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CO\$T-AIR CONTROL COST SPREADSHEETS:

Novocaine for Number Crunchers

By Bill Vatauvuk
ISEG/AQSSD/OAQPS

Anyone familiar with the *OAQPS Control Cost Manual (Manual)* knows that air pollution control costs depend upon a variety of emission stream, control device, and financial parameters. Often this dependency is quite complex.¹ For that reason, it is cumbersome and time-consuming—if not downright *painful*—to make these sizing and costing calculations by hand, especially if costs are needed for a range of input parameters (e.g., waste gas flowrate).

To enable the thousands of *Manual* users to make these calculations more

efficiently, we developed 20 spreadsheet programs, collectively named "CO\$T-AIR," to cover twelve control devices and one category of auxiliary equipment (ductwork). Because the spreadsheets allow for the escalation of equipment costs, they bridge the gap between the *Manual* and the *VAPCCI* (Vatauvuk Air Pollution Control Cost Indexes), the latter being documented in a recent EPA report.² The CO\$T-AIR programs are written in Lotus 1-2-3® (version 2.0). Each program outputs itemized total capital investment and total annual costs for a given set of input parameters. The devices and auxiliary for which we wrote spreadsheets are listed in the table (See page 2), alongside the Lotus® file names and the *Manual* chapters that correspond to

them.

In each of these file names, "TCI" denotes "total capital investment," while "WK1" is simply the Lotus® version 2.0 file extension. Those file names containing "2" are second versions of the spreadsheets in question. The character "L" signifies that the spreadsheet is for "large" units—i.e., those devices whose sizes exceed the upper limits of the cost correlations. As the list indicates, we



wrote "large" spreadsheets for thermal and catalytic incinerators, regenerative thermal oxidizers, flares, mechanical collectors, and wet impingement scrubbers.

Finally, for the refrigeration systems, "-C" and "-P" denote the spreadsheets for "custom" and "packaged"

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AIR WAVES

By Bob Blaszczak
CTC CO-Chair, OAQPS

Yes, the CTC is still around. A little leaner and not necessarily firing on all cylinders, but still functional. I've lost track of which continuing resolution (CR) we're being funded under - I think it's number 5 or 6. What ever the case, we're pleased to be here and proud to serve. This year's Federal budget process has certainly kept us focussed on the here and now. CRs that last one to six weeks tend to do that to you. Program planning, even within the current fiscal year, has become an abstract concept.

TO PRINT OR NOT TO PRINT? That's really not a question, because we really don't have a choice. I hope you are enjoying this electronic version of the CTC NEWS. If not, I hope it will grow on you. Printing of newsletters is out during the CRs, and maybe forever, depending on what the final

budget numbers look like. So, check the CTC HOME PAGE on the World-Wide Web or the CTC BBS on the Technology Transfer Network periodically for the latest copy of the NEWS. New editions are scheduled quarterly (January, April, July and October).

PROJECT IDEAS? The CTC still offers technical and engineering assistance projects (i.e., projects requested by staff at state and local agencies and funded, all or in part, by the CTC). Times are lean but some funding may still be available for critical projects. Don't procrastinate! Don't let the budget situation stop you from thinking ahead. Be an optimist! Get your request in now!!! If more money becomes available, the CTC will have to put funds on appropriate contracts in June 1996!

WHAT'S IN A NAME? Well, we think our name should reflect what we do and the organizations that support us. Our name, **CTC**, may be changing to the **CP²TC - Control and Pollution Prevention Technology Center**. The CTC has traditionally looked at both add-on controls and pollution prevention measures in assisting you, and it's time that the

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CO\$T-AIR

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units, respectively.

Most of the programs were based on design and cost data and procedures in the *OAQPS Control Cost Manual* (Fourth Edition, 1990) and its supplements. The exceptions were the programs for mechanical collectors, venturi scrubbers, and wet impingement scrubbers. Spreadsheets for these three devices were based on information in the book *Estimating Costs of Air Pollution Control (ECAPC)*.⁵

Spreadsheet Components

Although there are significant differences among the various spreadsheets, some components are common to all. First, each spreadsheet consists of six sections: (1) "Cost Base Date"/"VAPCCI," (2) "Input Parameters," (3) "Design Parameters," (4) "Capital Costs," (5) "Annual Cost Inputs," and (6) "Annual Costs". In the first section, the "Cost Base Date" is the date corresponding to the equipment costs ("base costs") in the *Manual* or *ECAPC*. This date ranges from third quarter 1986 (fabric filters) to second quarter 1993 (ductwork).

Next, the "VAPCCI" is used by the spreadsheet to escalate the equipment costs from the base date to the quarter and year selected by the user.⁶ Eleven VAPCCI have been developed, one for each of the control devices listed above.⁷ (The sole exceptions are the "venturi scrubbers" and "wet impingement scrubbers" categories, which have been combined into one index: "wet scrubbers".) Each spreadsheet is written so that once the user inputs the latest VAPCCI available, the total capital investment cost and capital cost-dependent annual costs will automatically be escalated.

The second section, "Input Parameters," contains technical data that, in nearly all cases, *must be entered by the user*. Because these input parameters vary so much according to control device designs and applications, there are no "default" values for them. Input parameters include standard stream parameters (e.g., waste gas volumetric

flowrate) and data specific to a device (e.g., gas absorber packing parameters). The spreadsheet needs these data to compute the design parameters, the costs, or both.

