Enhancing Reservoir Management in the Appalachian Basin by Identifying Technical Barrier and Preferred Practices

Final Report

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ABSTRACT

The Preferred Upstream Management Practices (PUMP) project, a two-year study sponsored by the United States Department of Energy (USDOE), had three primary objectives: 1) the identification of problems, problematic issues, potential solutions and preferred practices related to oil production; 2) the creation of an Appalachian Regional Council to oversee and continue this investigation beyond the end of the project; and 3) the dissemination of investigative results to the widest possible audience, primarily by means of an interactive website.

Investigation and identification of oil production problems and preferred management practices began with a Problem Identification Workshop in January of 2002. Three general issues were selected by participants for discussion: Data Management; Reservoir Engineering; and Drilling Practices. At the same meeting, the concept of the creation of an oversight organization to evaluate and disseminated preferred management practices (PMP's) after the end of the project was put forth and volunteers were solicited.

In-depth interviews were arranged with oil producers to gain more insight into problems and potential solutions. Project members encountered considerable reticence on the part of interviewees when it came to revealing company-specific production problems or company-specific solutions. This was the case even though interviewees were assured that all responses would be held in confidence. Nevertheless, the following production issues were identified and ranked in order of decreasing importance: Water production including brine disposal; Management of production and business data; Oil field power costs; Paraffin accumulation; Production practices including cementing. An number of secondary issues were also noted: Problems associated with Enhanced Oil Recovery (EOR) and Waterflooding; Reservoir characterization; Employee availability, training, and safety; and Sale and Purchase problems. One item was mentioned both in interviews and in the Workshop, as, perhaps, the key issue related to oil production in the Appalachian region - *the price of a barrel of oil.*

Project members sought solutions to production problems from a number of sources. In general, the Petroleum Technology Transfer Council (PTTC) website, both regional and national, proved to be a fertile source of information. Technical issues included water production, paraffin accumulation, production practices, EOR and waterflooding were addressed in a number of SPE papers. Articles on reservoir characterization were found in both the AAPG Bulletin and in SPE papers. Project members extracted topical and keyword information from pertinent articles and websites and combined them in a database that was placed on the PUMP website.

Because of difficulties finding potential members with the qualifications, interests, and flexibility of schedule to allow a long-term commitment, it was decided to implement the PMP Regional Council as a subcommittee of the Producer Advisory Group (PAG) sponsored by Appalachian Region PTTC. The advantages of this decision are that the PAG is in already in existence as a volunteer group interested in problem identification and implementation of solutions and that PAG members are unpaid, so no outside funds will be required to sustain the group.

The PUMP website became active in October of 2002. The site is designed to *evolve*; as new information becomes available, it can be readily added to the site or the site can be modified to accommodate it. The site is interactive allowing users to search within the PUMP site, within the Appalachian Region PTTC site, or within the whole internet through the input of user-supplied key words for information on oil production problems and solutions. Since its inception in the Fall of 2002, the PUMP site has experienced a growing number of users of increasingly diverse nature and from an increasing geographic area. This indicates that the site is reaching its target audience in the Appalachian region and beyond.

Following up on a commitment to technology transfer, a total of eight focused-technology workshops were sponsored by the Appalachian Region PTTC center at the request of the PUMP project. Five Welltender Operations and Safety seminars were held in Kentucky, West Virginia, Ohio, and Pennsylvania. A two-day Applied Reservoir Characterization seminar and a one-day course on Paraffin, Asphaltene, and Scale problems were held in Pennsylvania. A one-day workshop on Produced Water was held in OH. In addition to workshops and the PUMP website, the project also generated several topical reports available to the public through the website and through USDOE.

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INTRODUCTION

The first commercial oil wells in North America were discovered in the 1850's. Whether the Drake well in Pennsylvania or the Williams well in Ontario, Canada is considered to be the initiator of the petroleum industry in North America, it is significant that both wells lie within the Appalachian basin. The end of the 19th century and the first half of the20th century saw small, independent oil companies grow into major producers. The latter half of the 20th century witnessed the reversal of this trend as major oil producers left the region to explore more lucrative petroleum provinces. In the 21st century, the oil industry in the Appalachian region is dominated by small, independent oil producers, just as it was in the early years.

Today, the oil industry in the Appalachian region is dominated by production rather than exploration. While profit margins rise and fall with the price of a barrel of oil, the economics of running an independent oil company dictate lean budgets and the need for efficient, trouble-free operations. Oil fields in the region have changed ownership numerous times since their discovery decades ago. One would expect there to be little interest in wells and fields that may be more than 100 years old. But, as noted by Patchen (1984) and in the Appalachian basin contribution to the Total Oil Recovery Information System (TORIS) database, even after primary recovery and several episodes of secondary recovery, 70% to 80% of the original oil in place may remain.

Preferred Upstream Management Practices (PUMP) is a five-year program sponsored by the United States Department of Energy (USDOE) designed to identify and disseminate Preferred Management Practices (PMP) to independent oil producers throughout the United States. The current, two-year project, sponsored under USDOE Contract #DE-FRC26-01BC15273 intends to improve oil field management practices in the Appalachian region by:

1) identifying problems and issues that reduce production efficiency and profitability;
2) identifying potential solutions to issues raised in 1);
3) disseminating information pertinent to issues raised in 1) and solutions identified in 2) through technology transfer to independent oil producers in the region.

Problematic issues related to oil production were identified by direct contact with oil producers in the Appalachian region during the Problem Identification Workshop (see Patchen, 2002) held early in the first year of the project and through personal interviews with producers. Likewise, potential solutions to these issues were solicited from oil producers within the Appalachian region. Additional, relevant information was gathered from scientific and technical organizations, individual geoscientists and petroleum engineers, and oil producers outside of the Appalachian region, especially when no solutions were forthcoming from the region itself.

Once production problems and issues of concern were identified, the PUMP project created an advisory council for the Appalachian region designed to continue to monitor production activities in the region after the end of the two-year project. This regional council will identify new production problems as they are encountered, will continue to seek solutions to existing problems, and will facilitate the transfer of information to oil producers in the region. The focal

point for the dissemination of information is an interactive, dynamic web site created during the two-year contract period and then maintained and improved under the oversight of the Appalachian regional council after the end of the project.

EXECUTIVE SUMMARY

The current project is part of a five-year effort sponsored by the United States Department of Energy to improve the efficiency and profitability of oil production through the identification of problems and problematic issues in the production oil and through the identification of potential solutions or preferred management practices (PMP's) that will facilitate solutions. Under USDOE Contract # DE-FC26-01BC15273, the PUMP (Preferred Upstream Management Practices) project sought to: 1) identify problems and issues that reduce production efficiency and profitability; 2) identify potential solutions to issues raised in 1); and 3) disseminate information pertinent to issues raised in 1) and solutions identified in 2) through technology transfer to independent oil producers in the region.

A list of interested parties was compiled through consultations with the oil and gas personnel at the various state geological survey throughout the Appalachian region; through the use of existing mailing and contact lists from the Appalachian Region Petroleum Technology Transfer Council (PTTC) center; and through contact with the various state Oil and Gas Associations (OGA's) and Independent Oil and Gas Associations (IOGA's) in the region. A group of 1300 individuals was identified.

In January of 2002, a Problem Identification Workshop was held to start the process of identification of problems and preferred practices. In addition, general interest in the purpose of the PUMP project was solicited as was the interest and willingness of oil producers to serve on an Appalachian Regional Council to oversee the search for PMP's. At the same time, producers were queried as to their willingness to submit to in-depth interviews regarding production issues and preferred practices.

PUMP project members followed up on issues raised in the Problem Identification Workshop by conducting personal interviews and by performing a combined internet and literature search on production problems and potential solutions. The PUMP website, created in October of 2002, became the compendium of information gathered during the PUMP project.

It was decided, for two reasons, to create the Appalachian Regional Council as a subcommittee of an existing Producer Advisory Group (PAG) operating under the auspices of the Appalachian Region PTTC. First, an adequate number of interested individuals qualified to populate and maintain the Regional Council could not be identified. Second, because the Appalachian Region PTTC and its PAG are an ongoing endeavor whose goals overlap those of the proposed PMP Regional Council, this combination of effort seemed to be the logical and most efficient method of continuing the objectives of the PUMP project – particularly, the continuing search for new production practices and the continued dissemination of information through the PUMP website.

PROBLEM AND BEST PRACTICE IDENTIFICATION - WORKSHOP

Methodology:

Problems and problematic issues related to oil production in the Appalachian region were identified by direct contact with oil producers within the region. Several *points-of-contact* were in place prior to the start of the PUMP project that provided names of individuals directly involved with oil production in the region. Chief among these resources were individuals within the oil-and-gas divisions of various state geological surveys, mailing and membership lists of the Independent Oil and Gas Associations (IOGA) within the region, and lists of attendees to petroleum-related workshops and symposia, especially those sponsored by the Petroleum Technology Transfer Council (PTTC).

From this large group of individuals, a mailing list with 1300 names was compiled. All received invitations to attend a Problem Identification Workshop. In addition, the Workshop was advertised to the petroleum industry in general by means of the PTTC web site and through informational flyers distributed at regional geological conferences. This Workshop was designed with multiple objectives:

1) to gauge general interest in the topic, i. e., to take the pulse of the oil industry in the Appalachian region;
2) to identify individuals who were particularly interested in the topic and who might make a further contribution to the project by serving on the regional council or by allowing in-depth interview regarding their production practices;
3) to identify problems and problematic issues related to oil production;
4) to identify solutions to 3) or best production practices in general.

The Problem Identification Workshop was held in January of 2002. The day-long meeting featured a half-day of industry speakers from within and outside of the Appalachian region and a half-day of group discussion of production problems, solutions, and best practices.

