COMMON GROUND

Study of One-Call Systems and Damage Prevention Best Practices

August 1999

Sponsored by the United States Department of Transportation; Research and Special Programs Administration; Office of Pipeline Safety, as authorized by the Transportation Equity Act for the 21st Century (TEA 21)

ACKNOWLEDGMENTS

The Common Ground report was prepared by over 160 individuals, representing a wide range of interests, organizations, and viewpoints on preventing damage to underground facilities. The project was initiated by the U. S. Department of Transportation's Office of Pipeline Safety (OPS). OPS is an element of the Department's Research and Special Programs Administration.

The following OPS staff members were directly involved in the project.

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Cycla Corporation staff supported all phases of the study and provided expert assistance in the report-writing process. Cycla personnel participating were: Jim von Herrmann, Herb Wilhite, Jean Dameron, Mary Lockhart, Andy McClymont, Chris McClymont, Dorian Stansberry, Sue vonHerrmann, and Skip Brown. Jim Quilliam, formerly of Cycla, worked in the initial phase of the study.

The One-Call Study Internet-based computer system that enabled participants across the Nation to have direct and immediate access to all project information was developed and maintained by Cycla's Randy Pearson.

Arrowhead and Telecommunications, Inc., supported OPS' personnel in this work. Janice Morgan arranged facilities for the scores of meetings held across the Nation during the project. Karen Munden and Peggy Thompson skillfully shared the administrative burden throughout the year.

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FOREWORD

AUTHORIZATION

This report, *Common Ground: Study of One-Call Systems and Damage Prevention Best Practices*, was prepared in accordance with, and at the direction and authorization of the Transportation Equity Act for the 21st Century (TEA 21), Public Law 105-178, signed into law on June 9, 1998 (see Appendix B). The Common Ground Study was performed and this report was written through the efforts of a joint government/industry quality team. The One-Call Systems Study (OCSS) was sponsored by the United States Department of Transportation's (DOT), Research and Special Programs Administration (RSPA), Office of Pipeline Safety (OPS). Representatives of many stakeholders (industries, industry associations, and other stakeholders) interested and involved in the many aspects of underground damage prevention participated fully in the Study. All of those participating stakeholders contributed tremendously in time, funding, and effort in completing the Study and the Common Ground Report.

All participants in the Study are to be complimented on their dedication and contributions to this project. The Study Team participants truly did a great deal of sharing of their diverse and sometimes differing views on damage prevention. They accomplished this effort in a manner that involved open and honest communication, which served to greatly improve the understanding and perspectives of all participants. The Study ultimately resulted in a quality product, this Report, that can be used to help in future efforts to improve underground damage prevention. The Study Team's ability to complete this effort in a relatively short time is a testament to how much all of the stakeholder participants contributed to the effort and how they openly communicated and learned to work together. All participants truly exhibited a sense of shared responsibility and are commended for their efforts, contributions, and for the development of this report.

STUDY OBJECTIVE

The purpose of the Study was to identify and validate existing best practices performed in connection with preventing damage to underground facilities.

The collected best practices are intended to be shared among stakeholders involved with and dependent upon the safe and reliable operation, maintenance, construction, and protection of underground facilities. These best practices contain validated experiences gained that can be further examined and evaluated for possible consideration and incorporation into state and private stakeholder underground facility damage prevention programs.

STUDY RESULTS

The Common Ground Study effort was divided into nine areas, which fostered a concentrated focus on work practices within the natural groupings of damage prevention activities. Eight of the Task Team Chapters provide a collection of current damage prevention best practices which are believed to help prevent damage to underground facilities. Appendix A, "Emerging Technologies," provides a view of new or developing equipment and technologies.

APPLICATION OF STUDY RESULTS

The damage prevention best practices identified in this report provide states and other stakeholders with a means of enhancing the public safety and service reliability of underground facilities. Consistent with the language of TEA 21, there is no requirement that these best practices be adopted, in whole or in part, by any current or future stakeholder, individual, or governing body.

TEA 21 encourages adoption of the best practices identified in this Report as follows: "The Secretary (of Transportation) shall encourage each State and operator of one-call notification programs to adopt and implement those practices identified in the Report that the State determines are the most appropriate."

TEA 21 also contains provisions for the application and receipt of grant funds during the years 2000 and 2001 to states that adopt or otherwise comply with these best practices as a part of their underground facilities damage prevention programs. State application for and receipt of said grant funds is outside the scope of the Study.

With consensus agreement between the U. S. Department of Transportation's Research and Special Programs Administration and the Common Ground Study Team, the focus of the Task Teams and the overall Study was confined to best practices. This Study did not include an analysis of least successful practices.

Effect on State Law and Private Contractual Rights

Nothing contained in this description of best practices is intended to supercede existing State laws, regulations, or existing underground facility damage prevention practices. Likewise, these best practices are not promoted in order to override private contractual agreements including, but not limited to, hold harmless agreements between and among property owners. The force and effect of a given State's laws or regulations is a matter for decision and enforcement by the judicial authorities of that State, as is the determination of whether any private contractual rights are modified or superceded as a matter of public policy or in the exercise of the State's police power.

Local, Regional, and Facility Specific Considerations

It is recognized that, while a practice may be the best under most conditions, local and regional factors may affect its adoption or adherence. These factors can include, but are not limited to cost/benefit analysis, regulatory issues, conflict with State Laws, practicality, economic conditions, and competitive considerations.

Further, it is recognized that physical differences in terrain, land use, climate, and environmental conditions should be evaluated when the offered best practices are being reviewed for application.

Another significant factor to be considered is the specific underground facility type. Each type may have its own associated safety and service interruption characteristics, which could have an impact on the adoption and consideration of universal best practices.

CHAPTER 1
Common Ground Study Background and Process

1.1 BACKGROUND INFORMATION – DAMAGE TO UNDERGROUND FACILITIES

Damages to underground facilities are usually preventable and most frequently occur due to a breakdown in the damage prevention process. The responsibility for preventing excavation damage is shared by all stakeholders, and includes elements such as planning, effective use of one-call systems, accurate location and marking of underground facilities, adherence to safe digging practices, proper placement of facilities, and strong public education and awareness. Damage to underground facilities can affect the vital services and products delivered through those facilities. Underground facility damage can result in injury and death, as well as severe property damage and loss of vital services and products, such as telecommunications, water and sewer, electric power, cable television, and the flow and supply of liquid petroleum and natural gas. Damage can cause vital facility outages for homes, businesses, hospitals, air traffic control operations, and emergency service providers.

At the heart of damage prevention is improved information accuracy and consistency in communication between excavators and operators of underground facilities. One-call systems provide a reliable and efficient process for excavators to notify facility owners/operators of planned excavations. The one-call process allows operators with facilities in the vicinity of a proposed excavation site to mark the location of their equipment and facilities in advance of the excavation. This gives excavators knowledge by which to excavate safely.

Damage prevention practices vary significantly among states, one-call centers, excavators, facility owners/operators, regulatory agencies, designers, and other stakeholders associated with or impacted by underground facilities. States have a variety of unique laws and regulations governing the practices, enforcement, and performance analysis data related to underground facilities' damage prevention.

1.2 LEGISLATIVE AUTHORITY FOR STUDY

The Transportation Equity Act for the 21st Century (TEA 21) was signed into law on June 9, 1998, as Public Law 105-178. TEA 21, Title VII, Subtitle C – Comprehensive One-Call Notification (see Appendix B) was intended to reduce damage to underground facilities during excavation and to reduce the attendant risks to the public and the environment that are associated with excavation activities.

Section 6105 of TEA 21 authorized the United States Department of Transportation (DOT) to undertake a study of damage prevention practices associated with existing one-call notification systems. The Study

was to be developed in consultation with other appropriate federal agencies, state agencies, one-call notification center operators, underground facility owners/operators, excavators, and other interested stakeholders. TEA 21 authorized the DOT to gather information to determine which existing one-call notification systems' practices were most effective in protecting the public, excavators, and the environment and in preventing disruptions to public services and damage to underground facilities.

The law encourages states to establish or improve existing one-call notification systems. TEA 21 encourages adoption of the best practices identified is this report as follows: "The Secretary (of Transportation) shall encourage each State and operator of one-call notification programs to adopt and implement those practices identified in the Report that the State determines are the most appropriate."

TEA 21 also established a two-year program under which a state may apply for grants upon a showing that the state's one-call notification system meets minimum standards. The grants are to be used for the enhancement of the one-call system. Authorizations are provided, subject to appropriation, for grants in Fiscal Years 2000 and 2001.

With consensus agreement between the U. S. Department of Transportation, Research and Special Programs Administration and the Common Ground Study Team, the focus of the Task Teams and the overall Study was confined to best practices. This Study did not include an analysis of least successful practices.

1.3 RSPA PARTNERSHIP PRACTICES

The DOT's Research and Special Programs Administration (RSPA) has established a successful history of forming and enhancing partnerships with other government agencies, transportation industries, and other stakeholders that are affected by RSPA actions. Using the "Quality Action Team" model, RSPA has successfully brought diverse stakeholders together for problem solving. This has been an effective process for gathering data, identifying issues, and determining realistic options for issue resolution. RSPA has used the quality action team approach to address damage prevention education. The Damage Prevention Quality Action Team (DAMQAT), a joint government/industry initiative, was established in October, 1996 to increase awareness of the need to protect underground facilities and to promote safe digging practices. The results achieved to date by the DAMQAT efforts have been very encouraging, and have further demonstrated the value of pursuing these initiatives through joint industry/regulatory agency partnership to maximize opportunities for improvement.

1.4 ONE-CALL BEST PRACTICES STUDY INITIATION

Consistent with the provisions in TEA 21, RSPA established a Study Team to evaluate damage prevention practices associated with existing one-call notification systems. The purpose of the Study was to gather and assess information in order to determine which existing one-call notification systems' practices are most effective in protecting the public, excavators, and the environment and in preventing disruptions to public services and damage to underground facilities. The findings contained in this Study will be used to inform

stakeholders about practices, technologies and methods that can improve overall damage prevention and one-call system performance. Stakeholders include state agencies, one-call system operators, underground facility owners/operators, contractor associations, and other interested stakeholders who are impacted by and have an impact upon underground facilities.

On July 22, 1998, a Federal Register notice (63 FR 39362) was published that announced RSPA's initiative to establish the One-Call Systems Study Team. The notice described the desired representation that would be necessary to ensure inclusive and robust discussions while developing this report. Specifically, RSPA requested participants that:

- represented organizations with defined missions and objectives related to preventing damage to underground facilities, and were able to communicate regularly with these organizations;
- had ready access to or first hand existing knowledge of the factors, factual data, history and aspects affecting one-call system and underground facilities performance;
- had a demonstrated ability to work both individually and in a group environment; and,
- represented the Public and affiliated organizations that are affected by, or concerned with, damage prevention programs.

The One-Call Systems Study was initiated during the Fall of 1998, and was concluded in the Spring of 1999. The first step in the implementation of the Study began with a public meeting held in Arlington, Virginia, on August 25-26, 1998. The two-day meeting was attended by a broad representation of underground facility owners/operators, contractors, one-call system operators, regulatory agencies, private citizens, industry associations, and State agencies. Approximately 150 people were in attendance, and they participated in a presentation of 20 individual reports addressing numerous issues associated with damage prevention to underground facilities. The Common Ground title for the Study was adopted during the Arlington meeting. Interactive breakout work sessions by the meeting attendees resulted in the division of the Study into nine distinct focus areas. Subsequent to this meeting, an overall time line and milestones associated with the Study were developed. The "Common Ground - Damage Prevention Best Practices Study Time Line" is shown in Figure 1-1.

Figure 1-1 Common Ground Study Time Line

Month / Year	09 98	10 98	11 98	12 98	01 99	02 99	03 99	04 99	05 99	06 99	07 99
OCSS Public Meeting	! (8/25/98)										
Linking Team (LT) Kickoff Mtg		! (9/21/98)									
Study Teams Organizational Meeting			! (10/19/98)								
Task Teams (TT) Kickoff Meeting			! (11/04/98)								
Finalize Study Team Membership				! (12/04/98)							
TT Best Practices Discovery				!!!!!!!!!!!!!!! (2/01/99)							
TT Chapters Detailed Outlines				!!!!!!!!!!!!!!!! To LT, 2/05/99							
TT Chapters Initial Drafts				!!!!!!!!!!!!!!!!! To LT, 2/15/99							
LT Feedback					!!!!!! To TT, 3/15/99						
Initial Drafts to Steering Team (ST)					! (3/15/99)						
ST Feedback					!!! (To TT, 4/01/99)						
Intro/Summary Sections Draft (LT)					!!!!!!!!!!!!!! (4/01/99)						
TT Chapters Final Drafts to LT & ST					!!!!!!!!!!!!! (4/15/99)						
LT/ST Feedback					(To TT, 5/15/99) !!!!!!						
Final Report Preparation									!!!!!!!!!!! (6/15/99)		
Best Practices Report to RSPA										! (6/15/99)	
Best Practices Report Publication											! (6/30/99)

1.5 COMMON GROUND STUDY TEAM COMPOSITION

1.5.1 Study Team Overview

More than 160 stakeholders participated in the development of the Study. It was conducted through the formation, efforts, and resulting work products of several distinct Teams, utilizing a hierarchical Study Team structure. These teams included:

- Task Teams that evaluated existing practices and developed chapters for this Report;
- a Linking Team that coordinated information throughout the Task Teams and developed the overall Report; and,
- a Steering Team that provided broad guidance to all Teams and conducted a final review of the Report.