The "Design Parameters" section lists data (such as ESP collecting area) that are primarily calculated by the spreadsheet based on the input parameters. The "Capital Costs" section displays the control device total equipment cost (itemized), the purchased equipment cost, and the total capital investment (TCI). Two values are given for the total equipment cost. The first corresponds to the base date of the costs (e.g., second quarter 1987); the second, to the VAPCCI escalation date.

The fifth section, "Annual Cost Inputs," lists nearly all of the parameters needed for the program to calculate the various annual costs. These include the "operating factor" (the hours per year the control device operates), operating and maintenance labor rates, utility prices, the interest rate, and the control system life. As with the

"Input Parameters" section, *the user must provide all of these inputs*. Nevertheless, typical values for the parameters are given in the *Manual* chapter covering the device in question.

Given in dollars/year, the "Annual Costs" are listed in the last section of the program. These are itemized according to: (1) *direct annual costs* (operating, maintenance, and supervisory labor; maintenance materials; utilities; operating materials (e.g., caustic soda); replacement parts; and waste treatment/disposal), (2) *indirect annual costs* (overhead; capital recovery; and taxes, insurance, and administrative charges), and (3) *recovery credits* (if any).

Obtaining the Spreadsheets

The CO\$T-AIR spreadsheets are installed on the OAQPS TTN, where it is posted on both the Control Technology Center (CTC) and the Clean Air Act Amendments (CAAA) bulletin board systems. Because the spreadsheets are written in Lotus® (version 2.0), they are in a format that is importable to later versions of Lotus®, as well as to such

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TABLE. CO\$T-AIR SPREADSHEET PROGRAMS³

Classification	Control Device Type	Manual Chapter	Lotus® File Name(s)
Particulate emission controls	Electrostatic precipitators	6	TCI-EP2.WK1
	Fabric filters	5	TCI-FF2.WK1
	Mechanical collectors (cyclones)	None ⁴	TCI-MC.WK1 TCI-MC-L.WK1
	Venturi scrubbers	None ⁴	TCI-VS2.WK1
	Wet impingement scrubbers	None ⁴	TCI-WIS.WK1 TCI-WI-L.WK1
	Gaseous emission controls	Carbon adsorbers	4
Catalytic incinerators		3	TCI-CI.WK1 TCI-CI-L.WK1
Gas absorbers		9	TCI-GA.WK1
Flares		7	TCI-FL.WK1 TCI-FL-L.WK1
Refrigeration systems		8	TCI-RS-C.WK1 TCI-RS-P.WK1
Regenerative thermal oxidizers		3	TCI-RTO.WK1 TCI-RTL.WK1
Thermal incinerators (recuperative)		3	TCI-TI.WK1 TCI-TI-L.WK1
Auxiliary equipment		10	TCI-CTX.WK1

MACT, CTG, NSPS, ACT AND TITLE I RULE SCHEDULES**

MACT STANDARD	Proposal	Final	ACT	Final
Asbestos MACT/GACT	*1/24/95***	11/95***	Plywood/Particle Board (PM10)	Schedule Under Dev.
Asbestos Litigation	*1/1/93	***		
Ferroalloys	7/96	7/97	NSPS	Proposal
Flexible Polyurethane Foam	8/96	7/97	Cold Cleaning	*9/9/94
Gasoline Distribution	*12/8/95	5/96	Degreaser NSPS	*8/31/94
Haz. Waste Inc.	*4/19/96	4/97	Elec. Utility Gen. Rev. (NOx)	*5/30/94
Mineral Wool	8/96	10/97	Landfill NSPS & 111(d)	*5/30/91
Off-site Waste & Recovery	*10/13/94	6/96	Med. Waste Inc. NSPS & III(d)	*2/27/95
Oil & Gas Production	1/97	9/98	Mun. Waste Combustors II & III	*9/20/94
Pharmaceutical Production	6/96	1/98	NOx NSPS Revision (407(c))	*11/31/95
Polymers & Resins I	*6/12/95	7/96	SOCMI Sec. Sources Suppl.	7/96
Polymers & Resins III	Schedule under revision		Starch Mfg. Industry NSPS	*8/31/94
Polymers & Resins IV	*3/15/95	5/96		
Portland Cement	6/96	11/97	Other Rules	Proposal
Primary Aluminum Prod.	8/96	9/97	Arch./Ind. Coatings (§183e)	5/96
Primary Copper Smelting	7/96	8/97	Auto Refinishing (§183e)	*4/30/96
Printing/Publishing	*3/1/95	5/96	Consumer Products List (§183e)	*8/31/95
Pulp & Paper (combustion)	*2/27/95	8/96	Household Consumer Products	*3/26/96
Pulp & Paper (non-comb.)	*10/29/95	8/96	Haz. Waste TSDF, Phase II (RCRA)	*7/22/91
Secondary Aluminum Prod.	8/96	10/97	Haz. Waste TSDF Phase III (RCRA)	Schedule under revision
Shipbuilding (coatings)	*11/22/94	*12/15/95		
Steel Pickling-HC1 Process	5/96	5/97		
Wood Furniture Coating	*11/21/94	*12/7/95		
Wood Treatment	Proposal to be delisted		NOTE:	
Wool Fiberglass Mfg.	6/96	10/97	* Indicates date completed.	
			@ Indicates on a court ordered deadline.	
			** All schedules are tentative and subject to change without notice. Only those rules with proposal or promulgation dates within one year are included. Completed rules are removed from list after six months.	
			*** Schedule to be determined by litigation/negotiation	
			**** ACT's were issued for most CTG categories in April 1995	
			***** Final CTG cancelled or no plans to finalize.	
CTG ****	Proposal	Final		
Aerospace Coatings	6/96	4/97		
Industrial Wastewater	*12/29/93	*****		
Shipbuilding (coating)	*12/6/94(BACM)	*****		
Offset Lithography	*11/93	*****		
Plastic Parts Coating	*****	*****		
VOL Storage	*12/93	*****		
Wood Furniture Coating	*9/7/95	5/96		

CO\$T-AIR

(continued from page 2)

programs as Excel® and Quatro-Pro®. Accompanying the spreadsheets is an *Introduction* (in WordPerfect 5.1), which provides background on the programs, describing their general and specific features. Those with questions or comments about CO\$T-AIR should contact **William M. Vatavuk, at (919)-541-5309 (fax: 919/541-0839)**. Readers desiring copies of the *OAQPS Control Cost Manual* should phone the **Control Technology Center at (919)-541-0800**.