Results and Discussion:

Patchen (2002) summarized the results of the Problem Identification Workshop held in January of 2002. Thirty-eight individuals (including six PUMP project members) attended the meeting. This number represents only a small fraction of those contacted by mass mailing (less than 3%). Nevertheless, all attendees were active participants in the afternoon discussions. Three general topics were selected by Workshop participants for extended discussion: Data Management; Reservoir Engineering; and Drilling Practices.

Data Management - The group concluded that a standardized digital data format is highly desirable, especially regarding geographic location, elevation, production, and reservoir data. Basic operational data such as tank fluid levels need to be collected in a more automated manner. This goes hand-in-hand with improving education for welltenders so that they can recognize a

well that is under-performing. Other issues identified were paper versus digital format and storage, location and condition of old records, availability of information on very old plugged and abandoned wells, and cost-effective and efficient ways to gather data used to make decisions. Reservoirs with high production potential should be evaluated and prioritized on a regional scale (as done in the TORIS database). Interstate stratigraphic nomenclature inconsistencies need to be addressed and resolved (as done in *The Atlas of Major Appalachian Gas Plays*, Roen and Walker, 1996). The desirability of internet access to these specific types of data was noted.

One final data issue identified was the need for consolidated reporting of such things as annual production data. The differences between individual states within the Appalachian region were noted. For example, Ohio has a consolidated reporting system; West Virginia has a variety of different reports required by the Tax Department and Office of Oil and Gas.

Reservoir Engineering - Current practice in the Appalachian basin includes the creating of a standard suite of open-hole geophysical logs, usually gamma-ray and density; the taking of cores, primarily side wall; and conducting pressure build-up tests in old fields. The acquisition of whole core is becomingly increasingly rare despite the information that can be gleaned from it. Rare or underutilized methods include dipmeter logs and nuclear magnetic resonance imaging (MRI) for saturation and permeability. Reservoir imaging techniques such as cross-well tomography, magnetic surveys and surface geochemical surveys have not found wide use in the basin. Only a limited number of seismic surveys have been done and these are generally proprietary.

The group agreed on the importance of isolating productive zones to determine their characteristics; of carrying out geologic modeling; and of integrating data of different types from disparate sources. Access to existing information on specific fields, including company and government reports, is vital. Group members voiced the opinion that many reports may lie overlooked and unused in company files. There is a need to integrate this information and make it available, again, perhaps by the internet. It was suggested that regional *experts* be identified and interviewed to help locate sources of obscure or little-known data

The group identified the need for techniques for characterizing isolated wells, or groups of wells within a field, i.e. situations when a company owns small portions of a field and must make decisions and plans based on limited data. Published case studies on reservoir management specific to the Appalachian basin, the creation of a database of reservoir characterization efforts in the basin, and a basin-wide repository of reservoir data were all suggested as items that would aid reservoir management in the region.

Drilling Practices – Workshop participants with experience in Kentucky, New York, Ohio, Pennsylvania, Tennessee, and West Virginia ranked the following drilling problems in the order of their importance:

1) Drill rig safety and knowledge of safe drilling practices;
2) Regional lack of drilling personnel – trained or otherwise;

3) Existing equipment is aging and possibly poorly maintained – new equipment unavailable;
4) Permitting and regulatory process becoming increasingly complex;
5) Drillers unprepared for high pressure/high volume flow from new wells.

Potential solutions to personnel problems include: guaranteed work contracts (length of employment specified at time of hiring); *mentoring* or apprenticeship of new employees by experienced personnel; cash bonuses to stay with the company; use of relief crews and guaranteed time off; automation of some of the *repetitive* tasks on the drill site; scheduling a *steady* drilling program throughout the year to minimize rig downtime and personnel turnover; and subsidizing drilling contractors to help them stay in business during slow periods.

Potential solutions to safety problems include: developing a well control or well safety school, perhaps sponsored by PTTC; and developing and hosting a workshop highlighting *best* drilling practices.

Completion problems, again ranked in order of their importance by the group, included:

1) Difficulties with *accurate* multistage completions
    a) how to identify *best* zones for completion
    b) how to identify zones to be treated
    c) well or production testing;
2) Cementing - particularly in deep wells with long drill string leading to excessive cement heights for production string;
3) Unsafe or poorly maintained service rigs;
4) Stimulation difficulties;
    a) incompatibility between fluids and formation
    b) difficulty in determining perforation density
    c) difficulty with proppant – type and amount;
5) Reservoir-specific problems
    a) accurate identification of lithology
    b) selection of best completion technique for fractured reservoirs.

Potential solutions to the cementing problems include: using foam cement; addition of microspheres to cement; and *stage* cementing. Participants noted that any solution must be both cost effective and feasible in an engineering sense.

It was noted that there is a need for additional education for welltenders concerning environmental and safety regulations and practices. Existing resources such as the generic safety manual available from the Ohio Oil and Gas Association (OOGA, 1988) and materials that the Oklahoma Marginal Well Commission (Langston, 2003) has developed should be used where appropriate. In addition, the Appalachian Region PTTC center was asked to sponsor a series of workshops for welltenders designed as a *refresher* course in basic oilfield operations and safety practices. Five of these workshops were in held at in 2003 at various locations throughout the region: Pikeville, KY - April 22, 2003; Buckhannon, WV – April 24, 2003; Bremen, OH – August 26, 2003; and Indiana, PA – August 28 and 29, 2003. These workshops were so well

attended that the meeting held in Indiana, PA, originally scheduled as a one-day workshop on August 28th, was repeated on the following day.

PROBLEM AND BEST PRACTICE IDENTIFICATION – INTERVIEWS

Methodology:

The Problem Identification Workshop was the primary initial source of individuals to be contacted directly to get their input regarding problems, problematic issues, and potential solutions related to oil production. Of the Workshop's 38 attendees, 16 completed evaluation forms designed to gauge interest in the PUMP project, their willingness to serve on the regional council, and to be interviewed regarding production problems and practices. Of the six oil producers, four indicated that they would allow an interview and would serve on the proposed regional council. Of the remaining two oil producers, one agreed to serve on the council; the other agreed to be interviewed. Four representatives from service companies and the consulting sector responded. Two agreed to be interviewed and to serve on the council; two agreed only to be interviewed. The remaining four respondents declined to be interviewed or to serve on the Council.

This small number of individuals was expanded to 80 by reexamination of the original Workshop mailing list. A form letter (see Appendix I, p. 10) was prepared that spelled out the purpose of the PUMP project and inquired as to the individual's willingness to participate in an interview. This letter was sent to all prospective interviewees and was followed up by a telephone call, an e-mail, or both when a response was not forthcoming in a *reasonable* amount of time (approximately two weeks). A standardized interview form was prepared to be used by all project members to insure that a consistent set of questions was presented to the interviewees. An example of this form is given in Appendix I (see page 19). After discussions with potential interviewees, it was decided that an office visit to each was impractical for most of the interviewees. The majority of interviews were conducted by telephone, e-mail, or through a combination of both.

Results and Discussion:

Of a potential group of 80 individuals, only 28 were interviewed; the majority of these agreed to the interview on the condition of confidentiality. The remainder refused outright, did not respond, or agreed but could not fit the interview into their schedule. This scheduling problem was encountered even with those potential interviewees that preferred telephone contact – the economics of the oil business in the Appalachian region may not be positive but business details must still be attended to. For the independent producer, small staffs necessitate lots of *hands-on* activity, even by management personnel.

The general consensus among PUMP project members was that the interviews yielded few if any actual solutions or preferred practices. There was a reticence among interviewees to put forth solutions to production problems, perhaps because in a competitive market, revealing a solution might reduce a company's competitive advantage. The same trend was encountered regarding the discussion of detailed, company-specific production problems. Nevertheless, the input from interviews helped focus oil production issues within the Appalachian region. Project members assigned a final rank to production problems, based on the frequency of mention during interview or as suggested by interviewees:

1) Water production including brine disposal;
2) Management of production and business data;
3) Oil field power costs;
4) Paraffin accumulation;
5) Production practices including cementing.

Additional issues raised included:

Problems associated with Enhanced Oil Recovery (EOR) and Waterflooding;
Reservoir characterization;
Employee availability, training, and safety;
Sale and Purchase problems.

One item was mentioned both in interviews and in the Workshop, as, perhaps, the key issue related to oil production in the Appalachian region - *the price of a barrel of oil.* Obviously, market economics is a topic beyond the scope of the PUMP project but the fact that this issue was consistently raised as a limiting factor indicates its importance.

PROBLEM AND BEST PRACTICE IDENTIFICATION – LITERATURE SEARCH

Methodology:

Based on issues raised in the Problem Identification Workshop and during personal interviews, it was decided to search the literature (both print and electronic) related to the petroleum industry. This literature search include web-based sources such as the websites of the oil and gas divisions of state and Federal agencies, the regional and national PTTC websites, and a number of periodicals and journals including the Journal of Petroleum Geology, American Association of Petroleum Geologists (AAPG) Bulletin, Bulletin of Canadian Petroleum Geology, and the numerous publications of the Society of Petroleum Engineers (SPE).

The literature search was generally restricted to recent information (no more than ten years old) and was prioritized based on its appropriateness to the Appalachian region and to the production issues identified for this region. Articles pertaining to geographic region other than the

Appalachian basin were considered relevant if they specifically addressed a production issue or provided a solution deemed applicable to the Appalachian region by the reviewer.

Results and Discussion:

In general, the PTTC website, both regional and national, proved to be a fertile source of information, particularly with regards to case studies describing production problems and their solutions. Technical issues include water production, paraffin accumulation, production practices, EOR and waterflooding were addressed in a number of SPE papers. Articles on reservoir characterization were found in both the AAPG Bulletin and in SPE papers. Materials in the Journal of Petroleum Geology and Bulletin of Canadian Petroleum Geology were generally found to be too geographically specific or lacking in engineering focus to be of value to the PUMP project.