The team reporting structure, as depicted below in Figure 1-2, "Study Team Reporting Structure," consisted of nine Task Teams, a Linking Team, and a Steering Team.

The various Teams achieved their assigned tasks through a combination of scheduled meetings and conference calls. All members of the Study Team were expected to represent the concerns and interests of their constituent organizations. Team members worked with their respective industries to facilitate broad communication with their constituency regarding specific areas of knowledge and interest. The Study Team responsibilities are further described and defined below. Biographical information for each Study Team member is provided in Appendix F to this report.

Figure 1-3, "Study Team Composition Matrix," provides an overview of industry and regulatory affiliations that participated in each of the Common Ground Study Teams. Of particular note is the diverse representation within each Task Team. Even though the Task Teams typically dealt with a discreet portion of damage prevention programs, significant benefit was obtained by including experiences and expertise from multiple sectors of the damage prevention process. Note that the table only identifies organizations specifically recognized as trade/industry associations (e.g., EEI, AGC, OCSI, etc.).

While the primary objective of this Study was to identify damage prevention best practices, the participants also gained a greater appreciation and understanding of how other stakeholders are impacted by their fellow Team members' activities. The Study process facilitated ideas on how underground facility damage prevention can be positively impacted through the improvement of working relationships, enhanced communication, and mutual problem identification and resolution.

A brief, professional biography of each Study Team member, that may include the identification of their sponsoring companies, agencies, and industry associations, is provided in Appendix F of this Report.

Figure 1-2 Study Team Reporting Structure

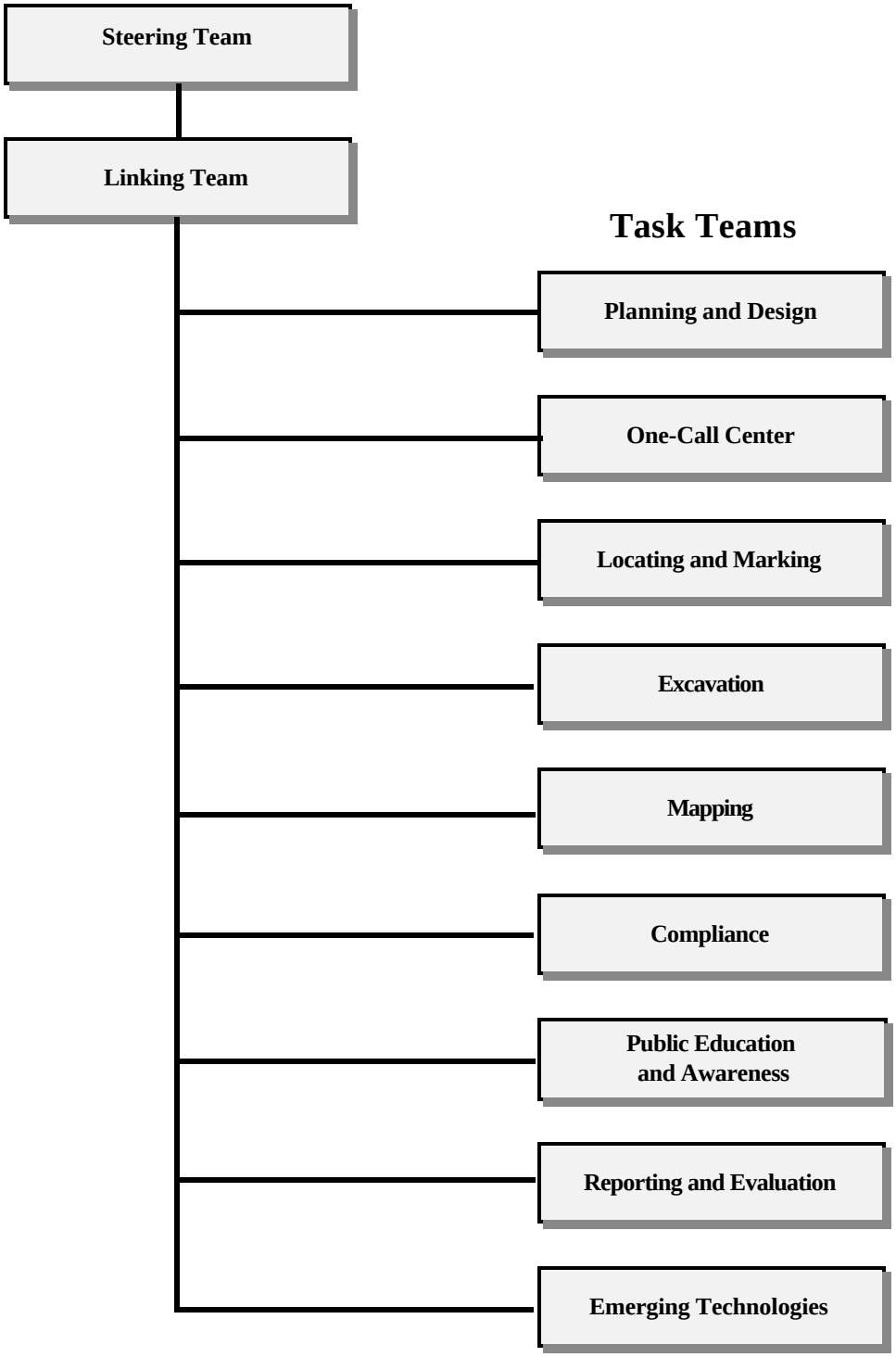

Figure 1-3 Study Team Composition Matrix[1] [2]

Organization[3]	Steering	Linking	Compliance	Emerging Technologies	Excavation	Locating/ Marking	Mapping	One-Call	Planning	Public Education	Reporting/ Evaluation
AAR	X	X	X		X	X	X		X		
AGA	X	X	X	X	X	X	X	X	X		X
AGC	X	X			X	X		X		X	
AOPL									X	X	X
APGA										X	
API		X	X			X	X	X	X	X	X
APWA	X	X	X				X				
ARTBA			X	X	X	X					
EEI		X									
Gov - Fed	X	X	X		X		X	X	X	X	
Gov - State		X	X		X	X		X	X		X
INGAA		X	X		X	X	X	X	X	X	
NAPSR			X								
NARUC		X					X				X
NCTA		X			X						
NRSC-FST	X			X							
NRWA			X								
NTDPC	X	X	X	X	X	X		X	X	X	X
NUCA	X	X	X	X	X	X	X	X	X	X	X
NULCA	X	X		X	X	X	X	X	X	X	X
OCSI	X	X	X	X	X	X	X	X		X	X
TIA/EIA							X				

[1] Only Team members have been included.

[2] The Steering, Linking and Emerging Technology Task Team members are listed as members of their respective Teams only.

[3] See Appendix D for a detailed list of acronyms.

1.5.2 Task Teams

As a result of the initial August 1998 meeting in Arlington, Virginia, the Task Teams were defined as the natural groupings of activities and critical functions that are impacted by, or that impact upon, the safety and reliability of underground facilities damage prevention. The broad focus was to study those activities that are integral to the initial design, operation and maintenance, identification, protection, governance, and performance assessment elements associated with underground facilities.

The Task Teams were responsible for identifying best practices and producing the detailed chapters in this Report. The nine Task Teams included:

- Planning and Design Practices,
- One-Call Center Practices,
- Locating and Marking Practices,
- Excavation Practices,
- Mapping Practices,
- Compliance Practices,
- Public Education and Awareness Practices,
- Reporting and Evaluation Practices, and
- Emerging Technologies.

The individuals who participated as Task Team Members are listed near the front of each respective Task Team Chapter or Appendix A, "Emerging Technologies," of this Report. Each Task Team was assigned at least one liaison from the Linking and Emerging Technologies Teams.

1.5.3 Linking Team

The Linking Team, comprised of representative stakeholders, served as an overall review board to the Task Teams and their work processes and products. Additionally, the Linking Team was responsible for ensuring that each Task Team had sufficient representation and input from various stakeholders regarding the Team's work products and processes.

The Linking Team assigned a liaison to each Task Team. The primary role of the Linking Team liaisons was to:

- interface between the Linking Team and the assigned Task Team,
- assist with the resolution of Task Team chapter scope issues, and
- help resolve any significant issues or items of conflict that developed within the individual Task Teams.

The liaisons also helped to facilitate interface issues with other Task Teams, and were responsible for ensuring that all relevant information was shared among all levels of the Study Team. The liaisons assisted with the editing of their assigned Task Team chapters by collecting and communicating comments on the

Draft chapters from other Teams and groups back and forth between the Task Teams. In total, the liaisons monitored the overall activities, Task Team dynamics, work products, and project time lines of their assigned Task Team.

The Linking Team Members included:

Team Member	**Representing**[4]	**Employer**	**Team Role**
Glynn Blanton	NARUC	Tennessee Regulatory Authority	Compliance Liaison Public Education Liaison
Claudette Campbell	APWA/OCSI	Utilities Protection Center, Inc. of Georgia	One-Call Liaison Public Education Liaison
Larry J. Davied	API, INGAA	The Williams Companies	Co-Chairperson LT Writing sub-team
Donna Erat	APWA	APWA	Reporting and Evaluation Liaison LT Writing sub-team
Larry Galbreath	AAR	CSX Transportation	LT Writing sub-team
Griff Goad	NTDPC	BellSouth Telecommunications, Inc.	Co-Chairperson
Russ Kopidlansky	AGA	Wisconsin Public Service Corporation	Mapping Liaison
Rich Maxwell	Independent Excavator	A&L Underground	Excavation Liaison
Michael McDonald	EEI	Arizona Public Service Company	Locating and Marking Liaison
Guy (Skip) McIntosh	NULCA	UtiliQuest Locate Services	Locating and Marking Liaison
Ken Naquin	AGC	Louisiana AGC	Emerging Technologies Liaison
Andy Scott	NCTA	National Cable Television Association	LT Writing sub-team
Paul Scott	FHWA	DOT-FHWA	Planning and Design Liaison

[4] See Appendix D for a detailed list of acronyms.

Team Member (cont.)	**Representing** (cont.)	**Employer** (cont.)	**Team Role**
Jim Stutler	NUCA	Tierdael Construction Company	Excavation Participant
Massoud Tahamtani	State Governments	Virginia State Corporation Commission	Public Education and Awareness Liaison
Eben Wyman	DOT, RSPA, OPS	Office of Pipeline Safety	LT Writing sub-team

1.5.4 Steering Team

The purpose and function of the Steering Team was to provide senior-level representation and support for the Study. The Steering Team consisted of eight individuals who represented the federal government, one-call systems, contract locators, underground facility owners/operators, railroads, and excavators.

Team Member	**Representing**[5]	**Employer**
James Barron	NUCA	Ronkin Construction, Inc
Willard S. Carey	AGA	Public Service Electric and Gas
Charles E. Dettmann	AAR	AAR
Don Evans	APWA/OCSI	Dig Alert
Stacey Gerard	DOT, RSPA, OPS	DOT, RSPA, OPS
Allen S. Gray, Sr.	AGC	AGC
John Healy	NTDPC, NRSC-FST	Telcordia Technologies
John Walko	NULCA	Excavac Corporation

1.6 COST OF COMMON GROUND STUDY

As the Common Ground One-Call Systems Best Practices Study sponsor, RSPA provided overall Study support and guidance. This included:

- in-house and contractor support personnel;
- sponsoring the development, deployment, and maintenance of the OCSS Information System (an Internet-based information, communication, and messaging system);
- handling the logistics in arranging for hotel accommodations for over sixty Study Team meetings;

[5] See Appendix D for a detailed list of acronyms.

- arranging for and providing meeting rooms and meeting facilitation and reporting functions; and

- coordinating Study Team conference calls and providing facilitation and reporting functions for those calls.

The industry stakeholder participants, along with their respective companies, associations, and organizations, contributed in excess of an estimated 20,000 hours and $500,000 in direct-cost expenditures in completing the Common Ground Study. The estimated industry cost contributions include travel, lodging, meals, communication, and other direct expenses incurred by the participants. This is exclusive of the salaries, benefits, and other compensation that was contributed by their sponsoring organizations.

1.7 CONSENSUS PROCESS

The Task Teams utilized a consensus process as a means to consider, evaluate, and identify their specific best practices. Consensus decisions required that the attendant Team members reach 100 percent agreement with the considered practice. Consensus decisions were only made during prescheduled Team meetings to allow for broad representation and membership diversity, which ensured adequate debate of the proposed practices. Consensus agreement meant that the decisions may not have been the first choice of all members, but all members indicated they would accept and support them. This ensured that all aspects of input from the various interest groups and individual experiences were fully discussed and understood before the existing duly evaluated practice could be recognized as a best practice.

Due to the unique focus of each Task Team's subject matter, each Team was responsible for developing its own best practices evaluation criteria. There are many similarities between the Task Teams in these criteria, but there are also subtle differences. The specific evaluation criteria used for determining each Task Team's best practices are included in each Task Team Chapter.