FOOTNOTES

- ¹ Consider, for instance, the sizing and costing procedures for gas absorbers, presented in Chapter 9 of the *Manual*.
- ² *Escalation Indexes for Air Pollution Control Costs* (EPA-452/R-95-006, October 1995). Both the report and quarterly VAPCCI updates are posted on the OAQPS Technology Transfer Network ("Clean Air Act Amendments" and "Control Technology Center" bulletin boards).
- ³ All programs are written in Lotus 1-2-3® (*version 2.0*).
- ⁴ Design and cost procedures and data for these devices may be found in the book *Estimating Costs of Air Pollution Control*, by William M. Vatavuk (Boca Raton, FL: CRC Press/Lewis Publishers, 1990).
- ⁵ Vatavuk, William M. *Estimating Costs of Air Pollution Control*. Boca Raton, FL: CRC Press/Lewis Publishers, 1990.
- ⁶ As of this writing, the VAPCCI have been updated through first quarter 1996 (preliminary).
- ⁷ The ductwork costs are escalated via a Producer Price Index published by the Bureau of Labor Statistics, Department of Labor.

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AIRWAVES

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CTC got full recognition for what it does. Also, one of the CTC's prime sponsors has reorganized. The Air and Energy Engineering Research Laboratory, Office of Research and Development (ORD) is now the Air Pollution Prevention and Control Division (APPCD) of the National Risk Management Research Laboratory, ORD. This change significantly strengthens and expands the CTC's ability to provide pollution prevention assistance. So what do you think of **CP²TC**? It's not chiseled in granite yet, but could be soon. If you have a better option, please let us know by BBS message, FAX or E-MAIL (see page 7).

HAVE YOU TRIED THE CTC HOME PAGE? The CTC now has a HOME PAGE on the World-Wide Web. You can access the CTC from the OAQPS HOME PAGE. Our address is <http://www.epa.gov/oar/oaqps/ctc.html>. This initial CTC HOME PAGE is kind of basic. We will upgrade this page in July, shortly after TTN-2000 becomes operational. TTN-2000 will give the Technology Transfer Network (TTN) a fully operational World-Wide Web site. As a result, all of the CTC BBS functions now available on the TTN BBS will be available on the World-Wide Web through TTN-2000. Check out the July edition of the CTC NEWS for an update on CTC HOME PAGE improvements and TTN- 2000.

You can also access the *Centro de Información sobre Contaminación de Aire* (CICA) HOME PAGE from the CTC's HOME PAGE. CICA is the CTC sponsored program to help resolve air pollution problems along the U.S.-Mexico border. The direct address for CICA is <http://www.epa.gov/oar/oaqps/cica.html>.

Enjoy the NEWS!

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NEW LANDFILL AIR EMISSIONS MODEL

By Bob Blaszczyk,
CTC/OAQPS

The Landfill Air Emission Model is now available on the CTC BBS and HOME PAGE. It provides an automated estimation tool for quantifying emissions from municipal waste landfills. The model estimates emissions of methane, carbon dioxide, nonmethane organic compounds, and toxic air pollutants. Information on the assumptions used in the model can be found in the background information document (NTIS # PB91-197061) written to support the Municipal Landfill New Stationary Performance Standards (NSPS), 40CFR60 Subpart WWW, and Guidelines for Control of Existing Sources, 40CFR60 Subpart CC, and in the public docket, Docket A-88-09. This article contains information on the beta release versions of the Landfill Air Emissions Estimation Model for DOS (Version 2.0) and Microsoft® Windows (Version 1.0).

The Landfill Air Emissions Model is regarded as a screening tool. It can be used with site-specific data, or it can be used with two different sets of default values. The CAA (Clean Air Act) default values reflect the expected maximum emissions and generally would be used only for determining the applicability of the landfill regulations and guidelines. To estimate actual emissions in the absence of site-specific data, a second set of default values (the AP-42 defaults) is provided in the model. The AP-42 default values are based on emission factors from the EPA's Compilation of Air Pollutant Emission Factors, Fifth Edition, AP-42

(EPA 1995). The AP-42 default values provide emission estimates that should reflect typical landfill emissions and are the values suggested for use in developing estimates for state inventories.

An IBM-compatible personal computer with at least one floppy disk drive and 4 megabytes of memory is recommended for this program. The Windows version requires Windows 3.1 or better. The DOS version requires DOS 2.0 or better. All software components of the models for this beta release are fully functional. As of this writing, the AP-42 values have been revised and are available for public comment. The beta version of this software includes the revised AP-42 suggested defaults. Once the AP-42 revisions are published as final, the defaults in these models will be revised to reflect any changes.