Project members extracted topical and keyword information from pertinent articles and websites and combined them in a database that was placed on the PUMP website. Access to that database is discussed later in this report (see page 11).

CREATION OF THE APPALACHIAN REGIONAL COUNCIL

Methodology:

One of the primary objectives of the PUMP project was to create an Appalachian Region Preferred Management Practices (PMP) Council, which would have as their main goal the identification of PMP's beyond the end of this contract and to maintain an oversight on the dissemination of existing information through the PUMP website. The intent was to create a Council that would provide information on technical problems faced by industry in the region; the typical practices employed by industry to solve these problems; their opinion as to which of the standard practices should be considered as PMP's for the region; and PMP's that can be transferred from other regions to assist operators in this basin. It was envisioned that the Council would advise project members during the two-year course of the project through periodic meetings to guarantee the sufficiency of the effort put out by the team, and the continuance of the Council past the immediate life of the project.

Ideally, the Regional Council should include members of the Appalachian Regional Producer Advisory Group (PAG), other oil industry representatives not currently on the PAG, and the State Geologists on the Appalachian Oil and Natural Gas Consortium (AONGRC) Advisory Board. The PAG is a well-established, producer-driven advisory group that has been in existence since 1994 when PTTC's program was implemented in the Appalachian basin. Industry members of the PAG represent oil and gas producers, consultants, and service companies. Those representing oil producers would be natural additions to the Regional Council.

This does not mean that other members of the oil industry would be excluded from the new Council, and indeed they were not. Very early in the PUMP project, we began to recruit interested members of the petroleum industry who were not current PAG members; this process begin with the Problem Identification Workshop held in January 2002.

There were two initial concerns in the creation of the Regional Council. It was desired to create a Council with the necessary expertise and Appalachian basin experience to be able to ascertain which of the current practices are indeed the preferred practices that should be employed. Secondly, a mixture of members was needed that would assure that the Council would continue to function on its own once direct support ended of with the end of the PUMP contract.

Because the Regional Council represents both the producing and service sectors of industry, it will need members from both sectors with the necessary expertise and corporate experience. These members will be natural stakeholders in an improved oil industry, and thus will be interested in continuing identification of preferred production practices. On the government side, the state geological surveys are well-established and permanent fixtures in the region with long histories of research and technology transfer to benefit industry. Therefore, their involvement will assure the longevity of the Appalachian Region PMP Council by providing leadership and administrative assistance beyond the end of the PUMP contract.

Once the Regional Council was in place its role would be to select the preferred practices from a list of those currently in use in the basin, to assure the effectiveness of the PUMP website through continuous review of website contents, and to develop procedural plans for the continuation of the Council beyond the end of the PUMP contract period.

Results and Discussion:

The creation of the Regional Council did not go as smoothly as planned. Several attendees at the January 2002 Problem Identification Workshop expressed an interest in serving on the proposed Regional Council, which was described in detail during the Workshop. Unfortunately, only a single individual followed through with a commitment to become part of the Council. Each of the State Geologists in Ohio, Pennsylvania, Kentucky, and West Virginia was contacted and their interest and support was solicited. Although all were interested in the concept, none offered to personally sit on the Council, preferring instead to appoint a staff member, and most expressed concern the long-term commitment for an unfunded obligation.

Creation of the Regional Council was included as an agenda item during at least two meetings of the Appalachian Region PAG. However, interest among PAG members was lukewarm. None offered to serve on a separate Council. However, several suggested that the role and duties of the proposed Regional Council be incorporated into the PAG's role of supporting and promoting technology transfer to independent producers in the Appalachian basin.

During the writing of the PUMP project's proposal, it was not possible to anticipate this low level of interest among producers and state surveys. When this lack of interest became apparent, project members were unprepared. In general, during the two-year PUMP contract period there was considerably more industry interest in developing gas plays, especially the deep Trenton-Black River Play, or the shallow, coal-bed methane plays, as well as other conventional plays. There appeared to be very little interest in drilling oil wells or in participating in enhanced oil recovery projects. Therefore, PUMP project members were forced to consider other options to recruit members for the proposed Regional Council.

Several models for the Regional Council were discussed at monthly project meetings during the second year of the contract. One option was to continue with the original approach, but with a reduced number of Council members. A second option was to accept the suggestion of PAG members to create a PAG subcommittee that would serve as a PMP Regional Council. This subcommittee of oil producers would serve as a working group, reporting to the PAG as a whole for advice and further input. The latter option gained favor when it was announced that the Appalachian Region PTTC program was to be extended another five years.

A third model considered was to create a Regional Council similar to the Stripper Well Consortium (SWC), to which members would pay an annual fee for the support the administrative costs. A part-time director would be hired to keep the Council moving and set up meetings. It was also was suggested that the Executive Director of the SWC be approached to ascertain his level of interest in having the PMP Council attached to the SWC. The reasoning here was that both groups were interested in obtaining more oil production from old fields, and both were interested in technology and better production practices. The PMP Council's main role would be to determine which of the existing methods are the best practices, whereas the main focus of the SWC would remain to develop new technology through research and demonstration projects. Technologies developed under the auspices of the SWC have the potential of becoming future preferred practices so a synergy exists between goals of the SWC and of the PMP Council.

In the end, the second model was chosen – creating a subcommittee of the Appalachian Region PAG that would serve as a PMP Council. The advantages are that the PAG is in already in existence as a volunteer group interested in problem identification and implementation of solutions. In addition, PAG member are unpaid, so no outside funds will be required to sustain the group. Finally, PTTC fully intends to continue as an entity beyond the proposed five-year extension, although their immediate future is still tied to public sector funding.

CREATION OF THE PUMP WEBSITE

Methodology:

Bocan (2003) summarized the design and implementation of the PUMP website. The site (http://pttcims.wvgs.wvnet.edu/pump) went through two developmental stages: 1) the creation of a trial website containing prototype pages for PUMP project members to examine and critique and

2) the creation of the final public version website to be housed at the West Virginia Geological and Economic Survey (WVGES). Part of the design process involved reviewing existing websites with oil and geological orientation for the purpose of determining the current *state of the art* in publicly available, petroleum-related web presentations. To ensure continuous public access, the server was connected to the internet *outside* of the WVGES firewall. Figure 1 illustrates the structure of the PUMP site.

Information regarding production problems, problematic issues, and potential solutions was collected from Workshop discussions, personal interviews, and literature search and workshop discussions, were categorized by topic and made accessible to user inquiry on the PUMP website. In addition, a collection of links to websites with relevant information, including the TORIS (Total Oil Recovery Information System) database, was created.

The effectiveness of the PUMP website in disseminating information to oil producers in the Appalachian region and beyond is evaluated based on the analysis of statistics on access to the site. Quarterly statistics have been generated using Web Trends™ statistical and presentation software from October, 2002 through August, 2003. These statistics include: general statistics; most downloaded files by visits over time; and cities with most numerous web visits. Starting with the third quarter 2003, analyses include: top organizations and top visitors based on the number of *hits* (connections to the website).

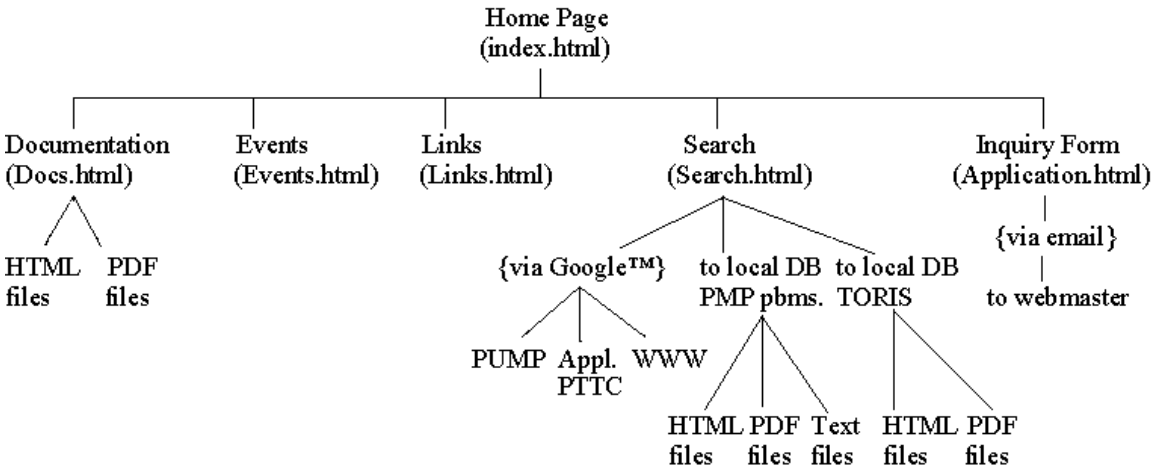

Figure 1: Structure of the PUMP website showing general topics, links, and data types provided.

Results and Discussion:

The PUMP website is designed to *evolve.* As new information becomes available, it can be readily added to the site or the site can be modified to accommodate it. User inquiries are accommodated by online search techniques. The popular Google™ Search Engine is

incorporated in the PUMP Search Page (see Figure 1) to allow the user to search within the PUMP site, within the Appalachian Region PTTC site, or within the whole internet through the input of user-supplied key words. From the Search Page, users can query the local PUMP databases for information on oil production problems and solutions. This search can examine data specific to the Appalachian region or to a wider geographic area.
In addition, TORIS data can be downloaded for individual states in the Appalachian region or for the region as a whole.

