee members. Such a conference is a wonderful opportunity to meet and network. Our presence in a major conference, whether or not related to cryogenics, allows us to reach out to numerous users of cryo processes.

Without discarding the importance of ASME-specific conferences such as IMECE, industrial conferences are a privileged avenue for our committee to be known in the industrial community. We provide a knowledge pool or a think-tank to manufacturers and facility owners/operators. We can answer questions related to the use of cryogen for metal treating, as well as the storage/handling of hydrogen for power cycle improvement.

In light of this success, it is likely that we seek a similar participation at other conferences (Mining, Pulp & Paper, Cryogenic Institute etc.) To accomplish this, we need YOUR help and active participation.

*Nils E. Tellier*

## The 2001 International Joint Power Generation Conference New Orleans, LA



*Samuel Sami and Nils Tellier*



*The Process Industries Division Booth*

# Process Industries Division

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