The CTC BBS and HOME PAGE have versions of the Landfill Air Emissions Estimation Model for DOS and Windows. Each model is provided in a separate self-expanding ZIP file (LAND_DOS.EXE for the DOS version and LAND_WIN.EXE for the Windows

version). Just download the appropriate version and put it in its own directory. To extract the files, either double-click on the file name in the Windows File Manager or type the file name in DOS and hit enter. (**NOTE:** All software components for each version

should be located in the same directory prior to execution.)

For the DOS MODEL, go to the directory that contains the expanded files and type LANDFILL. to execute the model. (SPECIAL NOTE: Hercules graphics card users should execute the MSHERC.COM program prior to running the model. This component is required to view graphical output with these cards).

For the WINDOWS MODEL, use
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SMALL BUSINESS UPDATE

Deborah M. Elmore, Federal SBAP Coordinator, CTC/OAQPS

SBAP FORUM

Welcome to the SBAP Forum. For each issue, we will invite one or more of our State or local Small Business Assistance Programs to discuss successful and innovative activities that may be of interest to their colleagues across the country.

MASSACHUSETTS PRINTERS PARTNERSHIP PROGRAM (MP²)

by George Frantz,
Office of Technical Assistance/SBAP

The Massachusetts Printers Partnership (MP²) is a joint project involving:

- Printers, consultants and vendors to the printing industry
- Printing Industries of New England (PINE)
- Massachusetts Department of Environmental Protection (DEP)
- OTA's Small Business Assistance Program (OTA/SBAP)
- EPA - New England Environmental Assistance Team (NEEAT)
- Screen and Graphic Imaging Association.

The pilot program began last spring with a series of meetings involving printers and agency personnel, at which the group identified both environmental concerns in the printing industry and a set of environmental criteria which would indicate that best environmental management practices were being followed.

MP² allows printers to come into compliance with the new protocols simply, inexpensively and in multi-media fashion. It imposes some additional requirements, both in photo wastewater discharge and in air emissions, which will assure industry-wide emissions reductions based on pollution prevention (P2). Program elements follow:

Aggressive outreach, including the development of a "plain language workbook" or printers, which will detail compliance require-

ments to which printers are subject and closely coordinated program materials which will lead the individual printing plant manager in a step-by-step self-certification process. OTA is hosting a series of six half-day workshops and clinics at convenient sites across the state, jointly funded by DEP, EPA-New England and OTA.

Regulatory Reform, the Partnership enrollment will replace virtually all environmental permits typically required of small and midsize printers and a six month enforcement moratorium to allow Partnership members to come into compliance.

Pre and post-program sampling to determine level of improved environmental performance, according to established measures of success and a carefully selected statistical sample. EPA has placed a high priority on demonstration projects which validate the concept of improving environmental performance by creating incentives for voluntary compliance. There was resistance to the concept of beginning a cooperative program with inspections, but this was deemed essential to establish a baseline. Fifty inspections were agreed upon and conducted under enforcement discretion, there would be no penalty except in extreme situations.

Strong public relations efforts, involving key state officials and representatives of the printing industry, working with statewide media to tout the program and encourage consumers to patronize printers who display the MP² logo.

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SMALL BUSINESS CONFERENCE A BIG SUCCESS!

Deborah M. Elmore
Federal SBAP Coordinator
CTC/OAQPS

The 1996 "State Small Business Ombudsman and Small Business Assistance Program Conference," co-sponsored by the Office of Air Quality Planning and Standards (OAQPS) Small Business Assistance Program (SBAP) and EPA's Small Business Ombudsman's Office, was held February 28 - March 1, 1996, in San Diego, California. This annual event provides an opportunity for the State programs to share information with each other, and with EPA. The conference attracted 150 attendees, representing 44 States and 2 territories; quite a good turn-out in this era of downsizing and budget cuts.

This year, planning of the conference "content" was carried out primarily by a group of State program representatives. The first day was devoted to industry sector presentations (printing, metal finishing, automotive service, and painting & coatings), with many of the speakers representing trade associations or actual small businesses. The second day had 16 different breakout sessions related to more operational issues of the State programs (policy and process), with the vast majority of speakers from within the State programs themselves. This combination of planning and presentation by the target audience proved to be amazingly successful; we literally had more volunteers to chair sessions or make presentations than we could use.

The response to "learning from your peers" was very enthusiastic.

OAQPS had a small, but visible, presence. In addition to serving as the Conference Co-Organizer (continued page 6)

Mom's Bakery Special Hot Cross Buns!! 3 for \$1	APPLIANCE REPAIR SERVICE Spring Air Conditioner Check Time!	Handy Dry Cleaners Special - 5 Shirts for One Dollar! ONE DAY SERVICE!!	Clyde's Copies Color Copies Too!!
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SMALL BUSINESS CONFERENCE

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nizer, I introduced several recent OAQPS small business assistance accomplishments, including the new SBAP BBS on the OAQPS Technology Transfer Network (TTN), as well as the SBAP Home Page on the World Wide Web. Janyce Riess lead an excellent discussion on the series of small business satellite seminars put on by OAQPS's Education and Outreach Group (EOG) in cooperation with the University of Tennessee. In fact, the session that Janyce participated in was one of the most popular in the whole conference.

Organizing a national meeting can be an extremely time consuming and frustrating experience. The rewards, however, can be very satisfying. Some comments we received on the evaluation forms include:

- "Great meeting"
- "This was my first meeting and I enjoyed every aspect"
- "I learned a lot and I am very grateful for this experience"
- "We plan on using OAQPS resources much more"
- "Annual conference should be considered as part of training for all States". Somehow, in the end, it all seems worth while!