1.8 BEST PRACTICES DETERMINATION PROCESS

The Task Teams, with the exception of the Emerging Technologies Task Team, were instructed to collect data and performance results of current damage prevention practices. Recognizing that there are a wide variety of practices and processes being used today, the goal of this Study was to determine the "best" of these. The Task Teams' analysis of the results and successes of these various existing practices resulted in the identification of the best practices that are included in the Task Team Chapters.

In some cases, the best practices presented by the Task Teams may not currently exist in totality as they are described within this Report. Rather, when this situation exists, the Task Teams developed their best practices by compiling the best attributes of two or more existing practices. The Task Team consensus process and oversight provided by the Linking and the Steering Teams ensured that the consolidated or compiled best practices are within the guidelines and intentions of this Study.

The Reporting and Evaluation Practices Task Team was also afforded some discretion in recommending best practices. While several states and various industry sectors have established incident reporting processes, none of these universally provide categorical root cause analysis and an understanding of incidents and near misses. Consequently, the Reporting and Evaluation Practices Task Team extrapolated existing reporting programs to formulate their best practices.

As noted above, the Emerging Technologies Task Team was not bound to the same requirement of identifying existing best practices. For the purposes of this Study, emerging technologies implies new or developing equipment or technologies which may prove to be beneficial in reducing or eliminating damage to underground facilities. The Emerging Technologies Section, which is found in Appendix A, is significant as it is entirely possible that today's best practices may have been derived from yesterday's emerging technologies. Further, today's emerging technologies may lead to tomorrow's better practices.

1.9 PUBLIC PARTICIPATION

The Study was open to public participation, and meeting schedules were posted on the OCSS Information System[6] for public access. Additionally, the One-Call System Study(OCSS) Information System allowed for public review of Study Team documents. It also supported public input of issues and concerns related to the Study or to damage prevention. Issues and concerns submitted by the public were directed to the Task Teams for consideration. The Study process ensured that all public input received from meeting participation, written communication, Internet E-mail, or submission through the OCSS Information System was considered and made a part of the best practices evaluation process.

1.10 INTERNET COMMUNICATIONS SYSTEM

As noted above, Study Team communication was facilitated by the development and implementation of the OCSS Information System accessible to all Study Team members and the public via the Internet. This system was an invaluable tool that greatly enhanced the ability of the Study Teams and Team members to communicate. The OCSS Information System provided a variety of communications tools including:

- posting notices of and details about future, planned Team meetings;
- posting Linking Team and Task Team meeting summaries for access by all OCSS participants and the public;
- posting and sharing of related documents among Team members and the public;
- broadcast messaging capabilities to notify multiple Team members simultaneously of important information;

[6]The web site is: http://www.cycla.com/ocss.

- direct E-mail messaging to specific Study Team members;
- access to rosters of Team members and other participants, including contact information;
- public access to post and review issues and concerns regarding the Study or damage prevention practices for Study Team consideration; and
- specialized forums for identified issues, concerns, or topics.

Use of the OCSS Information System enhanced the ability to make information regarding the Common Ground Study Teams' efforts, meetings, and documents available to all participants, interested stakeholders, and the public.

1.11 PATH FORWARD CONCEPT

Although the primary focus of each Task Team was the identification of best practices associated with the Team's specific focus area, there were also discussions of new practices, equipment, or methodologies that were promising in terms of improving damage prevention efforts. Since these relatively new or prospective practices could not be reasonably evaluated for effectiveness, they could not be considered as best practices. Where new technology was involved, information was made available to the Emerging Technologies Task Team for consideration. In other cases, where a new practice or methodology was involved, the individual Task Team may have felt it would be remiss in not making this information available for consideration to the readers of this Report. Where appropriate, individual Task Teams have included a "Path Forward" section in their chapters to highlight some of the more significant future potentials of underground facility damage prevention practices and methodologies. Chapter 10, "Conclusions," summarizes and provides overall Report conclusions for Path Forward consideration.

1.12 BASIS FOR DAMAGE PREVENTION

The underlying premise for preventing damage to underground facilities, and the foundation for this Study, is that all underground facility owners/operators are members of one-call centers, and that it is always best to call before excavation.

1.13 EXCEPTIONS TO THE ONE-CALL PROCESS

During preparation of the Report, a need was identified to clarify and further define activities not universally considered part of the one-call notification process. These activities sometimes are classified as routine maintenance work (reference Appendix C, "Glossary of Terms/Definitions" for *Minor or Routine Maintenance of Transportation Facilities*), and may involve the use of heavy machinery or hand digging tools. It is critical to note, however, that simply because an activity may be exempted in some states from calling prior to excavation, it does not mean there is no risk associated with disturbing the surface grade.

It is always safer to call before beginning excavation. Each State should have a process to evaluate exceptions to its one-call damage prevention laws, taking into consideration risks to public safety, the environment, excavators, and vital public services. Activities exempted by some states include:

- Routine maintenance of transportation facilities.
  Reference: Arkansas Law, Kentucky Law (other state laws); (See Appendix C, "Glossary of Terms/Definitions" - *Minor or Routine Maintenance of Transportation Facilities*).

- Routine maintenance of railroads above grade or ground level.
  Reference: General practice of all major railroads in the US; Georgia Law, Virginia Law (other state laws). (See Appendix C, "Glossary of Terms/Definitions" - *Minor or Routine Maintenance of Transportation Facilities*).

- Routine plowing/tilling of soil on private property by the property owner where no outside underground facilities exist.
  Reference: Idaho Law, Indiana Law (other state laws).

- With hand tools, on property owned or occupied by the person performing the excavation, while gardening or tilling such property.
  Reference: California Law, Kentucky Law (other state laws).

- Routine cleaning of paved drainage facilities or man-made permanent culverts.
  Reference: Washington State Law, South Dakota Law (other state laws).

- Opening of graves in existing cemeteries where no outside underground facilities exist.
  Reference: Minnesota State Law, Arkansas State Law (other state laws).

CHAPTER 2
Planning and Design Task Team Best Practices

2.1 CHAPTER SUMMARY

2.1.1 Critical Areas of Study

Inadequate legislation or limited one-call system practices can hamper the planning and design process. Information about existing facilities should be obtained early in the design process to facilitate a design, which minimizes conflicts between facilities.

As a project proceeds, continued design interface is essential to minimize the impact of inaccurate location markings of facilities and the impact that discovery of unknown facilities may have on the project's safety, schedule and cost.

2.1.2 Major Conclusions Reached

- Planning and design must be recognized as an integral part of damage prevention and the one-call process.
- Interfaces between the project owner, designer, and the contractor should be maintained through the bid process and all phases of construction.
- Damage prevention legislation and one-call system practices should provide designers with opportunities to obtain information about facility owners/operators located in or near the proposed excavation area.

2.2 BACKGROUND AND MOTIVATION

2.2.1 Motivation for the Entire Work Effort – Continuing Excavation Damage

Underground facilities have become increasingly complex and congested. Power and communication lines have joined water, sewer and gas distribution lines underground. Petroleum product and natural gas transmission lines have become more numerous and slurry product lines and cable television lines were added to the mix. A deregulation of telecommunication services added dozens of new underground lines for long distance carriers.

Many new facilities were directly buried and fragile lines could be easily damaged by excavation or even by locating methods intended to prevent damage. Television cables of foam filled aluminum tubes could

be easily dented with a resulting loss of use. Fibre optic telecommunication lines as small as a pencil may carry thousands of channels and could be cut with a shovel; usually these lines could not be readily detected with ordinary locating instruments. Often little consideration is given to designing new installations to prevent future excavation damage. This made apparent the need for improved planning and design to minimize the potential for damage to facilities. As the number of installations increased, excavations increased and excavation damage to existing facilities began to soar.

One-call systems were developed to reduce the number of telephone calls an excavator was required to make and to further encourage calling before digging. By 1970 the first one-call system began operating in Rochester, New York. Excavators were encouraged to contact facility owners/operators before excavating so that the locations of existing lines could be marked on the ground surface. Some states had adopted laws requiring various levels of excavation care. The emphasis was and still is to "Call Before You Dig!"

The concept of designing excavations and facilities to avoid damage has developed slowly. Only a few states have included planning and design in their damage prevention laws. In many areas the use of the one-call center for planning and design is discouraged or even prohibited as a one-call system service. However, planning and design must be recognized as an integral part of damage prevention and the one-call process. Efforts must be made to encourage efficient damage prevention. Consideration must be given to the development of underground facility installation practices and construction standards that will minimize damage during subsequent excavation for installation or maintenance.

2.2.2 Scope for the Planning and Design Task Team

The scope of the Planning and Design Task Team was to identify and describe planning and design practices used to prevent damage to buried facilities prior to breaking ground. The Team also attempted to identify and describe the design practices used during and after excavation activities to avoid existing subsurface facilities. Through this process the Team has identified the best planning and design practices in support of underground damage prevention.

2.2.3 Chapter Contents

This chapter contains the following major sections:

- Chapter Summary
- Background, Motivation, Scope, and Chapter contents
- Team Members and their organization
- Data Collection and Evaluation Process
- Issues Identified
- Findings
- Measuring Improvements
- Path Forward
- Emerging Technologies Report

2.3 TEAM MEMBERS

The Planning and Design Task Team members are listed below. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	Representing[7]	Employer
Larry S. Abraham	INGAA	BP Oil Company
Robert C (Bobby) Arnold	INGAA	Duke Energy
Matt Bacon	NTDPC	Sprint
Johnny Becker	NUCA	Pipelayers, Inc.
Rocco Deprimo	State OPS	Florida Department of Transportation
James Farrell	AAR	Union Pacific Railroad
Don Gordon, Co-Chairperson	Electric Power Transmission and Distribution Industry	Wisconsin Electric (Ret)
Anne-Marie Joseph	OPS	Office of Pipeline Safety HQ
Gary Mentjes	AAR	Canadian Pacific Railroad
Patrick Murphy	A.G.A.	Consolidated Edison of New York
Paul Norgren	API/AOPL	Lakehead Pipe Line
John Robertson, Co-Chairperson	NULCA	The Spectra Group, Inc.

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	Representing	Employer
Ziyad Doany, Emerging Technology Liaison	Industry, Research and Development	3M, Telecom Systems Division
Paul Scott, Linking Team Liaison	FHWA	U.S. DOT Federal Highway Administration

[7] See Appendix D for a detailed list of acronyms.

2.4 DATA COLLECTION AND EVALUATION PROCESS

2.4.1 Information Sources

- Company Procedures
- Industry Standards
- Operating Practices
- Expert Opinions
- Governmental Laws and Regulations

2.4.2 Process for Collecting Information

The Task Team members represent pipeline owners/operators, long distance communication carriers, railroads, gas and electric power public utility transmission and distribution companies, states' departments of transportation, the Office of Pipeline Safety, one-call systems, excavators, and subsurface utility engineering providers. Task Team members familiar with each issue were assigned the task of researching that issue and providing objective information about that issue for team discussion. To protect proprietary information, company names were stripped from examples when requested.

2.4.3 Process for Selecting Issues

The Task Team utilized an outline developed during an early meeting of the Linking Team to develop issues. The Team discussed the planning and design issues in the categories of planning, design, pre-bid/bid, construction and post-construction. The Team agreed at its first meeting that the planning and design process should not end when construction begins. Rather, interface meetings between the project owner/operator, designer and contractor(s) should continue through a final review meeting.

2.4.4 Process for Evaluating Practices

The following criteria was used to determine which existing practices were best practices:

- Benefit to Damage Prevention
- Within the Team Scope
- Consensus

2.5 ISSUES IDENTIFIED

The following issues were identified by the Planning and Design Task Team in five categories:

2.5.1 Planning

- Sharing information
- Plat designation of existing lines/easements
- Design requirements

- Relocation Design Rule
- Underground Facilities Survey
- Subsurface Utility Engineering
- Marking existing facilities on drawings
- Utility Coordinating Committee

2.5.2 Design

- Effective above ground markings
- Clearances required by code
- Utility Conferences (minimize conflicts and investigate potential conflicts)
- Send plans to facility owners/operators for information to identify conflicts
- Pot holing
- Color coding

2.5.3 Pre-Bid/Bid

- Continued interface with designer
- Pre-qualification of contractors
- Mandatory pre-bid conferences (identify lines and any special provisions)

2.5.4 Construction

- Continuous interface (owner/designer/contractor)
- As-built drawings
- Tracer wires on non-metallic lines
- Abandoned facilities
- Discovered unknown facilities

2.5.5 Post-Construction

- Cathodic protection test
- As-built drawings

2.5.6 Standards Under Development

- The American Railway Engineering and Maintenance of Way Association (AREMA), "Specifications for Fiber Optic Route Construction on Railroad Right of Way"
- American Society of Civil Engineers (ASCE) "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data"

2.6 FINDINGS

The following were determined by consensus as best practices by the Planning and Design Task Team:

Planning

1. Plat Designation of Existing Underground Facility Easements
2. Gathering Information for Design Purposes
3. Identifying Existing Facilities in Planning and Design

Design

4. Utility Coordination
5. Markers for Underground Facilities
6. Follow All Applicable Codes, Statutes and Facility Owner/Operator Standards

Pre-Bid/Bid

7. Use of Qualified Contractors
8. Mandatory Pre-Bid Conferences
9. Continuous Interface between the Designer and Potential Contractors during the Pre-Bid/Bid Phase

Construction/Post-Construction

10. Continuous Interface between the Designer and the Contractor during the Construction Phase
11. As-Built Drawings

2.6.1 Planning

1. <u>Plat Designation of Existing Underground Facility Easements</u>

Practice Statement: Plats involving development of real property include the designation of underground facility easements.