There is evidence (see Appendix II - compare Fourth Quarter, 2002 to Third Quarter, 2003) of ongoing and increasing interest in the PUMP project based on website statistics on viewing and document downloading activities. The link from the Appalachian PTTC website (http://karl.nrcce.wvu.edu - hosted at West Virginia University) provides a major entry point to the PUMP site. However, registration of the PUMP site with Google supplies the greatest number of visitors/hits via *spiderbots* and *web crawlers* (automated, computer search engines). Since its inception in the Fall of 2002, the PUMP site has experienced a growing number of users of increasingly diverse nature and from an increasing geographic area. This indicates that the site is reaching its target audience in the Appalachian region and beyond

TECHNOLOGY TRANSFER

Methodology:

The transfer of information gathered during the PUMP project is designed along the lines of the PTTC model, i. e., through the establishment of local and regional contacts in the petroleum industry, through the presentation of information and acquisition of feedback at one-day workshops, and through the creation and maintenance of a dynamic, interactive website. A mailing list containing 1300 names was created with help from contacts at several state geological surveys and oil and gas organizations, including the regional Oil and Gas Associations (OGA's and IOGA's), and from past attendees of PTTC workshops. A Problem Identification Workshop (Patchen, 2002) was held in January of 2002 on the West Virginia University campus in Morgantown, WV. A Data Management Workshop is scheduled for October of 2003 at the same location. The PUMP website (Bocan, 2003) has been operational since October of 2002.

Production issues identified in the Problem Identification Workshop and during personal interviews served as the impetus for the scheduling of several *focused-technology* workshops sponsored by Appalachian Region PTTC center. Topics covered by these workshops included oilfield practices and safety, paraffin and scale, produced water, and applied reservoir characterization.

Finally, significant aspects of the PUMP project such as the Problem Identification Workshop and the creation of the PUMP website are summarized in Topical Reports (Patchen, 2002; Bocan, 2003) submitted to USDOE.

Results and Discussion:

Attendance at Problem Identification Workshop held in January, 2002 was low. Nevertheless, all attendees actively participated in a half-day of discussions. Several indicated willingness to serve on the PUMP regional council and to be interviewed regarding oil production problems, solutions, and preferred management practices. Thirty-two of the attendees filled out Workshop evaluations (see Patchen, 2002 for detailed attendee responses). The oil producers in the group all gave high marks to the Workshop and offered ideas to make future workshops even better. They liked the format of the Workshop, a combination of case studies and problem identification, called the technology presentations "stimulating," and suggested that the discussion sessions were well prepared and were the "highlight" of the Workshop. A final Data Management workshop scheduled for October, 2003 will be conducted in the same manner and it should be well-attended, based on interest generated by the first Workshop, the PUMP website, and the PUMP project as a whole.

A total of eight focused-technology workshops were sponsored by the Appalachian Region PTTC center at the request of the PUMP project. The Welltender Operations and Safety seminars held in Kentucky, West Virginia, Ohio, and Pennsylvania were well attended; the interest in the workshop held in Indiana, PA was so great, that the workshop was repeated. Two workshops were held in Washington, PA; a two-day Applied Reservoir Characterization seminar and a one-day course on Paraffin, Asphaltene, and Scale problems. Again, both meetings were well attended and generally well received. However, feedback from the Paraffin workshop suggests that the topic is simply too large to be covered in a single day (the course was actually condensed down from a week-long session). A one-day workshop on Produced Water was held in Zanesville, OH; the issue of brine disposal was raised at this meeting and incorporated into the list of oilfield issues previously identified by the PUMP project.

Since its inception in October, 2002, the PUMP website has shown a steady increase in activity as measured by the numbers of visitors and geographic locations those visitors represent (see Appendix II). The information content of the site continues to increase and improve and project members provide new data and new links to relevant websites. The suggestion is that the website is reaching a diverse audience both within the Appalachian region and beyond.

CONCLUSIONS

The Problem Identification Workshop in January of 2002 identified three general oil production issues of importance in the Appalachian basin: Data Management; Reservoir Engineering; and Drilling Practices. In-depth interviews with oil producers encountered considerable reticence on the part of interviewees in revealing company-specific production problems or company-specific solutions. This was the case even though interviewees were assured that all responses would be held in confidence. Nevertheless, the following production issues were identified and ranked in order of decreasing importance: Water production including brine disposal; Management of production and business data; Oil field power costs; Paraffin accumulation; Production practices including cementing. A number of secondary issues were also noted: Problems associated with Enhanced Oil Recovery (EOR) and Waterflooding; Reservoir characterization; Employee availability, training, and safety; and Sale and Purchase problems. However, one item was consistently mentioned as, perhaps, the key issue related to oil production in the Appalachian region - *the price of a barrel of oil.*

Solutions to production problems came from a number of sources. In general, the Petroleum Technology Transfer Council (PTTC) website, both regional and national, proved to be a fertile source of information. Technical issues include water production, paraffin accumulation, production practices, EOR and waterflooding were addressed in a number of SPE papers. Articles on reservoir characterization were found in both the AAPG Bulletin and in SPE papers. Project members extracted topical and keyword information from pertinent articles and websites and combined them in a database that was placed on the PUMP website.

Because of difficulties finding potential members with the qualifications, interests, and flexibility of schedule to allow a long-term commitment, it was decided to implement the PMP Regional Council as a subcommittee of the Producer Advisory Group (PAG) sponsored by Appalachian Region PTTC. The advantages of this decision are that the PAG is in already in existence as a volunteer group interested in problem identification and implementation of solutions and that PAG members are unpaid, so no outside funds will be required to sustain the group.

The PUMP website became active in October of 2002. The site is designed to *evolve*; as new information becomes available, it can be readily added to the site or the site can be modified to accommodate it. The site is interactive allowing users to search within the PUMP site, within the Appalachian Region PTTC site, or within the whole internet through the input of user-supplied key words for information on oil production problems and solutions. Since its inception in the Fall of 2002, the PUMP site has experienced a growing number of users of increasingly diverse nature and from an increasing geographic area. This indicates that the site is reaching its target audience in the Appalachian region and beyond.

Following up on a commitment to technology transfer, a total of eight focused-technology workshops were sponsored by the Appalachian Region PTTC center at the request of the PUMP project. Five Welltender Operations and Safety seminars were held in Kentucky, West Virginia, Ohio, and Pennsylvania. A two-day Applied Reservoir Characterization seminar and a one-day course on Paraffin, Asphaltene, and Scale problems were held in Pennsylvania. A one-day

workshop on Produced Water was held in OH. In addition to workshops and the PUMP website, the project also generated several topical reports available to the public through the website and through USDOE.

Our experience in this project suggests that the future of PUMP in the Appalachian region lies in:

1. Maintaining the PUMP website as a way for producers to identify best or preferred practices in the literature or on the internet;

2. Sponsoring workshops under the auspices of PTTC that are focused on best or preferred practices in the oil industry;

3. Identifying individuals and companies that utilize best or preferred practices and can present them to the remainder of the oil industry through workshops or the website.

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Patchen, D., 1984, A summary of oil West Virginia oil fields: in The Fifteenth Annual Appalachian Petroleum Geology Symposium, West Virginia Geological and Economic Survey Circular, C-34, p. 26-28.

Patchen, D., 2002, Problem and Preferred Management Practices Identification Workshop: First Topical Report for United Stated Department of Energy Contract #DE-FC26-01BC15273, unpaginated.

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ACRONYMS USED IN REPORT

AONGRC – Appalachian Oil and Natural Gas Regional Consortium
IOGA – Independent Oil and Gas Association
OGA – Oil and Gas Association
PAG – Producer Advisory Group
PMP – Preferred Management Practice
PTTC – Petroleum Technology Transfer Council
PUMP – Preferred Upstream Management Practice
SWC – Stripper Well Consortium
TORIS – Total Oil Recovery Information System
USDOE – United States Department of Energy
WVGES – West Virginia Geological and Economic Survey

APPENDIX I – SAMPLE FORMS AND CORRESPONDENCE

The following pages contain examples of forms and correspondence used to arrange and facilitate interviews with oil producers in the Appalachian region.

Preferred **U**pstream **M**anagement **P**ractices
Appalachian Region

"Best Practices, Improved Economics, Prolonged Well Life"

Dear :

West Virginia University and the West Virginia Geological and Economic Survey are engaged in a U.S. Department of Energy project to identify Preferred Upstream Management Practices (PUMP) for producing oil in the Appalachian basin. Objectives of this project are to determine from interviews and published sources practices used in the Appalachian region for reservoir characterization, drilling, stimulation, and production. We are looking for solutions to a wide variety of problems ranging from geology and petroleum engineering to business and accounting.

Results of literature searches and company interviews will be used on an interactive web site listing preferred practices. This web site will be available to all, and will be searchable by problem and solution. (Persons or companies providing information will not be identified on the web site.)

At the heart of our effort are interviews of producers in the Appalachian basin. Members of our project team have identified you as one of those with the expertise and experience to provide us with information on best practices in this basin. We would like to set up a time in which we can interview you. You are no doubt busy; to make the process more efficient I have enclosed a form listing the types of information we will ask about.

I am planning to contact you by phone or e-mail early in January to set up a time that we can talk. In the interim, if you would like to propose a time or have any questions, I can be reached at 304-594-2331 or by e-mail at PUMPprojectmember@geosrv.wvnet.edu.

Sincerely,

PUMP Project Member

Company Interview Template

1.) Interviewers/Interviews
- **a.) Who**
- **b.) When**
- **c.) Left/returned (hrs)**

2.) Interviewees
- **a.) Who**
- **b.) Contact Information**
  - **i.) address**
  - **ii.) phone**
  - **iii). fax**
  - **iv.) e-mail**
- **c.) Company**
- **d.) Location**

3.) Scope of Business
- **a.) Plays involved in**
- **b.) Number of wells in production**
- **c.) States of activity**
- **d.) Oil Production/year**
- **e.) Gas Production/year?**
- **f.) Water Production/year?**
- **g.) Reserves**
- **h.) Current active projects**
- **i.) Future plans**

4.) Common Technical Problems
- **a.) Drilling**
- **b.) Logging**
- **c.) Completion/cementing**
- **d.) Stimulation**
- **e.) Production**
- **f.) Water**
- **g.) Data management/storage/recovery**

5.) Preferred Management Practices
- **a.) Drilling**
- **b.) Logging**
- **c.) Completion/cementing**
- **d.) Stimulation**
- **e.) Production**
- **f.) Water**
- **g.) Data management/storage/recovery**

As necessary . . .