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NEW LANDFILL

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the FILE-RUN selections from the File Manager menu to execute the LANDWIN.EXE file to start the model. (Additional Note: This program will make a modification to your WIN.INI file to save setup information about the model.)

More details about the design and use of both the DOS and Windows versions of the landfill model are provided in the "User's Manual, Landfill Air Emissions Model." This manual is also available on the CTC BBS and HOME PAGE.

REPORTING PROBLEMS

If in the process of using the model you have a question or problem, please feel free to contact us. In the event of a problem, please include the following information:

- Your name, address, telephone (and fax, if available), and E-MAIL address (if applicable).
- Your computer type, brand, processor/CPU speed, installed RAM, HD size and available space, operating system version, operating mode (for Windows, e.g. Enhanced), available memory (physical and virtual), display adapter type and settings, and attached printer types.
- Description of problem in as much detail as possible.

Also, suggested improvements to the software and/or model are also encouraged. Future revisions will be considered as data and improved models become available.

Send all reports or inquiries to Susan Thorneloe of the U.S. EPA using any one of the following methods:
EMAIL: thorneloe.susan@epamail.epa.gov
FAX: (919) 541-2382 or (919) 541-7885
MAIL: U.S. EPA/APPCD, MD-63, RTP, NC 27711

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WHAT'S NEW ON THE RBLC

By Jo Ann Kerrick
ViGYAN

Information in the RACT/BACT/LAER Clearinghouse (RBLC) is updated nearly every month as users submit new control technology determinations to the data base. In addition to this information, the RBLC support staff continues to make changes to keep the system current. If you haven't been on the RBLC BBS lately, check the TTN

now for the updates described below.

New RBLC Data Fields in Standalone Editor

As you may have noticed, we recently changed the RBLC data base structure by removing extraneous dates at the facility level and adding new fields for notes about compliance verification at the process level. In addition, the cost fields at the pollutant level were expanded to accommodate larger numbers. In September we released a new version of the RBLC standalone editor designed to be compatible with these changes.

The standalone editor is an alternative to online entry of new control technology information. You can input new determinations locally on your PC and then transfer the data to the RBLC system administrator for inclusion in the online data base. While we were changing the system to be compatible with the new data base, we made some more changes to simplify the editor. We removed the edit menu and moved its functions to the facility list screen. Now



you can make all updates to your determinations, including adding new ones, from a single screen. Another new option at the facility list screen lets you delete all of your old determinations and start with a blank data base. (You would use this option after you have sent your data to the RBLC). We hope these changes make the system easier and quicker to use. If you are responsible for submitting your agency's determinations, you might want to try the standalone editor. All the files you need and installation instructions can be downloaded from the RBLC BBS.

Ranking Reports Updated

The RBLC ranking report compares pollutant emissions for a single process type and one pollutant. Typically you perform a search for the target information, and then download your results using the ranking report format. Based

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RBLC

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on standard emission limits for each applicable determination, the report presents statistics based on these limits and then reports them in rank order listing from most to least stringent.

Because the RBLC Ranking report can be a valuable reference for users making RACT, BACT, or LAER determinations, the RBLC staff has generated ranking reports for specific process type and pollutant combinations. The reports are available for downloading to your PC without doing a query. In October all of these reports were updated to reflect the latest information in the then current RBLC data base. If you want quick access to ranking information, look for these reports in the Download section of the RBLC BBS.

Regulation Data Base Updated

When it became available in late 1994, the regulation data base contained summaries of New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP) rules then in effect. Subsequently, we expanded

Control Technology Center NEWS

The CTC NEWS is a quarterly publication of the U.S. EPA's Control Technology Center (CTC). The CTC is an informal, easy-to-use, no cost, technical assistance service for all State and local (S/L) air pollution control agency and EPA Regional Office staffs. For others, some services may be on a cost reimbursable basis. The CTC offers quick access to EPA experts and expertise via the CTC HOTLINE and the CTC Bulletin Board, and in-depth technical support through source specific Engineering Assistance Projects or more generic Technical Guidance Projects. The CTC is operated by the Air and Energy Engineering Research Laboratory, Office of Research and Development, and the Emission Standards Division, Office of Air Quality Planning and Standards in Research Triangle Park, North Carolina.

If you have any air pollution emission or control questions, or would like more information about the CTC and the types of technical assistance available, CALL THE CTC HOTLINE!
(919) 541-0800

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the data base to include entries for Maximum Achievable Control Technology (MACT) standards. As of November 1995, the data base contained 105 rules, with 21 of them updated to reflect rules proposed or promulgated in 1995. Starting in 1996, we plan to add summaries of Control Technology Guidance (CTG) documents. If you need summary information about current federal rules, the regulation data base is a good place to start.

Help Rearranged for Process Type Codes

The RBLC uses numeric codes to group processes by category, such as combustion, surface coating, mineral

processing, etc. In fact, searching for the appropriate process type code can be the quickest way to get the control technology information you need. Performing these searches with the menu-driven search just became a little easier. You still choose a major category from a two-page display of 2-digit process type codes from 10 to 99. Now, however, the system displays the list of available detail codes in alphabetical order by the process name, rather than in numeric order. You can quickly scan the list for the process you want and find the appropriate code for it. We hope this improvement makes the RBLC easier to use.

CTC

CTC ASSISTANCE

No cost assistance to staff of State and Local agencies, EPA Regional Offices, and others on air pollution control technology issues.

CTC HOTLINE: CALL (919) 541-0800 to access EPA expert staff for consultations, references to pertinent literature, or access to EPA technical data and analyses. No question is too simple!