Practice Description: Various items are required on the plats filed prior to the development of lands. Where plats are required to be filed, the items required include the identification of the easements of underground facilities traversing the land described on the plat. Identification of easements of underground facilities on the plat increases notice to developers and the public about the existence of the underground facilities. Notification to the owners of underground facilities that a plat has been filed alerts underground facility owners/operators to establish communication between the developers and the operators to facilitate a plan and design for the use of the land which complements the underground facility.

Example of practice: St. Louis County surveyors in Minnesota require that plats show easements of underground facilities. Conditional use permits are required to develop gravel pits in St. Louis County, Minnesota, and a prerequisite to the permit being issued is the notification to the owners of underground facilities that a permit to develop the gravel pit in the vicinity of their facilities has been sought.

Benefits: Often underground facility owners/operators do not receive notice of developments impacting their facilities until excavation activity has commenced. This compromises the optimal use of the land and potentially compromises the integrity of the underground facility.

Reference:
St Louis County, Minnesota zoning ordinances.

2. Gathering Information for Design Purposes

Practice Statement: The designer uses all reasonable means of obtaining information about underground facilities in the area of the planned excavation.

Practice Description: During the planning phase of the project, all available information is gathered from facility owners/operators. This includes maps of existing, abandoned and out-of-service facilities, cathodic protection and grounding systems, as-builts of facilities in the area if the maps are not current, proposed project designs, and schedules of other work in the area**.** This information is gathered for the purpose of route selection and preliminary neighborhood impacts, and as part of the process of impact analysis when evaluating different design possibilities.

Methods of gathering information may include contacting a one-call center, facility owners/operators, coordinating committees/councils, other designers, engineering societies, and governmental agencies as a means of identifying underground facility owners/operators in an excavation area. Gathering information may also include a review of the site for above ground indications of underground facilities (i.e. permanent signs or markers, manhole covers, vent pipes, pad mounted devices, riser poles, power and communication pedestals and valve covers). The one-call center provides a listing of operators directly to the designer, or to the designer's subsurface utility engineer. This information is available in formats that are accessible to all users such as voice, fax, E-mail or web-site**.** Once identified, the designer contacts the operators directly

or uses the one-call system. The facility owner/operator may locate their underground facilities or provide locations of their underground facilities to the designer by other means, such as by marking up design drawings or providing facility records to the designer.

Examples of Practice:

- As a minimum, the designer responsible for the preparation of plans and specifications for an excavation obtains information on underground facilities within and near the project area. Some states, such as Wisconsin, Pennsylvania and Minnesota have statutes requiring such designers to contact one-call centers within a set time frame to obtain facility information. Where the information obtained suggests facilities may conflict with the excavation, an underground facility survey or subsurface utility engineering is used.

- Designers often utilize an underground facility survey process to minimize conflicts with existing underground facilities. The underground facility survey process employed in New York, NY, by Consolidated Edison and other utilities has several distinct steps. Each of the steps is performed in order, but any higher step may be omitted, depending on the proposed construction and the locations of existing underground facilities discovered in the next lower step.

  Underground Facility Survey Steps Include:

  < Use company records and contact other facility owners/operstors to obtain information about locations of existing underground facilities. This step includes the entire construction/excavation area.

  < Using the information obtained in the first step, visit the job site to correlate the information gathered about existing underground facilities with above ground features. This step may be limited to those portions of the construction area where existing facilities are present and where excavation is to occur.

  < Use appropriate instruments or other methods to determine the approximate horizontal locations of the underground facilities identified in the second step. This step may be limited to specific areas where existing facilities are expected to conflict with excavation.

  < Use test holes to positively determine the exact location of existing underground facilities. At this point, horizontal and vertical control measurements may be taken of the underground facility. This step is usually limited to those specific areas where conflicts are anticipated between existing facilities and proposed construction activities or proposed facilities, or where elevation information is essential to design the proposed facility.

Test holes are used to positively locate and identify an underground facility by exposing the facility by a non-destructive means of excavation. Such non-destructive means can be by hand, vacuum truck, air knife, etc.

Test holes may be requested under the following conditions:

- the design calls for a grade change,
- facility records indicate that proposed underground facilities or excavation may be in close proximity of existing underground facilities,
- elevations of proposed sewers or drains may interfere with existing underground facilities where required to determine potential geometry changes for water main installations,
- to locate points where proposed underground facilities may be tied into existing underground facilities, and
- to determine environmental conditions in an excavation area.

Test hole data includes at a minimum:

- date performed and purpose;
- type of existing surface and base of roadway or sidewalk and depth of each;
- general soil conditions found;
- any indication of oil or waste materials found in the pit; and
- facility cover, size, configuration, elevations (if applicable), and distance from curbs or other horizontal control.

- Subsurface Utility Engineering (SUE) is performed by, or under the direction of a registered professional engineer. SUE includes up to four quality levels for gathering underground facility information, to be specified by the project owner to be part of the project planning and design process. The Federal Highway Administration (FHWA) advocates its use and many state DOT's, such as but not limited to, Virginia, North Carolina, Maryland, Texas, Ohio, Florida, Washington, and Delaware, use this process.

Subsurface Utility Engineering Quality Levels are:

- Quality Level D information comes solely from existing utility records. It may provide an overall "feel" of the congestion of utilities, but it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should be confined to project planning and route selection activities.

- Quality Level C involves surveying visible above ground facilities such as manholes, valve boxes, poles, pedestals, pad-mounted devices, etc., and correlating this information with facility records obtained in Level D. When using this information, it is not unusual to find that many facilities have been omitted from

records or erroneously plotted. Its usefulness should be confined to locations where facilities are not prevalent or are not expensive to repair or relocate.

< Quality Level B involves the use of surface geophysical techniques to determine the existence and horizontal position of facilities, including those identified in Level C. This activity is called designating. Two-dimensional mapping information is obtained. This information is usually sufficient for excavation planning. Decisions can be made on where to place structures or new facilities to avoid conflicts with existing facilities. Slight adjustments in the design can produce substantial cost savings by eliminating facility relocations.

< Quality Level A involves the use of nondestructive excavation devices at critical locations to determine the precise horizontal and vertical position of existing facilities, as well as the type, size, condition, material, and other characteristics. This activity is called "locating." When surveyed and mapped, precise plan and profile information is available for use in making final design decisions. Additional information such as facility material, condition, size, soil contamination and paving thickness also assists the designer and facility owner/operator in their decisions.

Caution: Both the underground facility survey process and Subsurface Utility Engineering (SUE), as described above, may include marking the ground surface to indicate the approximate location of existing underground facilities. Both processes are tools to be used in project design. They should not be confused with underground facility locating (and marking) that is performed in response to a request, usually by an excavator, to a one-call center, immediately prior to beginning excavation work, as described elsewhere in this Report.

Some one-call centers accept calls for design purposes but the locating usually provided in response to such calls should be enhanced as described in this Chapter to be adequate for project design purposes. Such locating, however, may be adequate when planning smaller excavations and less extensive work where excavations can easily be adjusted to avoid marked facilities with appropriate clearances. Such less extensive work might include utility pole replacements, electric power or communication buried service installations, highway sign replacements, roadside ditch cleaning, smaller homeowner excavations or residential fence posts.

Benefits: Gathering underground facility information and including this information in the planning phase minimizes the hazards, cost and work to produce the final project.

- Safety is enhanced.
- Unexpected conflicts with facilities are eliminated.
- Facility relocations are minimized.

References:

- Wisconsin Sec. 186.0175 Stats.
- Minnesota Statute 216D.

- Pennsylvania Act 287 of 1974, as amended by Act 187 of 1996.
- See related Finding Number 3, "Identifying Existing Facilities in Planning and Design."
- "Construction Management Interference Control Manual," Consolidated Edison, New York, New York, June 9, 1997.
- Subsurface Utility Engineering, Federal Highway Administration (FHWA), February 1999, Office of Program Administration (HIPA).
- Florida Department of Transportation Utility Accommodation Manual, Document No.: 710-020-001-d, Section 11.4, January 1999.

3. Identifying Existing Facilities in Planning and Design

Practice Statement: Designers indicate existing underground facilities on drawings during planning and design.

Practice Description: During the planning phase of the project, existing facilities are shown on preliminary design plans. The planning documents include possible routes for the project together with known underground facility information. The various facility owners/operators are then given the opportunity to provide appropriate feedback.

During the design phase of the project, underground facility information from the planning phase is shown on the plans. If information was gathered from field located facilities, from underground facility surveys or from subsurface utility engineering, this is noted on the plans. The designer and the contractor both know the quality of the information included on the plans. If an elevation was determined during the information gathering, it is shown on the plan. The facilities shown include active, abandoned, out-of-service, and proposed facilities. The design plans include a summary drawing showing the proposed facility route or excavation including streets and a locally accepted coordinate system. The plans are then distributed to the various facility owners/operators to provide the opportunity to furnish additional information, clarify information, or identify conflicts.

Examples of Practice: The City of San Antonio, Texas, Public Works Department requires three main phases of design in engineering contracts. The 30% design submittal includes existing utilities in plan and profile views, taken from existing records. During this phase the designers have coordinated with the local facility owners/operators and coordinating council to learn what facilities are in the project area. The plans are obtained where available and shown and used in the design. Potential facility conflicts are noted in this phase. A summary drawing is included to orient the project and show the streets and major facilities.

The 60% design submittal updates the 30% submittal. This phase includes the balance of the field work, geotechnical information, and relative elevations on all facilities in potential conflict. It includes preliminary traffic control plans and Office of Safety and Health Administration (OSHA) requirement considerations. During this phase, the designers visit the site after the facilities have been located.

The 90% submittal includes final identification and resolution of conflicts with facilities, final facility designs, project schedule, and description of management of potential hazards.

Benefits: Providing complete underground facility information and including this information on design drawings reduces the hazards, simplifies coordination and minimizes the cost to produce the final project.

4. Utility Coordination

Practice Statement: Project owners and facility owners/operators regularly communicate and coordinate with each other concerning future and current projects.

Practice Description: Utility coordination fosters an open exchange of information among private and public facilities, governmental agencies and construction related organizations. Utility coordination also promotes cooperation among said groups in the planning, design and construction of projects affecting the overall good of participating parties, their organizations and customers or constituents, and the general public.

Utility Coordinating Committees (or Councils) include private utilities, public agency utilities, engineering firms, contractor associations, and others with facilities or business interests in public rights-of-way. Coordinating Committees function in multiple communities, counties and states to promote excavation project coordination. Typical items of discussion include facility excavations in existing and recently paved roadways, disruption of essential facility services, location of utility facilities, environmental impact of damages to utilities, permit procedures, right-of-way access controls and underground facility damage prevention. Plans of future roadway improvement and of future facility installations are reviewed regularly.

Examples of Practice:

- The Los Angeles, CA, Substructure Committee meets monthly to share information on specific projects and to review facility and roadway issues. The meeting agenda includes minutes of previous meeting, project status report, reports of interest from each agency, and a one-call center report. Substructure reports are issued which list upcoming projects and projects in progress.

- The San Antonio, TX, area Utility Coordinating Council meets monthly and coordinates lists of planned projects two years in advance. The streets and drainage improvement projects drive most of the utility adjustments. All utilities have the opportunity to move, replace or maintain their plant prior to or as part of the project.

- Arizona Utility Coordinating Committee

- Albuquerque, NM, Utility Council

- Dane County, WI, Coordinating Committee
- Georgia Utility Coordinating Committee
- Florida Utility Coordinating Committee
- Legislated Coordination in Wisconsin – Sec. 84.063 Wis. Stats. and Wis. Administrative Rule Trans., 220.

References:

- Wisconsin Administrative Rule Chapter Trans 220 "Utility Facilities Relocations."
- Arizona Utility Coordinating Committee (AUCC) Public Improvement/Project Guide, December 1996.
- Highway/Utility Guide (FHWA), Publication No. FHWA-SA-93-049; June 1993.

2.6.2 Design

5. Markers for Underground Facilities

Practice Statement: The presence and type of underground facilities are indicated by permanent above and below ground markers and material.

Practice Description: A combination of above ground and below ground markers is used to identify and locate underground facilities. The purpose of above ground markers is to identify underground facilities, not to locate for excavation or circumvent the one-call process. However, designing underground facilities for future location reduces the risk of an incorrectly marked underground facility during an excavation project. Above ground markers are developed during the design process and include the company name, type of facility, emergency contact, and the one-call number. The locations and types of markers are specified in the construction plans. The design provides a marker system to include, but not limited to, stream crossings, public road crossings, other facilities' right-of-ways, railroad crossings, heavy construction areas, and any other location where it is necessary to identify the underground facility location. If non-detectable facilities are being installed, the design includes a means to accurately locate the underground facility from the surface. The facility is color-coded in accordance with the APWA guidelines to assist in identifying the particular facility. Road decals, stencils, tracer tapes, electronic markers or other appropriate systems may mark areas where traditional markers are considered impractical.

Example of Practice:

- A developer is planning a subdivision. The designer obtains a list of affected facilities and contacts the facility owners/operators for design and encroachment information. The design includes, as specified by the affected facility owner/operator, marker locations identified for each encroachment during construction and post-construction.