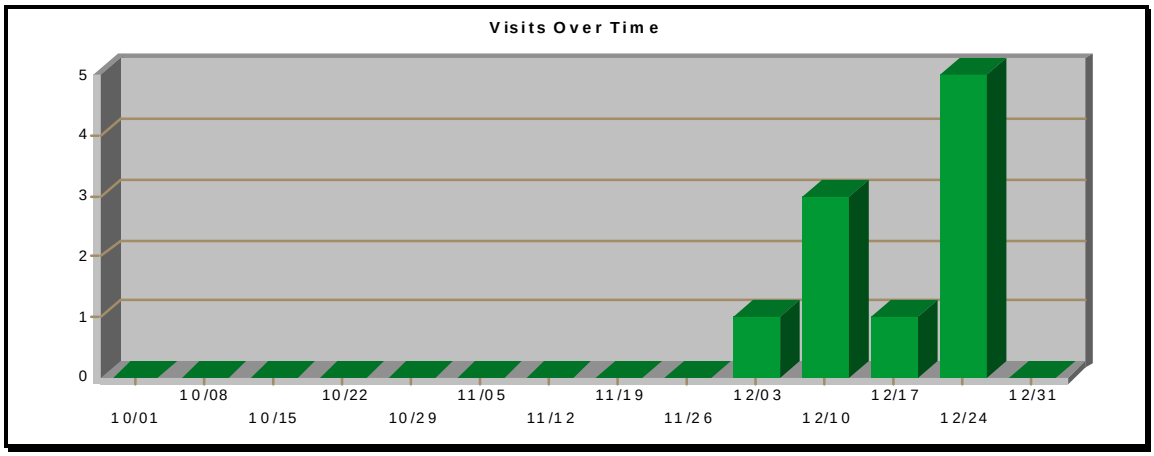
6.) Future Needs
- **a.) Better Practices**
- **b.) Case Studies**
  - **i.) Interested in receiving**
  - **ii.) Interested in providing**

7.) Next Visit Appointment
- **a.) Yes or no**
- **b.) If yes, when**

8.) Comments

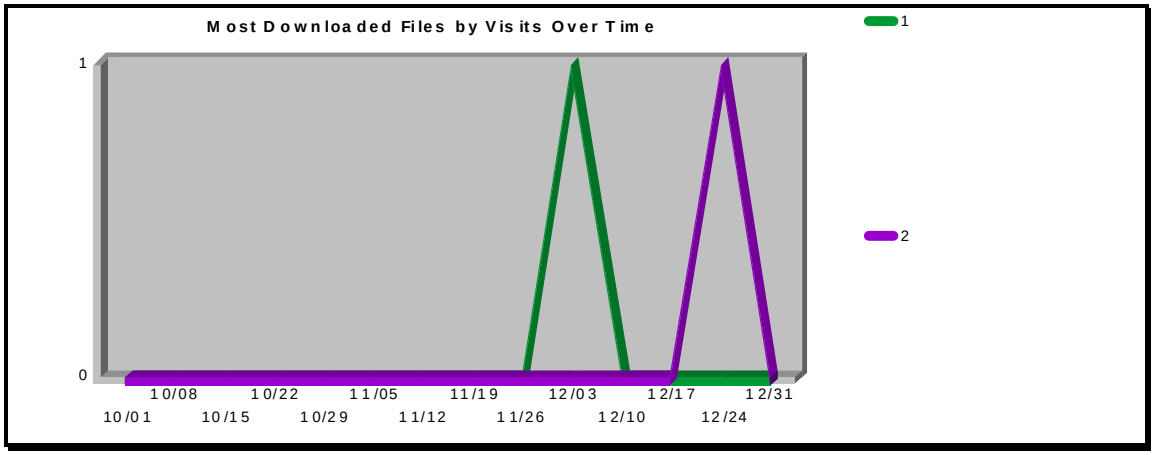
APPENDIX II – ACCESS STATISTICS FOR THE PUMP WEBSITE

Fourth Quarter – 2002 Overall Count of Visits to Website



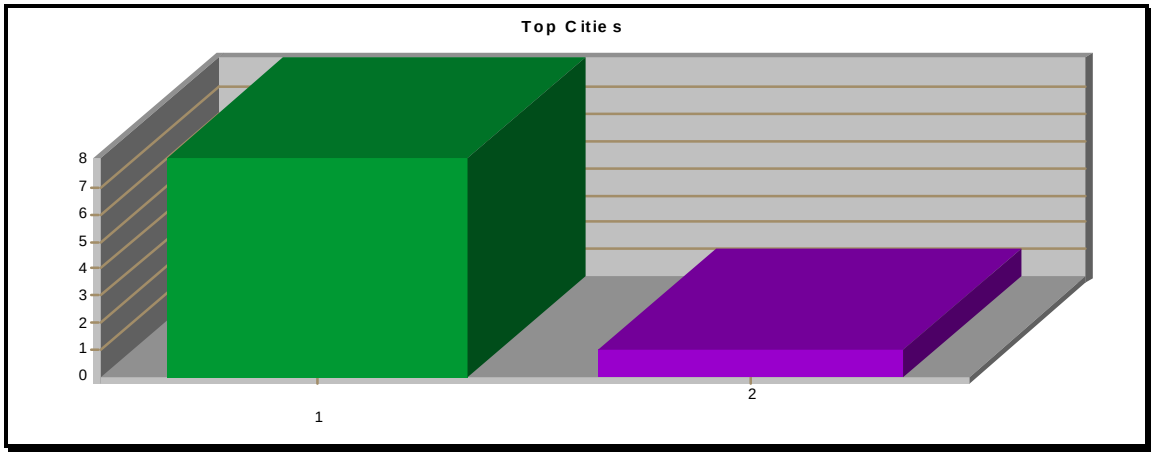
General Statistics	
Hits	
Successful Hits For Entire Site	140
Average Hits Per Day	1
Home Page Hits	N/A
Pages	
Page Views (Impressions)	55
Average Per Day	0
Dynamic Pages and Forms Views	0
Document Views	55
Visits	
Visits	10
Average Per Day	0
Average Visit Length	00:07:46
International Visits	0.00%
Visits of Unknown Origin	10.00%
Visits From Your Country: United States (US)	90.00%
Visitors	
Unique Visitors	8
Visitors Who Visited Once	7
Visitors Who Visited More Than Once	1

Fourth Quarter – 2002 Most Downloaded Files by Visits Over Time



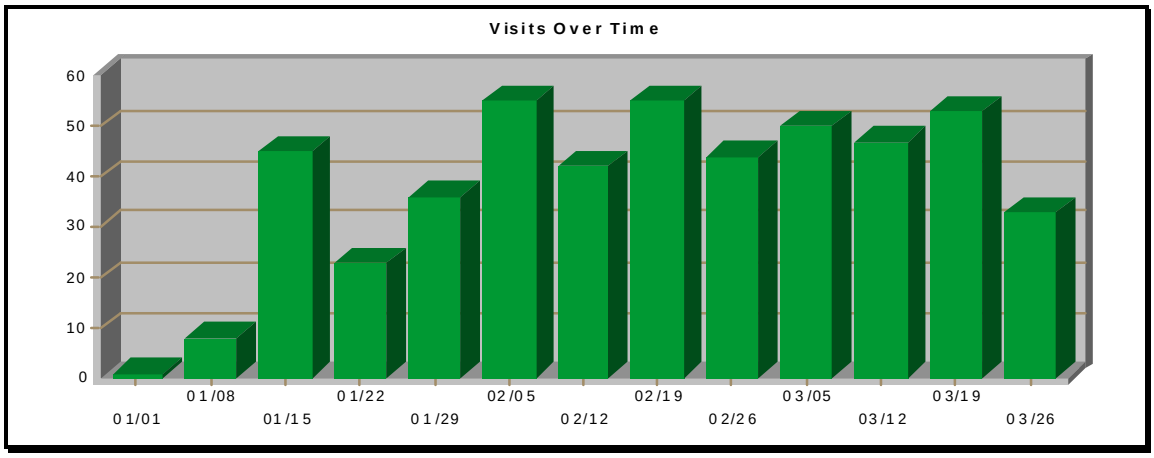
Most Downloaded Files by Visits Over Time			
	Files	**Visits**	**%**
1.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Cole.pdf	1	50.00%
2.	http://pttcims.wvgs.wvnet.edu/pump/PDF/Aapg.pdf	1	50.00%
	Total	**2**	**100.00%**