CTC FAX: You can send a request for any CTC service listed here by FAX. Our Fax numbers are: (919) 541-0242 or (919) 541-0361.

CTC BBS: Call (919) 541-5742 for up to 14400 baud modem to access the CTC Bulletin Board. Set communications parameters to 8 data bits, N parity, and 1 stop bit, and use a terminal emulation of VT100 or VT/ANSI. You may leave HOTLINE requests, order documents, suggest projects, and download documents and software. The BBS is part of the OAQPS Technology Transfer Network (TTN). In addition, the TTN may be accessed via the Internet at 'TELNET ttbnbs.rtpnc.epa.gov' or through the EPA Home Page on the World Wide Web. The TTN also has an FTP site for downloading files at 'ttnftp.rtpnc.epa.gov'.

FEDERAL SMALL BUSINESS ASSISTANCE PROGRAM (FSBAP): The FSBAP is available through the SBAP BBS on the TTN (see CTC BBS for connection information), or the CTC HOTLINE or FAX. The FSBAP provides support to State Small Business Assistance Programs.

US-MEXICO INFORMATION CENTER ON AIR POLLUTION (CICA - Centro de Información sobre Contaminación de Aire): Call the CICA Information line (919) 541-1800 (Spanish) or the CTC HOTLINE (English) to access technical support and assistance in evaluating air pollution problems along the Mexico-US Border.

INTERNET/WORLD-WIDE WEB ACCESS: Send E-Mail to 'blaszczak.bob@epamail.epa.gov'. In addition, you may access our services through the following sites:

For CTC - '<http://www.epa.gov/oar/oaqps/ctc.html>'

For FSBAP - '<http://www.epa.gov/oar/oaqps/sbap.html>'

For CICA - '<http://www.epa.gov/oar/oaqps/cica.html>'

RACT/BACT/LAER CLEARINGHOUSE (RBLC): The RBLC data base is available on the OAQPS TTN BBS (see CTC BBS for connection information). The Clearinghouse provides summary information on control technology and pollution prevention (P2) determinations made by permitting agencies, and on EPA emission standards and control techniques guidelines.

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INTERNATIONAL TECHNOLOGY TRANSFER CENTER FOR GLOBAL GREENHOUSE GASES (ITTCGGG): Call the CTC HOTLINE to access ITTCGGG information on greenhouse gas emissions, prevention, mitigation, and control strategies.

MAIL: Address conventional mail inquiries to: CTC (MD-12), U.S. EPA, RTP, NC 27711.

TECHNOLOGY NOTEBOOK

REFRIGERATED CONDENSERS INHAP-PRO

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There are two types of condensers: the surface type and the contact type. The Control Cost Manual (CCM) and HAP-PRO (type 1) calculate only the surface type. HAP-PRO defines a type

TABLE 1: Input Data Key

Data	Symbol	Units
Inlet Stream Flow Rate	Q_{in}	scfm (77°F, 1 atm)
Inlet Stream Temperature	T_{in}	°F
VOC Inlet Volume Fraction	$y_{voc,in}$	dimensionless ratio
VOC Removal Efficiency	ζ	percent as decimal
Antoine Equation Constants	A, B, C	-----
Heat of Condensation (VOC)	ΔH_{voc}	Btu/lb-mole
Heat Capacity of VOC	$C_{p,voc}$	Btu/lb-mole-°F
Specific Heat of Coolant	$C_{p,cool}$	Btu/lb-°F
Heat Capacity of Air	$C_{p,air}$	Btu/lb-mole-°F
Molar flow rate	M	-----

2 unit as one in which the area of the heat exchanger is defined, not calculated.

In a contact condenser (not addressed in either CCM or HAP-PRO) a refrigeration unit chills volatile organic compounds (VOCs), similar to those being removed. Chilled VOCs are sprayed into the emission stream to condense the vapors. Again, the CCM and HAP-PRO do not address this type of condenser.

The CCM and HAP-PRO do address the surface type of condenser, also known as the shell-and-tube type. This type of condenser has the emission stream directed into a shell. Within the shell, there are tubes which are maintained at a low enough temperature to reduce the vapor pressure of the VOCs. Condensation of VOC vapor reduces the concentration. The emission stream is then exhausted. Part of the design data is the level of VOC which is acceptable in the exhaust.

The refrigeration system must be capable of handling the heat load given up by the VOCs as heat of condensa-

tion. And, if there is too much moisture in the air, the ice on the tubes can impair heat transfer, and the condenser will have a lower control efficiency than calculated. Therefore, in emission streams that are known to have a high moisture content, a precooler is necessary. The precooler operates at about 35°F to condense most of the water.

The input data for the design of this refrigeration unit is in Table 1:

HAP-PRO erroneously calls for the specific heat of the coolant to be in Btu/hr-ft²-°F; it should be in Btu/lb-°F.

However, as long as the correct numerical value is given, it will compute properly.

The air is considered to be noncondensable, which is true at these temperatures. Since the partial pres-

sure of the VOC can be raised by either compression or cooling, it is given in the calculations that the condenser operates at atmospheric pressure. We must calculate the temperature at which condensation occurs.

First we use the equation: HAP-PRO uses the less obvious, but equivalent, calculation: where

RE = Removal Efficiency

HAPe = HAP concentration in the emission stream, ppm

ΔH_{con} = enthalpy change of condensed VOC

ΔH_{uncon} = enthalpy change of uncondensed VOC

This assumes that at the outlet the gas stream is at equilibrium with the VOC condensate.