- A company is installing additional underground facilities. The designer obtains a list of affected underground facilities and proceeds as above. In addition, the designer includes a detailed marker system to effectively mark the underground facilities to aid in the prevention of third party damages and future locates. Examples of a detailed marker system are:

  < Tracer wires on non-metallic facilities, or
  < Electronic markers or surface markers for facilities at excessive depth.

Benefits: Provisions to aid in future locating requests are included in the design. In addition, an effective marker system is beneficial to the underground facility owner/operator and first responders to an area involving more than one underground facility or an incident near underground facilities.

References:

- 49 Code of Federal Regulations (CFR) Part 192 & 195.
- Industry Standards.
- APWA, "Guidelines for Uniform Temporary Marking of Underground Facilities."

6. Follow All Applicable Codes, Statutes and Facility Owner/Operator Standards

Practice Statement: When planning and designing the installation of new or replacements of existing underground facilities, the designer follows all federal, state and local guidelines, codes, statutes and other facility owner/operator standards.

Practice Description: The designer of a facility project typically considers only national industry codes, regulations and practices applicable to that particular facility, and not of adjacent facilities. Regulations, codes, standards and other design documents generally specify depth of cover, and horizontal and vertical clearances between adjacent facilities. However, they are not always prescriptive and can be subject to interpretation by the designer. In addition, certain codes allow exceptions to the prescribed minimum clearances, contingent upon approval between the affected facility owners/operators.

The designer also has to consider the protection and temporary support of adjacent facilities, and any interference to existing cathodic protection and grounding systems. Consequently, the designer has to provide specifications on safety measures to be taken and procedures for emergency notification and repairs in the case of any damage to an adjacent facility.

Designers are aware of proposed and revised standards and codes that may affect the project.

Example of Practice: The Michigan Electrolysis Committee encourages cooperative efforts for the abatement of destructive corrosive conditions. The membership is open to any organization in Michigan which has property in Michigan and is involved in creating conditions which may cause or be damaged by electrolysis.

The Committee is interested in protecting the electrolytic condition of all members' systems. This includes notifying members of any damage or potential damage to electrolytic systems caused by nonmembers or members.

When changes in important bondings of underground structures or changes in drainage systems which would tend to affect electrolysis conditions on any underground structures are to be made, notice of this work is given to the Secretary-Treasurer so that all members of the Committee may be advised. Urgent cases of dangerous conditions needing immediate relief may be cared for temporarily by any member.

Examples and Sources of Standards and Codes:

- 49 Code of Federal Regulations (CFR) Parts 192 and 195.
- 23 Code of Federal Regulations CFR Part 645.
- National Fuel Gas Code.
- National Electrical Safety Code.
- National Electrical Code.
- American Association of State Highway and Transportation Officials (AASHTO) Standards.
- American Society of Mechanical Engineers (ASME) B31.8.
- National Association of Corrosion Engineers (NACE).
- American Society of Testing and Materials (ASTM).
- Occupational Safety and Health Administration (OSHA).
- American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual Chapter 1, Part 5 - Pipelines.
- Michigan Electrolysis Committee Standards.
- Wisconsin Corrosion Control Coordinating Committee Standards.
- Chicago Region Committee on Underground Corrosion Standards.

Examples and Sources of Proposed Standards and Codes

- Depiction of Existing Subsurface Utility Data
- The American Railway Engineering and Maintenance of Way Association (AREMA), "Specifications for Fiber Optic Route Construction on Railroad Right of Way"
- American Society of Civil Engineers (ASCE) "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data"

Benefits: The designer reviewing codes pertaining to adjacent facilities minimizes any potential conflict of code clearance requirements, and facilitates future locating efforts.

2.6.3 Pre-Bid/Bid

7. Use of Qualified Contractors

Practice Statement: Qualified contractors are used to excavate on and near underground facilities.

Practice Description: Contractors that excavate on and near underground facilities possess the qualifications necessary to conduct such activities in a manner that is skillful, safe and reliable. The requisite qualification of the contractor serves to protect the public and integrity of underground facilities in the vicinity of the excavation. Using qualified contractors ensures that all contractors who bid and work on a project employ safe work habits and are capable of performing the requested work.

When working with contractors, the project owner is familiar with the contractors' work experiences and financial abilities and should not ask the contractors to bid beyond their capabilities. Allowing a competitive bidding process from qualified and competent contractors will assure the best quality and pricing available, while reducing damages to underground facilities.

Example of Practice:

- Duke Energy and other transmission companies have procedures in place to identify qualification requirements for contractors based on work history, insurance, financial statement, and safety records.

- The Florida Department of Transportation (FDOT) requires contractors to be qualified to perform transportation projects above $250K. FDOT reviews the financial history, employees construction experience, equipment list, work performance, and work history in determining the contractor's qualifications.

Benefits:

- Enhances safety,
- The quality of work increases, and
- Damage to facilities decreases.

References:

- Florida Law (Chapter 337.14 FS.) And Rules of the State of Florida, Department of Transportation, Chapter 14-22.
- Duke Energy of Houston, TX, procedures.

8. Mandatory Pre-Bid Conferences

Practice Statement: A mandatory pre-bid conference is held and bids are only accepted from attending contractors.

Practice Description: Depending on the level of impact of proposed construction upon facilities in the excavation area, the project owner or project designer requires potential contractors to attend a mandatory pre-bid conference including underground facility owners/operators. This pre-bid conference is exercised to discuss, among other things, the particular facilities in the area and the requirements to properly protect, support, and safely maintain the facilities during excavation. Official minutes are taken and disseminated as written to all attendees.

Example of Practice: Pre-bid conferences on larger projects normally include a senior contracts negotiator, real estate representative, the designer and staff, the general contractor and prime subcontractors. The conference may also include the local end-user and management personnel. The pre-bid conference can be used to issue the formal bid packages or scheduled within a brief period after the bidding contractors receive their formal bid packages.

During the pre-bid conference, the bidding contractors will be notified of what certifications will be required from the contractor. These certifications may include Shoring Competent Person certificates, railroad safety training certificates, resumes, commercial references and/or personal references.

Caution: This conference is not a substitute for notification of intent to excavate to underground facility owners/operators.

Benefits: Pre-bid conferences provide a forum for the contractor, owner and other interested parties to discuss a project and record binding changes or clarifications to the scope of the project. The pre-bid conference also provides an opportunity for all parties to review contract documents, regulatory requirements, schedules and submittal formats. Most large projects involve multiple levels of subcontracting activity, as well as multi-layered regulatory oversight. The pre-bid conferences traditionally address these issues in an open forum so that all bidders are equally aware of the ground rules. The ground rules would be both commercial and technical in nature, covering the spectrum from performance bonds to safety practices.

References:

Industry and governmental practices

- Florida Department of Transportation.
- Duke Energy of Houston, TX, procedures.

9. Continuous Interface between the Designer and Potential Contractors during the Pre-Bid/Bid Phase

Practice Statement: Once a project design is completed, the designer participates in the pre-bid/bid process.

Practice Description: The designer's continuing involvement during the pre-bid/bid phase with the potential contractor(s) allows for more effective communications between all parties. The designer can assess whether the interested bidders have the expertise needed and the correct understanding of the intended design.

Benefits:

- By providing quality assurance, this practice minimizes potential safety concerns and delays to project completion.

- The designer would have the opportunity to relay information not readily shown on the plans, such as accommodations of facility adjustments required to construct the project.

References:

- Industry Practice.
- Expert Opinion.

2.6.4 Construction/Post-Construction

10. Continuous Interface between the Designer and the Contractor during the Construction Phase

Practice Statement: The designer continues to interface with the selected contractor throughout the construction phase.

Practice Description: This practice allows the designer to be available for pre-construction conferences, unforeseen conditions and design changes and post-construction conferences.

Example of Practice: When an undesignated or otherwise unknown underground facility is discovered within a work area, the excavator reports such discovery to the one-call center and the designer. If the discovery is made during the locating phase of the work, the designer is made aware to determine if there is an impact on the design. Discovery of unknown facilities can impact the project by requiring additional work, increased hazards from the underground facility or its trench, or actually conflict with the installation of the new underground facility. Discovered facilities may contain hazardous substances, or may present other hazards which require notification of authorities. These facilities at a minimum are shown on the as-built drawings for consideration in future work.

Benefits:

- Potential safety concerns are resolved more quickly, thereby minimizing subsequent modifications to the project design, costs and completion.

- The designer's inspections of the project during different stages are also facilitated.

Reference:
Industry and government practice.

11. As-Built Drawings

Practice Statement: As-built drawings are prepared and the information recorded to aid future excavations and locates.

Practice Description: Installation should be made in accordance with the approved construction plans; any deviation to the plans is documented and such changes indicated on the as-built drawings. As-built information is recorded, retained and made available for subsequent excavation.

Example and Source of Practice: Figure/drawing (not included in this Report), "Union Pacific Railroad Methodology for Equating Fiber Optic and Cable Locations to Railroad Tracks and Right-of-Way Maps."

Benefits: As-built drawings serve as an information source for future projects to minimize damage to existing facilities.

References:

- Union Pacific Railroad procedures.
- Expert opinion.
- Industry and governmental practices.

2.7 MEASURING IMPROVEMENTS

Due to the disposition of planning and design practices, improvements as direct results from their implementation are difficult to measure and require years of application to develop an evaluation basis. These best practices offer greater qualitative than quantitative measures due to the diversity of end users and differences in application. Since the outcome objectives are greater public safety along with a reduction in underground facility damages, the following are potential indicators of successful implementation of the suggested best practices.

Increases of:

- location requests by designers to the one-call centers,
- states that allow design phase locates,
- utility coordination councils/committees,
- accurate locates,
- underground utility markers, and
- projects utilizing an underground survey process or SUE.

Reductions in:

- incidents related to inadequate clearance between underground utilities,
- delays to the project caused by waiting for utility work to be completed so highway construction can begin, and
- number of third party damage occurrences attributed to any planning and design practice.

2.8 PATH FORWARD

A periodic review and update process for this Report should be put in place.

2.9 PLANNING AND DESIGN EMERGING TECHNOLOGIES SUMMARY

- Enhance locating through GPS/GIS technology,
- Improved Ground Penetrating Radar (GPR), and
- Detectable plastic.

CHAPTER 3
One-Call Center Task Team Best Practices

3.1 CHAPTER SUMMARY

The role of the one-call center is to receive notification of proposed excavations, identify possible conflicts with nearby facilities, process the information, and notify affected facility owners/operators.

The use of the term "caller" throughout this Report embodies a variety of techniques to request locates, including non-voice communications such as: fax, Internet, or direct-user entry. The term "facility owner/operator" is expanded to include agents who may be locating facilities on their behalf.

The process used by the One-Call Center Task Team was to evaluate existing practices in search of the best practice for each finding. A concise practice statement and practice description has been developed by the Team. These areas of study and best practices can be summarized as follows.

3.1.1 Members and Participation

- Public awareness and education programs are developed to foster a cooperative approach towards safe digging.
- The one-call center is structured so that an excavator need only make a single call and a facility owner/operator need belong to only a single one-call center.
- A clear agreement defining each party's role and responsibilities exists between users.

3.1.2 Operations and Procedures

- A single toll-free phone number is available to callers 24 hours per day, 7 days per week.
- Locate requests are voice-recorded, accessible, and retained.
- The ticket number and names of the facility owners/operators are provided to each caller.
- The one-call center documents operating procedures, policies, and training.
- The one-call center has methods to coordinate large projects, designer requests, and other special needs.

3.1.3 Systems and Equipment

- Mapping and data are current and routinely verified by facility owners/operators.
- The one-call center accommodates growth and change.
- The ticket includes sufficient information to determine the location of the proposed excavation and, through the use of technology, avoids over-notification to facility owners/operators.
- Plans are in place to provide for disaster recovery, security, system redundancy and new-millennium transition.
- Users are provided a means of direct electronic entry of locate requests.

3.1.4 Performance

- Performance standards are in place for the purpose of promoting accuracy, cost effectiveness, and efficiency.

Through the implementation of these best practices, one-call centers can evaluate their operations to provide better communication between excavators and facility owners/operators. This will accomplish the goal of protecting the public, excavators, and the environment and preventing disruptions to public services and damages to underground facilities.

3.2 BACKGROUND AND MOTIVATION

3.2.1 Particular motivation for this Task Team

The One-Call Center Task Team worked to identify and describe one-call center best practices that are currently used to: receive notifications of proposed excavations, identify possible conflicts with nearby facilities, process the information, and notify affected facility owners/operators for the purpose of protecting the public, excavators, and the environment and preventing disruptions to public services and damages to underground facilities.

3.2.3 Goals for this Task Team

The One-Call Center Task Team's goals were to identify existing one-call center operation best practices. The team established a panel of subject matter experts to evaluate best practices of one-call centers and to forward constituent issues for feedback. Information gathered pertaining to the needs of the one-call center, the owners/operators, the public, the excavating community, and state and federal governments were considered and evaluated by the team. Through consensus, recommended best practices were identified and accepted for the final Report.