Fourth Quarter – 2002 Top Cities Visiting



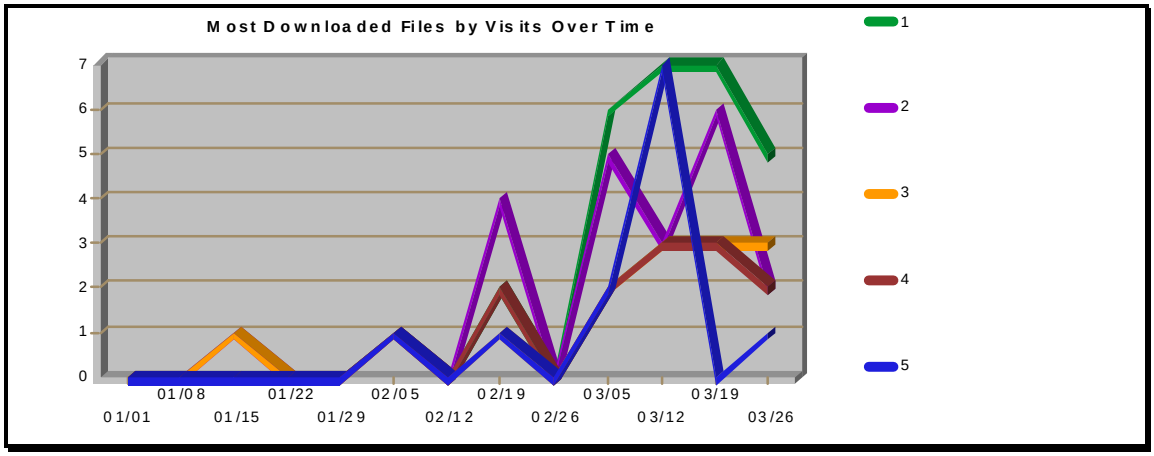
Top Cities			
	City	**Visits**	**%**
1.	Morgantown, West Virginia, United States	8	88.89%
2.	Atlanta, Georgia, United States	1	11.11%
	Total	**9**	**100.00%**

First Quarter – 2003 Visits Over Time



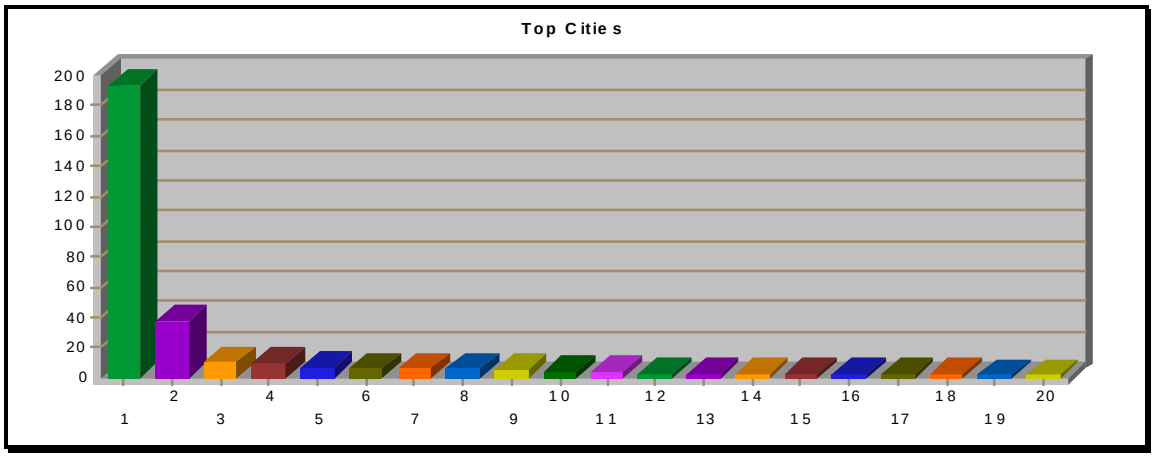
General Statistics	
Hits	
Successful Hits For Entire Site	1,714
Average Hits Per Day	19
Home Page Hits	N/A
Pages	
Page Views (Impressions)	512
Average Per Day	5
Dynamic Pages and Forms Views	0
Document Views	512
Visits	
Visits	492
Average Per Day	5
Average Visit Length	00:06:09
International Visits	16.06%
Visits of Unknown Origin	4.47%
Visits From Your Country: United States (US)	79.47%
Visitors	
Unique Visitors	252
Visitors Who Visited Once	202
Visitors Who Visited More Than Once	50

First Quarter – 2003 Most Downloaded Files by Visits Over Time



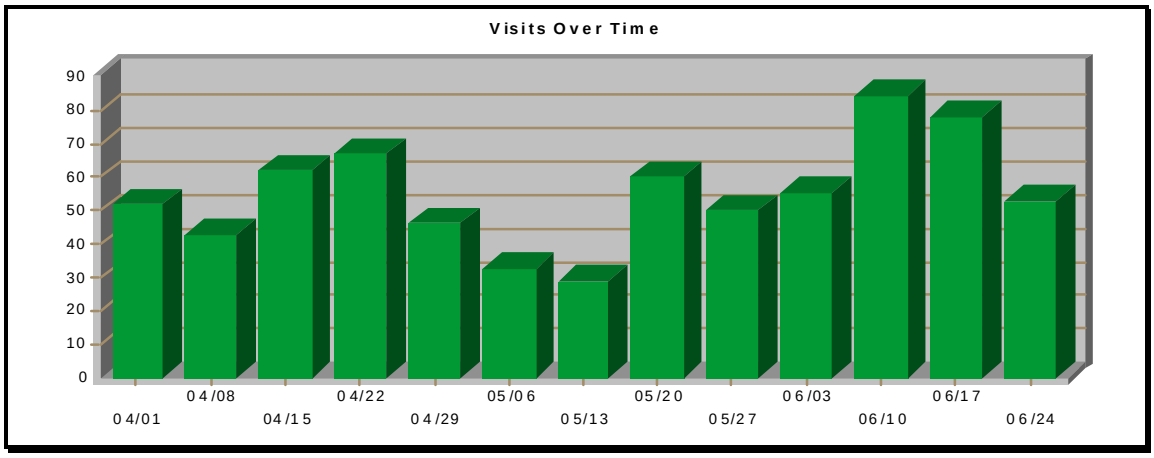
Most Downloaded Files by Visits Over Time			
	Files	**Visits**	**%**
1.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Miller.pdf	28	23.14%
2.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Avary.pdf	22	18.18%
3.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Rdissi.pdf	14	11.57%
4.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_Report.pdf	13	10.74%
5.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Knobloch.pdf	12	9.92%
	Subtotal	89	73.55%
	Total	**121**	**100.00%**

First Quarter – 2003 Top Cities Visiting



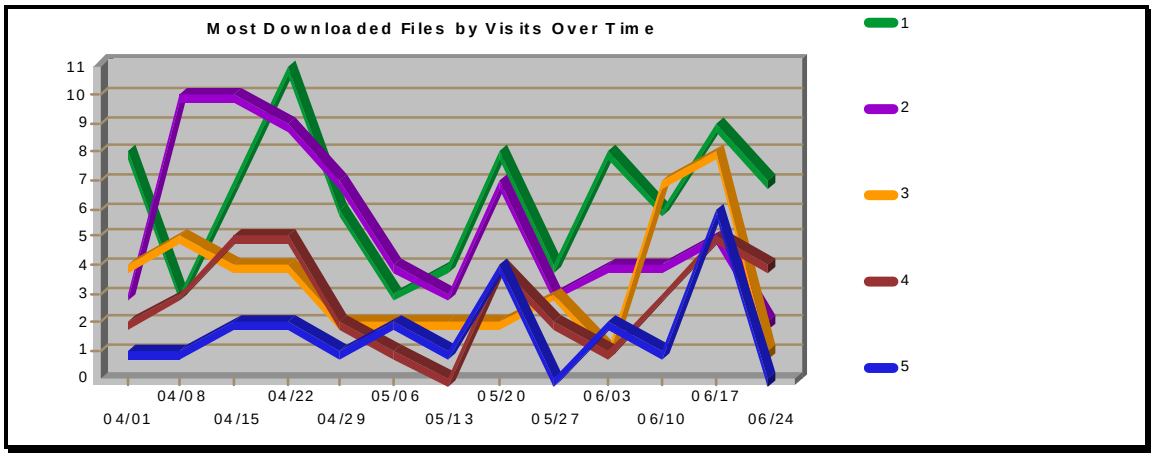
Top Cities			
	City	**Visits**	**%**
1.	Mountain View, California, United States	194	44.80%
2.	San Jose, California, United States	38	8.78%
3.	San Mateo, California, United States	11	2.54%
4.	San Diego, California, United States	10	2.31%
5.	Toronto, Ontario, Canada	8	1.85%
6.	Calgary, Alberta, Canada	7	1.62%
7.	Middletown, New Jersey, United States	7	1.62%
8.	Morgantown, West Virginia, United States	7	1.62%
9.	Hoboken, New Jersey, United States	6	1.39%
10.	Pittsburgh, Pennsylvania, United States	5	1.15%
11.	New York, New York, United States	5	1.15%
12.	Fairfax, Virginia, United States	4	0.92%
13.	Atlanta, Georgia, United States	4	0.92%
14.	Houston, Texas, United States	4	0.92%
15.	Lagos, Nigeria	4	0.92%
16.	Paris, France	4	0.92%
17.	Butler, Pennsylvania, United States	4	0.92%
18.	Edmonton, Alberta, Canada	4	0.92%
19.	Washington, D.C., United States	3	0.69%
20.	London, EN, United Kingdom	3	0.69%
	Subtotal	332	76.67%
	Other	101	23.33%
	Total	**433**	**100.00%**