In the CCM, this leads to the equation: $T_{con} = \frac{(B - C)}{A - \log_{10} P_{voc}}$

Now we know the temperatures we must obtain. The heat load is then equal to: $H_{load} = \Delta H_{con} + \Delta H_{uncon} + \Delta H_{noncon}$

where:

$$\Delta H_{con} = M_{voc,con} [\Delta H_{voc} + C_{p,voc} (T_{in} - T_{con})]$$

$$M_{voc,con} = M_{voc,in} - M_{voc,out}$$

$$M_{voc,out} = M_{voc,in} (1 - \eta)$$

$$\Delta H_{uncon} = M_{voc,out} C_{p,voc} (T_{in} - T_{con})$$

$$\Delta H_{noncon} = [(60Q_{in}/392) - M_{voc,in}] C_{p,air} (T_{in} - T_{con})$$

HAP-PRO computes the number of moles in the inlet stream:

$$HAP_{em} = \left(\frac{Q_{e,HAP}}{392} e^{10^{-6}} \right) * 60$$

Then the number of moles in the outlet stream: $HAP_{om} = HAP_{em} * \left[\frac{1 - (RE)}{100} \right]$

Then the number of moles condensed is: $HAP_{con} = HAP_{em} - HAP_{om}$

Then HAP-PRO computes the heat load just as the CCM does it, but erroneously uses the $C_{p,air}$ instead of the $C_{p,voc}$ in computation of the enthalpy change in the uncondensed VOC. This minor error was not previously discovered because it is negligible.

Next, the CCM addresses the heat exchanger or condenser. The Chemical Engineers Handbook gives values of 20 to 60 Btu/hr-ft²-°F for examples of brine cooled tubes condensing VOC. The CCM uses a conservative heat transfer estimate of $U = 20$ Btu/hr-ft²-°F. HAP-PRO uses this as the default value, but allows other values to be entered.

The coolant is brine, which must be chilled to about 15°F below the condensation temperature. The temperature of the brine will rise to 25°F above the condensation temperature in a properly sized counterflow heat exchanger. These values must be used in the following equations.

The condenser then becomes defined by:

$$A_{con} = H_{load} / (U) T_{lm}$$

The coolant flow rate is given by:

$$W_{cool} = H_{load} / C_{p,cool} (T_{cool,out} - T_{cool,in})$$

And the refrigeration capacity is defined as:

$$R = H_{load} / 12,000 \text{ tons}$$

The flaws that have been detected will be corrected.

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CTC RESOURCES ORDER FORM

The CTC provides reports and software resulting from its efforts to government personnel free of charge. (Others may order them from the National Technical Information Service using the "PB" numbers shown here.) Below is a list of CTC resources published in the past two years. The CTC is happy to provide its resources to government personnel. However, because of the large response we anticipate to this list, we ask that you limit your request to the resources for which you have an immediate need and the quantity to one. To order CTC resources, COMPLETE FORM AND MAIL INFORMATION (no reverse side), CUT OUT FORM, FOLD, STAPLE/TAPE CLOSED, APPLY POSTAGE AND MAIL TO THE CTC.

REF NO. AIR TOXICS

- 94 () "Analysis of Atmospheric Deposition Samples from Easton, PA," EPA-600/R-93-057, PB93-181600
- 95 () "Alternative Control Technology Document - Carbon Reactivation Processes," EPA-453/R-92-019, PB93-180826
- 100 () "Air Emissions and Control Technology for Leather Tanning and Finishing Operations," EPA-453/R-93-025, PB94-120219
- 106 () "Evaluation of Mercury Emissions from Fluorescent Lamp Crushing," EPA-453/R-94-018, PB94-175932
- 114 () "Evaluation of Emissions from Paving Asphalts," EPA-600/R-94-135, PB95-129110
- 133 () "HAP-PRO Model User's Manual, Version 2.0," EPA-456/B-94-002, PB95-503181 (software and user manual); PB95-172987 (manual only)
- 141 () "New Regulation Controlling Air Emissions from Chromium Electroplating and Anodizing Tanks," EPA-453/F-95-001
- 142 () "New Regulation Controlling Air Emissions from Solvent Cleaning Machines (Degreasers)," EPA-453/F-94-083
- 143 () "A Guidebook on How to Comply with the Chromium Electroplating and Anodizing NESHAP," EPA-453/B-95-001 PB95-220604
- 144 () "Guidance Document for the Halogenated Solvent Cleaner NESHAP," EPA-453/R-94-081, PB95-216412

COMBUSTION

- 66 () "Characterization of Emissions from the Simulated Open-Burning of Non-Metallic Automobile Shredder Residue," EPA-600/R-93-044, PB93-172914
- 78 () "Evaluation Costing of NO_x Controls for Existing Utility Boilers in the NESCAUM Region," EPA-453/R-92-010, PB93-142016
- 102 () "Emissions from Burning Cabinet Making Scraps," EPA-600/R-93-213, PB94-130408
- 105 () "Characterization of Air Emissions from Simulated Open Combustion of Fiberglass Materials," EPA-600/R-93-239, PB94-136231
- 108 () "Pilot-Scale Evaluation of the Potential for Emissions of Hazardous Air Pollutants from Combustion of Tire-Derived Fuel," EPA-600/R-94-070, PB94-169463
- 138 () "Used Oil Analysis and Waste Oil Furnace Emissions Study," EPA-456/R-95-001, PB95-240412