The process used by the Task Team was to:

- include industry stake holders,
- clarify existing practices,
- identify best practices for one-call center operations,
- achieve consensus on best practices,
- develop a practice statement, description, and references to support best practices,
- identify areas of emerging technology for future consideration,
- coordinate with the Linking Team to forward issues more appropriately addressed by other teams, and
- take ownership of issues identified by other teams that were within the One-Call Task Team's charge.

3.3 TEAM MEMBERS

The One-Call Center Task Team members are listed below. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	**Representing**[8]	**Employer**
Mike Ames	INGAA	ENRON Pipeline Safety Group
Danny Barrett	NTDPC	AT&T
Zach Barrett	DOT, RSPA, OPS	DOT, RSPA, OPS
Kirby (Tim) Brubaker	NTDPC	AT&T
John Collins	Louisiana DOT	Louisiana DOT
Roger Fleming	API	Explorer Pipeline Company
David Frey	OCSI	Louisiana One-Call
George Glenn, Co-Chairperson	OCSI	North Carolina One-Call Center, Incorporated
Team Member (cont.)	**Representing** (cont.)	**Employer** (cont.)
Jim Holzer	OCSI	One Call Concepts, Inc.
Glenn Johnston	AGC, NUCA	Glenn Johnston, Inc.

[8] See Appendix D for a detailed list of acronyms.

Steven Kindschy, Co-Chairperson	AGA	Consumers Energy
Patti Lama	Electric Power Transmission and Distribution Industry	ENRON Portland General Electric
Lee Marrs	OCSI	Texas Excavation Safety System, Incorporated
Michael McNamara	OCSI	One Call Systems, Inc.
Gregory A. Obsincs	OCSI	Ohio Utility Protection Service
Ron Olitsky	OCSI	Underground Service Alert of Southern Cal
Mark Palma	NULCA	Hinshaw & Culbertson

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	**Representing**	**Employer**
Claudette Campbell, Linking Team Liaison	OCSI	Utilities Protection Center of Georgia, Inc.
Sandra Daziani, Emerging Technology Liaison	OCSI	Arizona Blue Stake, Inc.

3.4 DATA COLLECTION AND EVALUATION PROCESS

3.4.1 Information sources

Various company procedures, standards and regulations, operating practices, and documents were reviewed and referenced during the Task Team's efforts. These included:

- One Call Systems International (OCSI) Voluntary Recognition Program;
- "Model One-Call For The 20th and 21st Century," AT&T;
- Existing operating practices from various states' one-call centers;
- One-Call Systems International Directory;
- 49CFR Part 192;
- 49CFR Part 198; and
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

3.4.2 Process for Collecting Information

The Task Team identified a preliminary list of best practices. Task Team members volunteered to become advocates for each best practice based on their individual knowledge and experience. Each advocate was

responsible for researching the best practice and developing a Practice Statement, Practice Description and References which were then presented to the Team for further discussion and evaluation.

3.4.3 Process for Selecting Issues

The One-Call Center Task Team did not attempt to separately identify or evaluate issues. It was considered that all existing industry practices inherently address some underlying issue. The issues can be ascertained by studying the practice.

3.4.4 Process for Evaluating Practices

The One-Call Center Task Team followed the process steps noted below to identify, develop, evaluate, and achieve consensus on the best practices noted in this chapter. In this process, it should be noted that regardless of who the practice advocate was, all Task Team members participated in the consensus agreement process on each Practice Statement, Practice Description, and acceptance of the practice. The logical process the Team followed was:

- The candidate practice was submitted or drafted by someone. This could have been an item submitted by the public or existing practices brought to the table by a Task Team member.

- The Task Team discussed the merits of the candidate practice. A primary consideration at this point was whether the candidate practice was within the scope of the One-Call Center Task Team. If accepted as a valid candidate best practice, a practice advocate(s) was assigned to develop a draft practice statement and a draft practice description.

- The draft practice statement was discussed by the Task Team and was either accepted as written by the practice advocate or it was modified by the Team until consensus was achieved. In some cases, Team discussion and evaluation resulted in the practice being deleted from further consideration as a best practice.

- Each Team member communicated the agreed-upon practice statement to his/her represented industry constituents.

- The Team members gathered constituent feedback and brought it back to the Team for further consideration and determination of whether the previously agreed upon practice statement should be modified.

- The practice advocate(s) developed a draft description of the practice, generally based on the consensus practice statement.

- The draft practice description was discussed and was either accepted as written by the practice advocate(s) or modified by the Team until consensus was achieved.

- Each Team member communicated the agreed-upon practice description to his/her represented industry constituents.

- The Team members gathered constituent feedback and brought it back to the Team for further consideration and determination of whether the previously agreed upon practice description should be modified.

- The Team compiled the final list of agreed upon best practices.

- The Team prepared the chapter as input to the Study Report.

It should be noted that any Team member could present a candidate practice for consideration and/or volunteer to become the advocate for a practice. The process outlined above helped to ensure that each industry constituent was represented in the discussion of the merits of every practice.

3.5 FINDINGS

Following is the list of practices developed by the One-Call Center Task Team for which consensus among the Task Team members has been achieved.

1. Pro-active Public Awareness, Education and Damage Prevention Activities
2. Specifically Defined Geopolitical Service Area with No Overlap
3. Formal Agreements with Members
4. One-Call Center Governance
5. Single Toll Free Statewide Number with Nationwide Access
6. Hours of Operation
7. Voice Record of All Incoming Calls
8. Retention of Voice Records According to Applicable Statutes
9. Caller Feedback
10. Printed Ticket Recall
11. Documented Operating Procedures, Human Resource Policies, and Training Manuals
12. Documented Owner Verification of Data Submitted by Facility Owner/Operator
13. Flexibility for Growth and Change
14. Meeting Between the Excavator and Facility Operator(s) Initiated by One-Call Notification
15. One-Call Center Accepts Notifications from Designers
16. Locate Request
17. Practices to Reduce Over-Notifications
18. Disaster Recovery
19. Remote User Interface
20. Accept Multiple Reference Points for Locate Requests

21. One-Call Center Security
22. Hardware Designed to Tolerate a Single Point of Failure
23. One-Call Quality Standards

1. Pro-active Public Awareness, Education and Damage Prevention Activities

Practice Statement: The one-call center has a documented, pro-active public awareness, education, and damage prevention program.

Practice Description: The one-call center seeks opportunities to promote the need to "Call Before You Dig," to enhance awareness of responsibilities to safeguard workers and the public and protect the integrity of the buried infrastructure, to foster a cooperative approach between the owners of buried facilities and the digging community toward the prevention of damage to buried facilities and to promote the service it provides.

Typical Call Center activities include: promotional items; media advertising; participation at safety meetings; seminars and trade shows; contractor awareness programs; distribution of education material describing how the one-call system works; maintaining a database of active members of the local digging community; mediating and rationalizing the expectations of both the facility owners/operators and the digging community; and participation in local damage prevention or facility location and coordination committees.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- One-Call Systems International Directory.
- 49CFR Part 192.
- 49CFR Part 198.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

2. Specifically Defined Geopolitical Service Area with No Overlap

Practice Statement: The one-call center(s) serving a specifically defined geopolitical area is (are) structured so that an excavator need only make one call, and a facility owner/operator need only belong to a single one-call center.

Practice Description: One-call programs are designed to promote ease of use for members (facility owners/operators) and for excavators. While this ease of use is enhanced when a one-call center serves a specifically defined geopolitical area that does not coincide with the service area of another one-call center, it is not essential.

There are three requirements a one-call program meets in order to be considered as having implemented this best practice:

- The program permits an excavator to use a single point of contact to submit and follow up on a notice of intent to excavate and notify affected facility owners/operators.

- The program permits a facility owner/operator to join a single one-call center and receive all appropriate notices.

- The program is designed so that all pertinent information is shared among one-call centers in the event more than one exists.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

3. Formal Agreements with Members

Practice Statement: Each member of the one-call center abides by state statute where applicable or written agreement that states the rights and the responsibilities of the one-call members and the one-call center.

Practice Description: Operating procedures and bylaws are established. Procedures for the operation of a one-call center are simple. The concept is for service, not paperwork. Topics for procedures can be classified as: general, communications, center operations, reports, expenses and publicity. These topics could be expanded to include guidelines and whatever else is needed for a particular system. Bylaws vary, depending on the type of organization. In some instances they may prove unnecessary. If bylaws are adopted, simplicity is the key word. Items that could be incorporated include sections on membership (including rights), financial matters, meetings, elections and duties of officers. Any other agreements required are kept as simple as possible to facilitate understanding by all participants. Consideration is given to include "hold harmless" clauses, amounts of liability insurance, errors and omissions insurance, retention of records, cost allocations, reimbursements, area served (with options to expand as planned), and any special arrangements necessary. If an agreement to contract the service to an outside concern is made, it contains controls, checks and balances.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- One-Call Systems International Directory.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

4. One-Call Center Governance

Practice Statement: The one-call center is governed by a board of directors representing the diverse makeup of the constituent groups, for example facility owners/operators, designers, contractors/excavators, and government.

Practice Description: To ensure that a one-call system functions to the best benefit of the entire community, it is governed by a board of directors made up of representatives of the stakeholders. Board members are from a variety of industry types, such as facility owners/operators, contractors, designers, project owners and government representatives. Each board member is knowledgeable in their own industry and of how it interacts with the one-call system and all of the represented stakeholders.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

5. Single Toll Free Statewide Number with Nationwide Access

Practice Statement: The one-call center(s) have a single toll free statewide number with nationwide access.

Practice Description: There will be only one statewide toll free telephone number for the one-call center(s) to receive locate requests. This number has nationwide access, meaning that a caller can reach the center(s) from anywhere in the country.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- 49CFR Part 198.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

6. Hours of Operation

Practice Statement: The one-call center can process locate requests 24 hours a day, 7 days per week.

Practice Description: The one-call center has in place a process where a caller, at anytime of the day or night, every day of the year, who has a locate request can contact the one-call center and have that request processed.

References:

- Existing operating practices from various states' one-call centers.
- One-Call Systems International Directory.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

7. Voice Record of All Incoming Calls

Practice Statement: A voice recording is maintained of all voice transactions concerning requests to locate facilities.

Practice Description: A voice recording of telephone communications for locate requests is made to ensure a precise record of the activity is retained. This recording can be legally supported in court as well as used for damage investigations.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- 49CFR Part 198.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

8. Retention of Voice Records According to Applicable Statutes

Practice Statement: Voice records of all calls concerning requests to locate facilities are kept in retention according to applicable statutes.

Practice Description: Voice recordings are a factual record of the events that occurred between the caller and the one-call center. These factual records must be maintained and accessible until the applicable statute of limitations in the state have expired. Since these laws vary from state to state, no specific time period is set forth as best practice. In the absence of notice by some party to the contrary, after the expiration of the statute of limitations the records may be destroyed. The one-call center has a procedure for processing requests for voice information.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- 49CFR Part 198.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

9. Caller Feedback

Practice Statement: The one-call center provides the caller with the ticket number and the names of facility owners/operators who will be notified for each locate request.

Practice Description: Providing the locate request number and the names of the facility owners/operators who will be notified enhances the efficiency of the one-call process. When provided the names of the facility owners/operators, the excavator knows which owners/operators will be notified in the area of the planned excavation. This helps the excavator determine if the facility owners/operators have responded to the locate request.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.
- 49CFR Part 198.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

10. Printed Ticket Recall

Practice Statement: The one-call center can provide a printed copy of any ticket for a period of time determined by applicable statutes.

Practice Description: In the event of a damage investigation, litigation, or other event, it is often necessary to have a hard copy printout of a location request ticket. Local governments have statutory requirements for record retention in such cases. The one-call center has the ability to produce, as necessary, a copy of a location request ticket for the appropriate statutory period.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- 49CFR Part 198.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

11. Documented Operating Procedures, Human Resource Policies, and Training Manuals

Practice Statement: The one-call center has documented operating procedures, human resource policies and training manuals.

Practice Description: The one-call center has documented operating procedures, human resource policies, and training manuals. Training manuals, practices, procedures, and policies are on the premises in a designated area or place, dated, and available for reference.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

12. Documented Owner Verification of Data Submitted by Facility Owners/Operators

Practice Statement: The one-call center returns the geographic description data base documentation to the facility owner/operator annually and after each change for verification and approval.

Practice Description: The one-call center can only work with the information related to the existence of buried facilities that its members provide. It is important that the one-call center be able to produce evidence that a member's data is accurate, according to that member. Regular verification of data is a part of the documented agreement or operating procedures between the owner or operator of buried facilities and the one-call center. Any deletions or additions made by the member are entered into the data base and documentation of the change sent back to the member for verification, prior to activation.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

13. Flexibility for Growth and Change

Practice Statement: The operating plan of the one-call center is sufficiently flexible to accommodate growth and change.

Practice Description: A successful one-call center maintains flexibility to respond to changes by forming and maintaining a responsive organization whose Board of Directors' composition allows adequate representation of the needs of all stakeholders.

A Board's ability to respond to change will be enhanced by drafting bylaws and operating procedures that reflect the current environment in which the one-call center serves. The most successful Boards review these documents on an ongoing basis to make sure they continue to reflect or respond to current conditions. These Boards conduct regular strategic planning sessions during which they review the current state of the Center's major systems, programs and outreach activities. Such assessments help them identify stakeholder needs for future growth and development.