Second Quarter – 2003 Visits Over Time



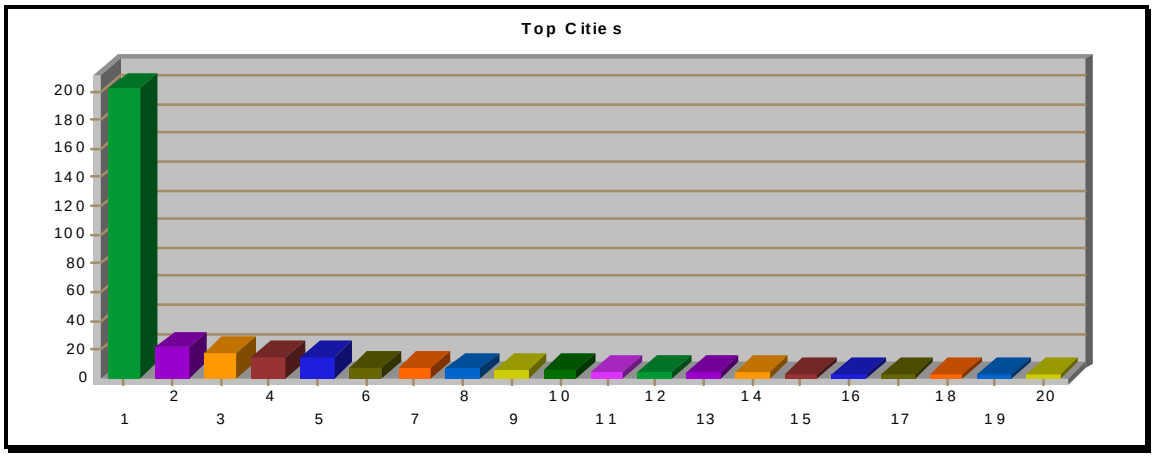
General Statistics	
Hits	
Successful Hits For Entire Site	3,554
Average Hits Per Day	39
Home Page Hits	N/A
Pages	
Page Views (Impressions)	613
Average Per Day	6
Dynamic Pages and Forms Views	0
Document Views	613
Visits	
Visits	712
Average Per Day	7
Average Visit Length	00:05:37
International Visits	22.75%
Visits of Unknown Origin	4.35%
Visits From Your Country: United States (US)	72.89%
Visitors	
Unique Visitors	411
Visitors Who Visited Once	346
Visitors Who Visited More Than Once	65

Second Quarter – 2003 Most Downloaded Files by Visits Over Time



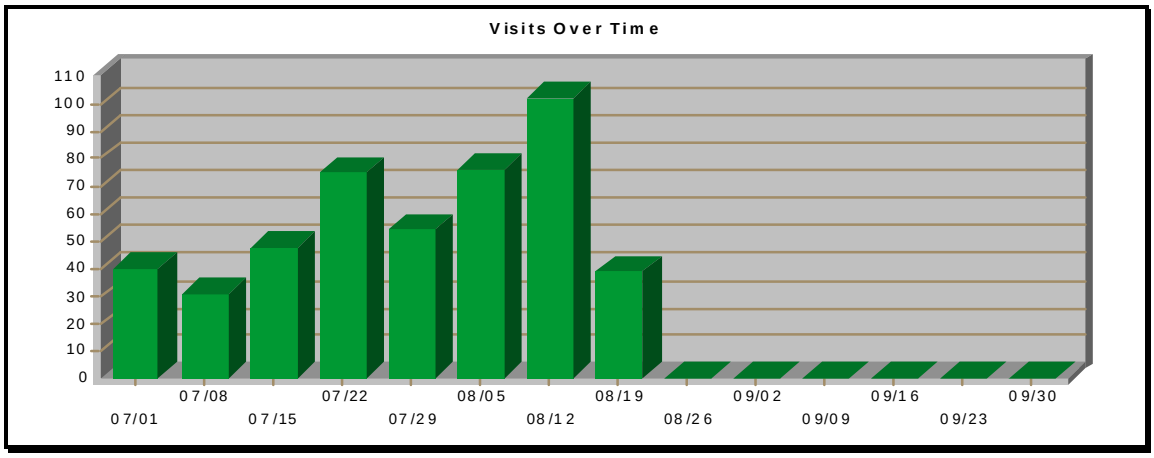
Most Downloaded Files by Visits Over Time			
	Files	**Visits**	**%**
1.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Miller.pdf	84	26.01%
2.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Avary.pdf	71	21.98%
3.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Rdissi.pdf	45	13.93%
4.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_Report.pdf	37	11.46%
5.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Cole.pdf	23	7.12%
	Subtotal	260	80.50%
	Total	**323**	**100.00%**

Second Quarter – 2003 Top Cities Viewed



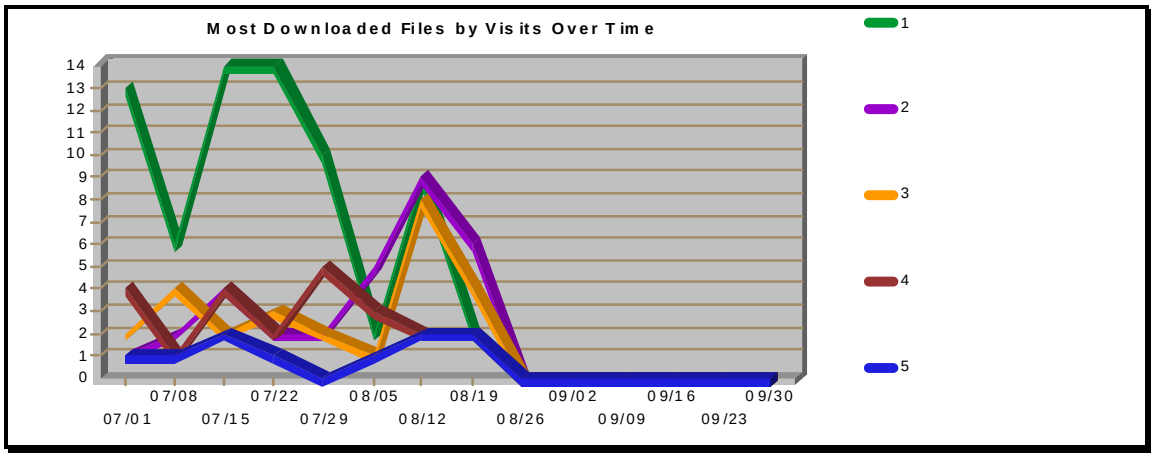
Top Cities			
	City	**Visits**	**%**
1.	Mountain View, California, United States	202	33.72%
2.	San Jose, California, United States	21	3.51%
3.	San Mateo, California, United States	18	3.01%
4.	San Diego, California, United States	15	2.50%
5.	Houston, Texas, United States	15	2.50%
6.	Morgantown, West Virginia, United States	8	1.34%
7.	Englewood, Colorado, United States	8	1.34%
8.	London, EN, United Kingdom	7	1.17%
9.	Denver, Colorado, United States	6	1.00%
10.	Boston, Massachusetts, United States	6	1.00%
11.	Pittsburgh, Pennsylvania, United States	5	0.83%
12.	Riyadh, Saudi Arabia	5	0.83%
13.	Paris, France	5	0.83%
14.	Middletown, New Jersey, United States	5	0.83%
15.	Columbus, Ohio, United States	4	0.67%
16.	Frankfurt, Germany	4	0.67%
17.	Colorado Springs, Colorado, United States	4	0.67%
18.	Tel Aviv, Israel	4	0.67%
19.	Toronto, Ontario, Canada	4	0.67%
20.	Atlanta, Georgia, United States	4	0.67%
	Subtotal	350	58.43%
	Other	249	41.57%
	Total	**599**	**100.00%**

Third Quarter – 2003 Visits Over Time (as of 8/19/03)



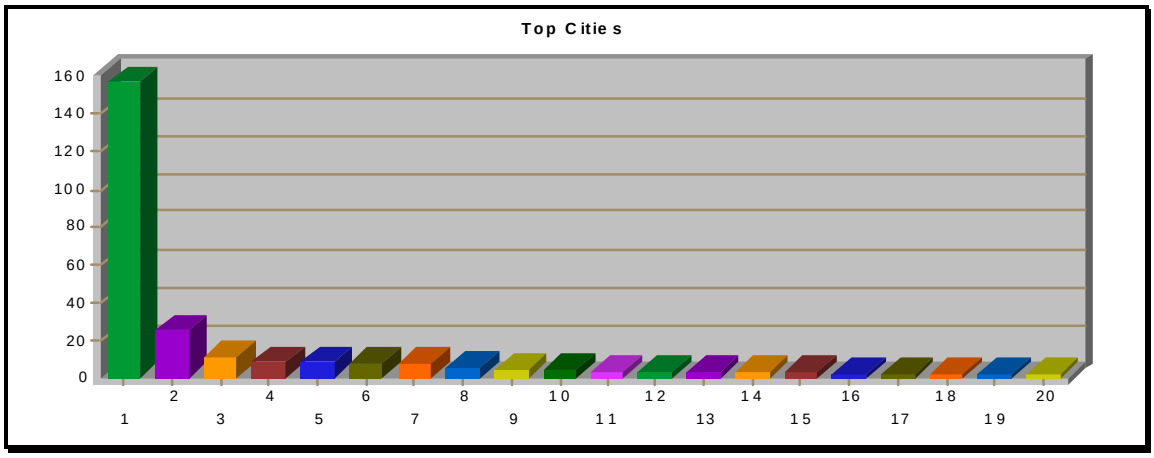
General Statistics	
Hits	
Successful Hits For Entire Site	2,116
Average Hits Per Day	40
Home Page Hits	N/A
Pages	
Page Views (Impressions)	528
Average Per Day	10
Dynamic Pages and Forms Views	0
Document Views	528
Visits	
Visits	465
Average Per Day	8
Average Visit Length	00:10:54
International Visits	16.99%
Visits of Unknown Origin	4.52%
Visits From Your Country: United States (US)	78.49%
Visitors	
Unique Visitors	233
Visitors Who Visited Once	191
Visitors Who Visited More Than Once	42