RACT/BACT/LAER Clearinghouse

- 104 () RACT/BACT/LAER: A Compilation of Control Technology Determinations, "Volume 1-Third Supplement to the 1990 Edition," EPA 453/R-93-037a, PB94-111234
- RACT/BACT/LAER: A Compilation of Control Technology Determinations, "Volume 2-Third Supplement to the 1990 Edition," EPA 453/R-93-037b, PB94-111572
- 145 () RACT/BACT/LAER Clearinghouse Information System (BLIS) User's Manual, EPA-456/B-95-003
- 146 () RACT/BACT/LAER: A Compilation of Control Technology Determinations," Fifth Supplement to the 1990 Edition, EPA 453/R-95-005
- 148 () RACT/BACT/LAER Clearinghouse Flyer, October 1995

VOC - Other Source Categories

- 75 () "Alternate VOC Control Technique Options for Small Rotogravure and Flexography Facilities" EPA-600/R-92-201, PB93-122307
- 93 () "Alternative Control Technology Document for Bakery Oven Emissions," EPA-453/R-92-017, PB93-157618
- 96 () "Automobile Plant Spray Booth Cleaning Emission Reduction Technology Review," EPA-453/R-94-029, PB94-206257
- 101 () "Initial Assessment of Emissions from Heat Setting Carpet Yarn," EPA-600/R-93-161, PB93-229862
- 110 () Lithographic Printing ACT
- 111 () DRAFT Model Rule for Wood Furniture
- 134 () "Survey of Control Technologies for Low Concentration Organic Vapor Gas Streams," EPA-456/R-95-003, PB95-241626
- 139 () "Beyond VOC RACT CTG Requirements," EPA-453/R-95-010, PB95-239497

MISCELLANEOUS

- 48 () Complete List of CTC Documents
- 69 () "Managing Chemicals Safely, Putting It All Together," EPA-510/K-92-001
- 71 () "The Clean Air Act of 1990: A Guide for Small Businesses," EPA 450/K-92-001
- 90 () "OAQPS Cost Control Manual—Supplement 2, Gas Absorbers" EPA/450/3-90-006b, PB93-138147
- 92 () "A Guidebook for Explaining Environmental Regulations to Small Businesses," EPA-453/B-93-023, PB94-120334
- 99 () "Evaluation of the Polyad® With FB Air Purification & Solvent Recovery Process for Styrene Removal," EPA-600/R-93-212, PB94-130317
- 107 () "OAQPS Cost Manual - Supplement 3, Hoods, Duct Work, Stacks," EPA-450/3-90-006c, PB94-177565
- 112 () "Oil Suppression of Particulate Matter at Grain Elevators," EPA-453/R-94-049,

(continued page 10)

- 118 () "Evaluation of a Liquid Chemical Scrubber System for Styrene Removal," EPA-600/R-94-211, PB95-167359
- 137 () SAGE 2.1, "Solvent Alternatives Guide, User's Guide," EPA/R-95-049a
- 140 () "Control and Pollution Prevention Option for Ammonia Emissions," EPA-456/R-95-002, PB95-241790
- 147 () "Escalation Indexes for Air Pollution Control Costs," EPA-452/R-95-006

Global Greenhouse Gases Technology Transfer Center

- 80 () "Development of an Empirical Model of Methane Emissions From Landfills," EPA-600/R-92-037, PB92-152875
- 82 () "Landfill Gas Energy Utilization: Technology Options and Case Studies," EPA-600/R-92-116, PB92-203116
- 84 () "List of Papers and Reports for EPA's Research Program on Air Emissions from Landfills and Other Waste Management Processes," updated 11/94
- 86 () "Landfill Gas Recovery/Utilization - Options and Economics," EPA-600/A-92-170, PB92-217066
- 88 () "Emissions and Mitigation at Landfills and Other Waste Management Facilities," EPA-600/R-92-116 (also EPA-600/R-94-008), PB94-132180
- 120 () "The Coprocessing of Fossil Fuels and Biomass for CO₂ Emission Reduction in the Transportation Sector," 1993, EPA-600/A-93-109, PB93-194165
- 121 () "Methane Emissions from Industrial Sources," 1993, EPA-600/A-94-089, PB94-174760
- 123 () "Landfill Gas Utilization - Technical and Non-Technical Considerations," March 1994, EPA-600/A-94-139, PB94-189651
- 124 () "Estimate of Methane Emissions from Coal Mines," 1993, EPA-600/J-93-249, PB93-212553
- 125 () "Landfill Gas and Its Influence on Global Climate Change," October 1993, EPA-600/A-93-240, PB94-113784
- 126 () "Methane Emissions from Landfills and Open Dumps," EPA-230/R-93-010
- 127 () "Methane Emissions from Wastewater Treatment and Disposal," EPA-230/R-93-010
- 128 () "Biomass Gasification Pilot Plant Study; Final Report," EPA-600/R-93-170, PB94-114766
- 129 () "Demonstration of Fuel Cells to Recover Energy from Landfill Gas Phase I Final Report: Conceptual Study," EPA-600/R-92- 007, PB92-137520
- 130 () "Proceedings: The 1992 Greenhouse Gas Emissions and Mitigation Research Symposium," EPA-600/R-94-008, PB94-132180
- 131 () "Estimate of Methane Emissions from U.S. Landfills," EPA-600/R-94-166, PB94-213519
- 132 () "Estimate of Methane Emissions from U.S. Natural Gas Operations," March 1994
- 135 () "Landfill Gas Utilization-Database of North American Projects," EPA-600/A-94-064, PB94-162773
- 136 () "Technological Considerations for Planning the Global Carbon Future," EPA-600/A-93-182, PB93-222008

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