Many members of Boards and center management teams keep themselves informed about and involved in the one-call industry by joining associations and attending conferences or other educational events that help them to better identify new opportunities for growth and change.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

14. Meeting Between the Excavator and Facility Operator(s) Initiated by One-Call Notification

Practice Statement: The one-call center has a process for receiving and transmitting requests for meetings between the excavator and the facility operator(s) for the purpose of discussing locating facilities on large or complex jobs.

Practice Description: The one-call center relays requests for job site facility meetings for excavators who request them with facility owners/operators. If a meeting is required to show the limits and schedule of the work, the one-call center indicates that a meeting is requested. The one-call center requires that the excavator provide sufficient information to fully identify the boundaries of the proposed work site. A meeting request does not necessarily eliminate the need for a locate request.

References:

- Existing operating practices from various states' one-call centers.
- One-Call Systems International Directory.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

15. One-Call Center Accepts Notifications from Designers

Practice Statement: The one-call center accepts design requests and has the ability to process them as designated by the facility owners/operators.

Practice Description: To facilitate damage prevention, project designers have a need for access to facility location information from facility owners/operators. If a design request is received, the one-call center provides a listing of facility owners/operators directly to the designer. Once the list is identified, the one-call center processes the request as designated by each facility owner/operator.

References:

- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

16. Locate Request

Practice Statement: The one-call center captures the following information, at a minimum, on a locate request: the caller's name and phone number; the excavator's/company's name, address and phone numbers; the specific location of the excavation; the start date and time of the excavation; and the description of the excavation activity.

Practice Description: A locate request is a communication between an excavator and one-call center personnel in which a request for locating underground facilities is processed. In addition to the minimum information required in the practice statement (above), the locate request should include any information, if available, that will help to establish the specific location of the excavation site. This additional information could include, for example:

A. More detailed information to help determine the specific location of the excavation. Such information may include:
   1. City
   2. County/Parish/Township
   3. State
   4. Street address
   5. Street name
   6. Length and direction of the excavation and the nearest adjacent cross streets (needed to bound area of excavation or extended excavation)
   7. Subdivision and lot number (for new development)
   8. Latitude/Longitude: Latitude-longitude coordinate(s) or specific address of the dig site may be done automatically by the GIS subsystem or determined by computer assisted customer service representative. The dig site can be a point, and area or box, or a polygon. For a spatial rectangle (maximum/minimum latitude/longitude), the dig site must be wholly within the included area.
   9. Highway mile markers
   10. Railroad mileposts
   11. General directions/instructions
   12. Map grids
   13. Distance to nearest cross-street
   14. Any other pertinent references to help establish the location of the dig site

B. The intended start date and time of the excavation (i.e., the date excavation is actually expected to begin, which may be later than when excavation can legally begin based on the ticket date).

C. Type of the excavation activity (e.g., boring, blasting, trenching, etc.)

D. Who the excavation work is being done for
E. What is the purpose of the work (i.e., what will be installed and/or built)
F. Additional remarks

References:

- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.
- 49CFR Part 198.

17. Practices to Reduce Over-Notifications

Practice Statement: The one-call center employs practices designed specifically to reduce the number of notices transmitted to facility owners/operators, in which the reported excavation site is outside the owner's/operator's desired area of notification.

Practice Description: The one-call center employs technology that allows the facility owner/operator to determine its desired area of notification by either polygons or grids. To reduce over-notifications, the technology should:

- enable the call center to define the proposed excavation site buffer to within approximately 800 feet; and

- provide the facility owner/operator the ability to identify its desired area of notification to within approximately 100 feet.

References:

- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.
- NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

18. Disaster Recovery

Practice Statement: A one-call center develops, implements, and maintains an effective disaster recovery plan enabling the one-call function to continue in the event of a disaster.

Practice Description: The one-call center develops and implements an effective disaster recovery plan enabling it to continue operations in the aftermath of a disaster affecting the facility. Excavators and underground facility owners/operators outside of the area affected by the disaster can continue to conduct business with minimum to no delays in the services provided by the one-call center. The disaster recovery plan makes provisions for the one-call center to process emergency locate requests for the areas affected by the disaster.

The one-call center (the primary center) has a backup arrangement with another facility at a remote location (the secondary center). This arrangement includes:

- Telecommunications - alternate routing schedules are in place, ready to be activated within minutes of the primary centers' failure.

- Software and Hardware - the secondary center has compatible hardware with the primary center. The secondary center always has a copy of the primary's current software.

- Database - the secondary center receives the primary center's database including locate requests on a regular basis, preferably real-time.

- Staffing - a portion of the secondary center's staff is cross-trained for the primary center's operation at all times.

- Simulated Emergency Testing - At least once a year, on a random basis, the disaster recovery plan is implemented to verify that it is operational.

References:

C "Model One-Call For The 20th and 21st Century," AT&T.
C Existing operating practices from various states' one-call centers.

19. Remote User Interface

Practice Statement: The one-call center provides users a means of direct, electronic entry of locate requests that maintains comparable ticket quality to an operator-assisted entry.

Practice Description: The one-call center has interactive data communications sufficient to permit remote data entry for members and excavators. The remote interface validates the input information and allows the user to make corrections if necessary. This correction is accomplished by referencing the same geographic database used at the one-call center when taking a voiced-in request. This process ensures that the ticket quality is maintained for all tickets.

References:

C "Model One-Call For The 20th and 21st Century," AT&T.
C Existing operating practices from various states' one-call centers.
C NTSB Safety Study (NTSB/SS-97/01; PB97-917003).

20. Accept Multiple Reference Points for Locate Requests

Practice Statement: The one-call center is able to accept multiple types of points of reference to define the exact location of an excavation site (i.e., latitude/longitude, highway/railroad/pipeline mile markers, address, street and cross-street, etc.).

Practice Description: The one-call center's locate request taking processes and computer system are designed to accept and process multiple types of reference points used by callers to (1) describe the location of their work and (2) define the excavation site. Examples of different types of reference points include: highway mile markers, railroad mileposts, valid address or street-cross street, latitude/longitude, township-range-section, city, county, political and mail address (zip code) boundaries, etc.

All stakeholders involved in the one-call process receive a corresponding benefit when the call center is able to define the excavation site as specifically as possible. The facility operator's job of determining the existence of a potential conflict is expedited, field personnel can find and mark the affected area much easier, and the excavator receives timely markings covering the area of excavation. Standardizing on a limited set of criteria reduces the flexibility of the system to serve the excavator and facility owner/operator. The one-call center invests in systems and processes that permit inclusion of a variety of types of reference points in defining the excavation site. The one-call center takes steps to link these reference points to the database used to register the facility operator's desired area of notification, thereby assisting in reducing over-notification.

References:

- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.

21. One-Call Center Security

Practice Statement: The one-call center provides appropriate physical and systems security, fire protection and electrical protection to protect the one-call center and its critical components.

Practice Description: The one-call center needs protection from natural disasters and other threats. Since the one-call center is a critical link in the communication chain between the excavating community and facilities, it is important that the one-call center does whatever it can to provide adequate security, taking into account that it may well need to be operational in times of natural disasters or in the face of other threats. Security components could include:

- Physical security for the building and its employees through locked operations areas, lighting, employee key cards, guard patrols.

- Physical security for critical systems components. This may include locating the facilities in locked enclosures and restricting access to necessary personnel.

- General fire protection for the one-call center personnel and property.
- Specialized fire protection for critical systems components.
- Specialized theft protection for critical systems components.
- Telephone demarcation points in a protected area within the One-Call Center.
- Passwords and protections to limit access to computers and other systems.
- Offsite storage of duplicate data base and necessary system software.

Reference: Existing operating practices from various states' one-call centers.

22. Hardware Designed to Tolerate a Single Point of Failure

Practice Statement: The one-call center uses fault tolerant hardware for its critical path operations, such as ticket taking, database access, and ticket delivery.

Practice Description: A fault tolerant system can withstand any single hardware malfunction without any interruption or degradation of service. These systems have the ability to identify the malfunctioning hardware component and permit its replacement while remaining online and processing its normal applications. These fault tolerant systems maximize the probability that the call center will be able to properly process an excavation request in the event of a failure or malfunction.

References:
- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.

23. One-Call Quality Standards

Practice Statement: The one-call center establishes performance standards for the operation of the center for the purpose of promoting accuracy, cost effectiveness and efficiency.

Practice Description:

A. Customer Quality of Service Performance Measurements – It is best practice in the one-call center industry to monitor the quality of service provided to the customer calling the center. Key measurements include:

1. Speed of Answer

Process – Most call centers route incoming calls through an ACD (automatic call distributor) either via an on-premise PBX or a Centrex at the telephone company's central office. Both of these devices provide reports that identify, on the average, how long a caller had to wait before they were answered. This measurement is called average speed of answer (ASA) and is normally captured on a half hourly basis and accumulated for the day.

Service Level – An objective service level should be set based on customer satisfaction and economics. An ASA objective of 30 seconds or less is recommended.

2. Abandoned Calls

Process – The PBX or Centrex also provides this data. It will normally identify the number of calls abandoned and how long the callers waited before they hung up.

Service Level – An objective service level should be set based on percentage of calls. An abandonment rate of less than 5% by callers that waited more than 60 seconds is a reasonable objective.

3. Busy Signals

Process – The one-call center is equipped with sufficient incoming lines to minimize busy signals.

Service Level – The performance level for busy signals received by callers into the one-call center does not exceed 1% of the total incoming call volume.

4. Customer Satisfaction

Process - A fundamental principal in measuring quality is that "the customer defines quality." Periodic customer satisfaction surveys of callers are conducted.

Service Level – An objective service level is set based on percentage of caller's responses. An objective of 99% customer satisfaction is recommended.

B. Locate Request Content

The one-call center has in place a quality of service plan which includes measurements of accuracy, productivity, and defects in locate request tickets.

C. Relational Database Quality and System Functionality

The geographic, relational database and the system that uses it confirms the hierarchical relationship between the street address, street, municipality, county and state.

D. Locate Request Delivery

The one-call center establishes the following minimum criteria for quality of locate request delivery. Transmission audit reports are sent to receiving locations daily.

1. Average emergency ticket transmission time (< 5 minutes)
2. Average short notice ticket transmission time (< 15 minutes)
3. Average normal ticket transmission time (< 30 minutes)
4. The ticket information should be transmitted in an electronic data format that allows the receiving equipment to parse/extract the data.

E. Ratio of Incoming Locate Requests to Outgoing Ticket Transmission

The one-call center monitors the ratio of incoming locate requests to outgoing ticket transmissions. This data assists in evaluating the center's marketing, education, mapping, budgeting, and cost performance.

References:

- One Call Systems International (OCSI) Voluntary Recognition Program.
- "Model One-Call For The 20th and 21st Century," AT&T.
- Existing operating practices from various states' one-call centers.

3.6 MEASURING IMPROVEMENTS

The following items describe how the DOT might measure improvements in damage prevention, public safety, and non-interruption of essential services resulting from the implementation of these best practices. The measurements include but are not limited to improvements in:

- call volume;
- volume of one-call center membership;
- public awareness of damage prevention;
- the number of public education programs;
- marketing/public relations efforts for damage prevention awareness;
- state one-call legislation;
- technology used for locate request input and delivery methods, mapping systems, and communication capabilities;
- compliance programs;
- the number of one-call centers offering extended hours;
- the number of damage incidents per number of locate requests;

- the percentage of "no notification" damages; and
- the number of exemptions from one-call participation.

The DOT could monitor, for example, the NTSB incident reports, FCC common carrier damage reports, RSPA annual incident reports, and the OCSI annual report in order to determine the improvements resulting from implementing these best practices.

3.7 PATH FORWARD

This document should be a living document in that the completion of the charge given to the Task Team does not end the project. It only begins the evolution to even better policies and procedures for more effective damage prevention.

Because damage prevention is an ongoing process, it is imperative that the Task Team remains intact for the purpose of reviewing, identifying and evaluating changes and additions to the methods of operating and managing one-call centers. This document should be reviewed at least on an annual basis by the Task Team.

There were a number of issues that were considered by the Team, but were left unaddressed because of the lack of universal acceptance. These appear to have potential merit. These included but are not limited to:

- positive response,
- broad-based education, and
- Internet tools.

True success of this Task Team's efforts should not be measured by this Report but by the universal acceptance of these practices and the resulting reduction of damages to underground facilities.

The One-Call Task Team discussed a practice, "Positive Response to Excavator; No Negative Response" that was previously referred to the Linking Team with the recommendation that other task teams evaluate. The Linking Team asked the One-Call Task Team to reconsider the need for inclusion of this item as a best practice. Since several states currently have requirements for positive response, the Task Team decided that the item was worthy of further consideration.

3.8 ACKNOWLEDGMENTS

The One-Call Task Team asked that the following acknowledgments be included in its chapter:

- DOT, Office of Pipeline Safety for encouraging and allowing industry participation
- all Task Team members' employers for their patience and financial support;
- George Glenn and Steve Kindschy, One-Call Practices Task Team co-chairs, for their excellence in team leadership;
- Janice Morgan, Office of Pipeline Safety, for her support in planning task team meetings;
- Herb Wilhite, Cycla Corporation, for his facilitation and support; and
- all constituent stakeholders for their participation and input.