Third Quarter – 2003 Most Downloaded Files by Visits Over Time



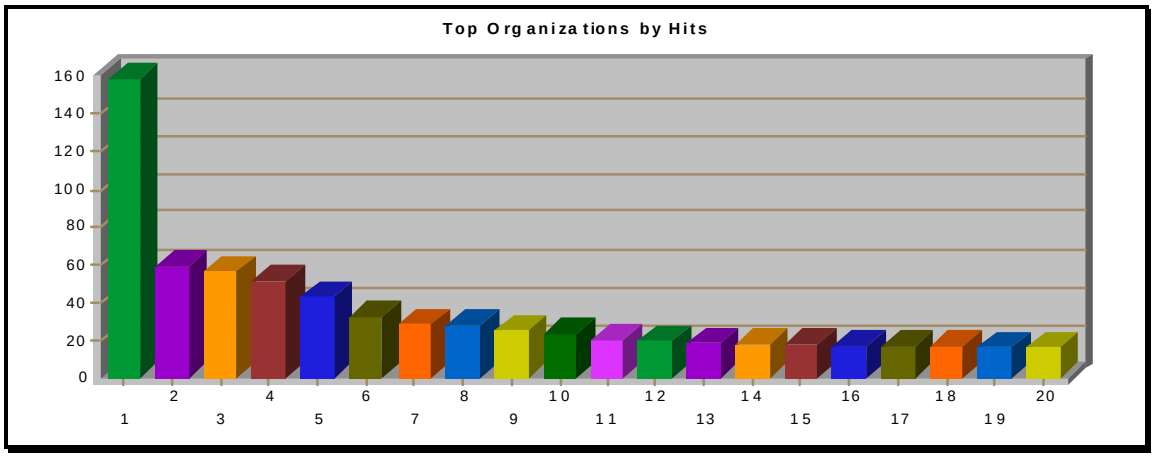
Most Downloaded Files by Visits Over Time			
	Files	**Visits**	**%**
1.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Miller.pdf	70	39.11%
2.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Avary.pdf	31	17.32%
3.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_Report.pdf	26	14.53%
4.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Rdissi.pdf	23	12.85%
5.	http://pttcims.wvgs.wvnet.edu/pump/PDF/PUMP_wksp_Cole.pdf	10	5.59%
	Subtotal	160	89.39%
	Total	**179**	**100.00%**

Third Quarter – 2003 Top Cities Visiting



Top Cities			
	City	**Visits**	**%**
1.	Mountain View, California, United States	157	39.35%
2.	Santa Clara, California, United States	26	6.52%
3.	Middletown, New Jersey, United States	11	2.76%
4.	Houston, Texas, United States	9	2.26%
5.	Cambridge, Massachusetts, United States	9	2.26%
6.	Morgantown, West Virginia, United States	8	2.01%
7.	Herndon, Virginia, United States	8	2.01%
8.	Calgary, Alberta, Canada	6	1.50%
9.	San Diego, California, United States	5	1.25%
10.	San Mateo, California, United States	5	1.25%
11.	Seoul, Korea (South)	4	1.00%
12.	Washington, D.C., United States	4	1.00%
13.	Paderborn, Germany	4	1.00%
14.	Philadelphia, Pennsylvania, United States	4	1.00%
15.	Beijing, China	4	1.00%
16.	Tokyo, 13, Japan	3	0.75%
17.	Arlington, Virginia, United States	3	0.75%
18.	Logan, Utah, United States	3	0.75%
19.	Austin, Texas, United States	3	0.75%
20.	Chennai, India	3	0.75%
	Subtotal	279	69.92%
	Other	120	30.08%
	Total	**399**	**100.00%**

Third Quarter – 2003 Top Organizations by Hits



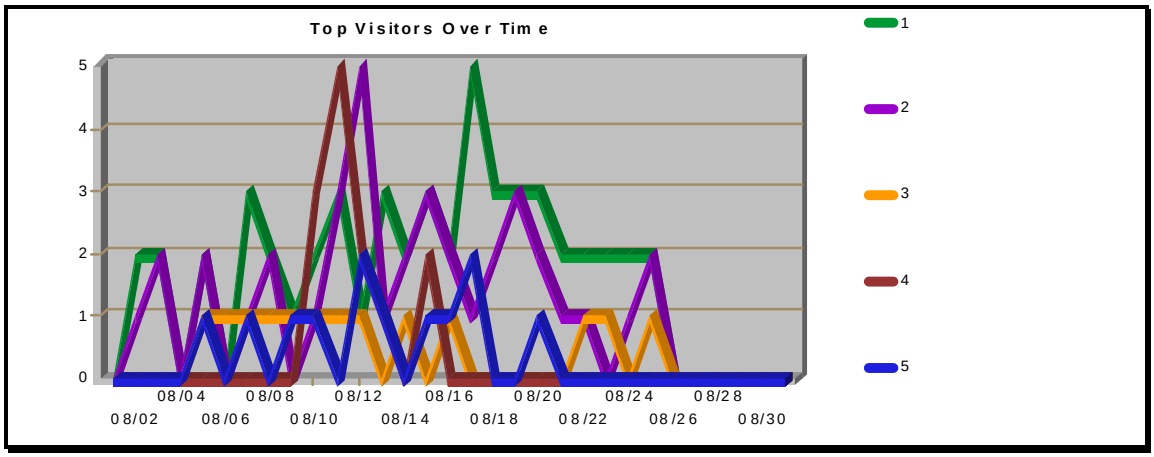
Top Organizations by Hits			
	Organization	**Hits**	**%**
1.	**Google Inc** Google Inc	159	10.11%
2.	**Consejo Nacional de Investigaciones** Consejo Nacional de Investigaciones	59	3.75%
3.	**WEST VIRGINIA UNIVERSITY** WEST VIRGINIA UNIVERSITY	57	3.62%
4.	**America Online, Inc.** America Online, Inc.	52	3.31%
5.	**Massachusetts Institute of Technology** Massachusetts Institute of Technology	43	2.73%
6.	**Singapore Cable Vision Ltd** Singapore Cable Vision Ltd	32	2.03%
7.	**Internet Connection** Internet Connection	29	1.84%
8.	**EXCALIBUR Group, A Time Warner Company** EXCALIBUR Group, A Time Warner Company	28	1.78%
9.	**CHARTER COMMUNICATIONS** CHARTER COMMUNICATIONS	26	1.65%
10.	**Com Net, Inc.** Com Net, Inc.	24	1.53%
11.	**CSC Holdings, Inc.** CSC Holdings, Inc.	21	1.34%
12.	**DEVON ENERGY** DEVON ENERGY	20	1.27%
13.	**telus** telus	19	1.21%
14.	**Prestige Cable TV**	18	1.14%

Top Organizations by Hits			
	Organization	**Hits**	**%**
	Prestige Cable TV		
15.	**Telecommunication Company of Iran** Telecommunication Company of Iran	18	1.14%
16.	**USG Corporation, Inc.** USG Corporation, Inc.	17	1.08%
17.	**California University of Pennsylvania** California University of Pennsylvania	17	1.08%
18.	**Bell South Intellectual Property Corporation** Bell South Intellectual Property Corporation	17	1.08%
19.	**ROADRUNNER-NYS** ROADRUNNER-NYS	16	1.02%
20.	**Gebze Organize Sanayii Bolgesi** Gebze Organize Sanayii Bolgesi	16	1.02%
	Subtotal	688	43.74%
	Other	381	24.22%
	Total	**1,069**	**67.96%**

Top Organizations and Domain Names by Hits			
Organization	**Domain Name**	**Hits**	**%**
1.Google Inc	googlebot.com	145	9.22%
	No domain name found	14	0.89%
	Total	159	10.11%
2.Consejo Nacional de Investigaciones	No domain name found	59	3.75%
	Total	59	3.75%
3.WEST VIRGINIA UNIVERSITY	No domain name found	36	2.29%
	wvu.edu	21	1.34%
	Total	57	3.62%
4.America Online, Inc.	Aol.com	45	2.86%
	No domain name found	7	0.45%
	Total	52	3.31%
5.Massachusetts Institute of Technology	w3.org	43	2.73%
	Total	43	2.73%
6.Singapore Cable Vision Ltd	maxonline.com.sg	32	2.03%
	Total	32	2.03%
7.Internet Connection	intcon.net	29	1.84%
	Total	29	1.84%
8.EXCALIBUR Group, A Time Warner Company	No domain name found	18	1.14%
	rr.com	10	0.64%
	Total	28	1.78%

Top Organizations and Domain Names by Hits			
Organization	**Domain Name**	**Hits**	**%**
9.CHARTER COMMUNICATIONS	charterwv.net	15	0.95%
	chartertn.net	6	0.38%
	No domain name found	5	0.32%
	Total	26	1.65%
10.Com Net, Inc.	bright.net	24	1.53%
	Total	24	1.53%
11.CSC Holdings, Inc.	No domain name found	21	1.34%
	Total	21	1.34%
12.DEVON ENERGY	No domain name found	20	1.27%
	Total	20	1.27%
13.telus	telus.net	19	1.21%
	Total	19	1.21%
14.Prestige Cable TV	bp.com	18	1.14%
	Total	18	1.14%
15.Telecommunication Company of Iran	No domain name found	18	1.14%
	Total	18	1.14%
16.USG Corporation, Inc.	No domain name found	17	1.08%
	Total	17	1.08%
17.California University of Pennsylvania	cup.edu	17	1.08%
	Total	17	1.08%
18.Bell South Intellectual Property Corporation	bellsouth.net	17	1.08%
	Total	17	1.08%
19.ROADRUNNER-NYS	rr.com	16	1.02%
	Total	16	1.02%
20.Gebze Organize Sanayii Bolgesi	No domain name found	16	1.02%
	Total	16	1.02%
Subtotal		688	43.74%
Other		381	24.22%
Unknown		504	32.04%
Total		**1,573**	**100.00%**

Third Quarter – 2003 Top Visitors Over Time



Top Visitors Over Time			
	Visitor	**Visits**	**%**
1.	crawler10.googlebot.com	52	18.64%
2.	crawler14.googlebot.com	38	13.62%
3.	216.88.158.142	13	4.66%
4.	buildrack82.sv.av.com	13	4.66%
5.	crawler11.googlebot.com	12	4.30%
	Subtotal	128	45.88%
	Total	**279**	**100.00%**