CHAPTER 4
Locating and Marking Task Team Best Practices

4.1 CHAPTER SUMMARY

Locating and marking is necessary before excavation can be carried out safely. Without accurate and timely location and effective marking of facilities, excavator damage to underground facilities is more likely and may have severe consequences. As part of the overall best practice identification effort, the Locating and Marking Task Team identified best practices for: (1) knowing, (2) appropriately marking, and (3) effectively communicating the location of all underground facilities in association with excavation activities. The Team reached consensus that carrying out these practices will enhance the accuracy, completeness, and timeliness of locating and marking. The Team believes that improvements in locating and marking through employment of these practices will translate directly into a lower risk of damage to facilities. The specific best practices identified by Team consensus are listed below.

1. Locators utilize available facility records at all times.

2. If a facility locator becomes aware of an error or omission, then the facility locator provides information for updating records that are in error or to add new facilities.

3. A uniform color code and set of marking symbols is adopted nationwide.

4. A single locator is used for multiple facilities.

5. Locators are properly trained. Locator training is documented.

6. Locates are performed safely.

7. A visual inspection is completed during the facility locating process.

8. Facilities are adequately marked for conditions.

9. Positive response is provided to facility locate requests.

10. Multiple facilities in the same trench are marked individually and with corridor markers.

11. Information on abandoned facilities is provided when possible.

12. When locating electro-magnetically, active/conductive locating is preferable to passive/inductive locating.

13. The facility owner/operator is identified.

14. Communication is established between all parties.

15. Documentation of work performed on a locate is maintained.

16. A damaged facility is investigated as soon as possible after occurrence of damage.

17. Forecasting/Planning for Predictable Workload Fluctuations. A plan is developed for dealing with unpredictable fluctuations.

4.2 BACKGROUND AND MOTIVATION

4.2.1 Motivation for Locating and Marking Practices Task Team

Each year a greater percentage of facilities placed in the field are placed underground. In 1994, Bell Communication Research estimated that total U.S. underground infrastructure totaled more than 20 million miles. This figure has likely dramatically increased in the years since.[9] This underground infrastructure is vulnerable to damage without careful preventive measures. Prevention of damage to underground facilities requires complete and accurate location of facilities before excavation work commences. Once facilities are located, they must be marked so that the facility locations are communicated effectively to excavators. Locating and marking is necessary before excavation can be carried out safely. Without accurate and timely location and effective marking of facilities, excavator damage to underground facilities is more likely and may have severe consequences.

4.2.2 Goals for Locating and Marking Practices Task Team

The goal of the Locating and Marking Practices Task Team was to contribute to a reduction in the risk of outside damage to underground facilities. As part of the overall best practice identification effort, the Task Team undertook to identify best practices for: (1) knowing, (2) appropriately marking, and (3) effectively communicating the location of all underground facilities in association with excavation activities. The specific best practices identified by the Team were chosen by Team consensus. The Team reached a consensus that carrying out these practices will enhance the accuracy, completeness, and timeliness of locating and marking. The Team believes that improvements in locating and marking through employment of these practices will translate directly into a lower risk of damage to facilities.

4.2.3 Organization of Chapter

The following section lists all Locating and Marking Task Team members and their organizations. Section 4.4 describes the process employed by the Task Team for identifying, evaluating, and selecting locating and

[9] Estimate of 20 million miles used by Bell Communications Research during the National Transportation Safety Board's 1994 excavation damage prevention workshop.

marking best practices. In Section 4.5, Findings, the specific candidate practices considered by the Team are described individually, along with the Team's evaluation and consensus of which of the candidate practices constitute best practices. The information and sources employed by the Team in the discussion and evaluation of the specific practices are listed or referenced.

Section 4.6 lists issues related to best practices that the Team identified and how these issues were resolved. Also listed are issues that the Team identified that were referred to other Task Teams because they were outside the scope of locating and marking best practices.

Finally, the chapter briefly describes potential approaches for measuring the improvement that might result from wider employment of the locating and marking best practices identified by the Task Team consensus and lists suggestions for activities to be carried out following completion of the Best Practices Report.

4.3 TEAM MEMBERS

The Locating and Marking Task Team included representatives from a wide spectrum of organizations involved in the prevention of damage to underground facilities. Industry segments that were represented on the Team included gas and liquid pipeline, electric, and telecommunications facility owners/operators; excavating contractors; locating companies; one-call centers; state regulatory agencies; railroads; and locating equipment vendors. Team members solicited opinions from their affiliated or sponsoring organizations, bringing diverse points of view to the discussions and evaluations in the Task Team meetings and in the background material used to support the evaluations.

Task Team members and their organizations are listed below. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	Representing[10]	Employer
L. Bradford Barringer	AGC	BRS, Incorporated
Ronald J. Boes	Gas Utilities	Indiana Gas
Dan Bradley, Co-Chairperson	NULCA	STS, Incorporated
Randy Burke, Co-Chairperson	API	Chevron Pipe Line Company
Rod Elms		UTI
Aydren D. Flowers	State Regulators	NC Dept. of Transportation
Bobby Haney	AGA	Reliant Energy-ENTEX
Kelly Hardy	OCSI	Utilities Protection Center, Inc. of Georgia
Tom Jackson	Electric Utilities	GA Power
Orlando Jerez	State Regulators	Utah Dept. of Transportation
Dan Knight	NTDPC	U S West
Keith G. Leewis	INGAA	Gas Research Institute
Joe Maresca		Vista Research, Incorporated
Gary L. McKay	Electric Utilities	Detroit Edison
Charles E. Moore	AGA	ENTEX
Bob Nighswonger		Utility Technical Services
Jerry Palmer	NULCA	RadioDetection Corporation
James Pfeiffer	NULCA	Sub-Site
Leroy Schoon	AGC	Schoon Construction, Inc.
Greg Strudwick	NUCA	Line One, Inc
Steven T. Theis	NUCA	Henkels & McCoy Contractors, Inc.
Buddy Waugh	NTDPC	GTE Network Services
Lynn Whitford	DOT	OK Dept. of Transportation
Henry Wyche	AAR	Norfolk Southern Corporation

[10] See Appendix D for a detailed list of acronyms.

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	Representing	Employer
Mike McDonald, Linking Team Liaison	EEI/AEI	Arizona Public Service
Guy (Skip) McIntosh, Linking Team Liaison	NULCA	Byers Locate Services, LLC
John Walko, Steering Team Liaison	NULCA	Excavac Corporation

4.4 BEST PRACTICE IDENTIFICATION AND EVALUATION PROCESS

The Task Team compiled a list of candidate best practices at the initial Task Team meeting. Additional practices were added to this list as new members joined the team and as members received input from their constituent organizations. Team members that were unable to attend meetings submitted candidate practices in writing via fax or E-mail.

In the course of discussions at Task Team meetings, the Team identified issues related to locating and marking and other areas of underground damage prevention. The issues were addressed according to the following steps:

1. If the issue was related to locating and marking, then the list of candidate best practices compiled by the team was reviewed to determine if the issue was addressed by one of the practices on the list.

2. If a locating and marking issue was not addressed by a candidate best practice, then the Team defined a candidate best practice to address the issue.

3. If a locating and marking issue was addressed by a candidate best practice already on the Task Team list, then no further action was taken.

4. If the issue was primarily related to another area of damage prevention, then the issue was referred to the specific Task Team that focused on that area. Communication with the relevant Task Team was carried out by documenting the referred issues in the Locating and Marking Team meeting summaries and by the Locating and Marking Team's Linking Team liaison.

Following the initial identification of practices and evaluation of issues, the candidate best practices were assigned to team members who served as practice advocates. The practice advocates were responsible for preparing material to support the selection of best practices. This material was distributed to the Task

Team and served as the basis for the discussion and evaluation of the practices. The candidate practices were evaluated according to the following selection criteria:

1. Probability of Damage Reduction - Does performance of the practice reduce the probability of damage to underground facilities during excavation?

2. Feasibility - Is performance of the practice feasible from a cost and technological standpoint?

3. Public Safety - Does performance of the practice promote the safety of the public?

4. Employee Safety - Does performance of the practice promote the safety of locator and excavator personnel?

5. Conformance with Existing Standards - Is the practice compatible with standards that have been established for the locating process?

Initially, group consensus was reached on seven best practices on the basis of the material already developed by the practice advocates. Provisional group consensus was reached on an additional ten best practices; however, further work was considered necessary on the definitions and descriptions of these practices in order for the provisional consensus to be maintained. Additional descriptive material was developed by the practice advocates and was subsequently reviewed by the Task Team. This review resulted in changes to the definition and description of the best practices to preserve the group consensus.

4.5 FINDINGS

4.5.1 Consensus Best Practices

The following sections present the best practices selected by Task Team consensus. Each practice is defined and the evaluation of the practices according to the Team's selection criteria is presented.

1. Locators utilize available facility records at all times.
2. If a facility locator becomes aware of an error or omission, then the facility locator provides information for updating records that are in error or to add new facilities.
3. A uniform color code and set of marking symbols is adopted nationwide.
4. A single locator is used for multiple facilities.
5. Locators are properly trained. Locator training is documented.
6. Locates are performed safely.
7. A visual inspection is completed during the facility locating process.
8. Facilities are adequately marked for conditions
9. Positive response is provided to facility locate requests.
10. Multiple facilities in the same trench are marked individually and with corridor markers.
11. Information on abandoned facilities is provided when possible.

12. When locating electro-magnetically, active/conductive locating is preferable to passive/inductive locating.
13. The facility owner/operator is identified.
14. Communication is established between all parties.
15. Documentation of work performed on a locate is maintained.
16. A damaged facility is investigated as soon as possible after occurrence of damage.
17. Forecasting/Planning for Predictable Workload Fluctuations. A plan is developed for dealing with unpredictable fluctuations.

1. Locators utilize available facility records at all times.

Practice Description: Facility locators use available records at all times. Facility records indicate approximate location, number of facilities and access points for buried facilities within a requested area. The use of facility owner/operator supplied records is an effective method of identifying facilities as part of the locating process.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: High.
2. Feasibility (cost): Cost will be minimal, limited to providing records to field personnel.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Meets current accepted industry standards.

2. If a facility locator becomes aware of an error or omission, then the facility locator provides information for updating records that are in error or to add new facilities.

Practice Description: During the course of a locating activity, a locator may become aware of errors or omissions. Methods are in place to notify a facility owner/operator of that error or omission. The corrections are submitted to the appropriate person or department in a timely manner. The method of notification is determined by the facility owner/operator and includes the following information:

- Name (and company if contracted),
- Contact phone number of the individual(s) submitting change,
- Location (either address or reference points),
- Size and type of facility,
- Nature of the error or omission, and
- Sketch of the change in relation to the other facilities.

Omissions and errors may occur due to misdrawn records, changes during construction at the job site, repair or abandonment of facilities and delays in posting new records. Failure to note errors or omissions when found could result in damages to the facility at a later date.

The 1994 NTSB Excavation Damage Prevention Workshop stated: "facility operators should be required to update maps when excavation finds errors in the mapping system."[11]

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes.
2. Feasibility (cost), where technologically feasible: Minimal; cost of manpower to review and update existing records.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: While not practiced as an industry standard, this would fall under the mandate of state laws requiring accurate records of underground facilities.

3. A uniform color code and set of marking symbols is adopted nationwide.

Practice Description: A national standard is adopted defining color specifications relevant to facility type. The specifications could be similar to the accepted NULCA[12] or APWA[13] standards. The December 1997 National Transportation Safety Board safety report[14] cites the use of the APWA/ULCC color code as the model example.

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[11] National Transportation Safety Board, 1995. *Proceedings of the Excavation Damage Prevention Workshop; 1994 September 8-9; Washington, DC*, Report of Proceedings NTSB/RP-95/01 (pp.177-178), Washington, DC.

[12] National Utility Locating Contractors Association, 1998. *Underground Facility Marking Standards,* Spooner, WI.

[13] American Public Works Association, 1999. *Guidelines for Uniform Temporary Marking of Underground Facilities*.

[14] National Transportation Safety Board, 1997. *Protecting Public Safety through Excavation Damage Prevention*, Safety Study NTSB/SS-97/01 (pp. 25-26), Washington, DC.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: High. A national standard alleviates any question of "what stands for what" for excavators working in multiple regions across the country.
2. Feasibility (cost): Minimal. Outside of public awareness education, costs are low. Most states/regions have already adopted the APWA standard.
3. Public Safety: Yes. A national standard would reduce errors associated with misinterpreting locate marks.
4. Employee Safety: Yes - indirectly. Proper interpretation of locate marks will result in a safer job site.
5. Conformity to Existing Practices: Yes. The color codes of the APWA/ULCC are widely accepted as the industry standard.

4. A single locator is used for multiple facilities.

Practice Description: This practice is employed when determined to be advantageous by the facility owner/operator. The use of a single locator to mark multiple facilities may provide several advantages to both the facility and the excavating communities. Among these advantages are:

- more responsive service to the excavation community,
- better communication with the excavating community (fewer points of contact),
- improved safety due to less traffic on the road,
- improved worker safety,
- reduced environmental impact, and
- maps of multiple facilities.

It should be noted that this best practice does not suggest that all facilities be located by a single locator, but rather that conditions exist in which locating multiple facilities with a single locator will reduce the likelihood of errors and resulting damage (e.g., multiple facilities with the same owner or multiple facilities that are marked with the same or similar color codes). This practice has been employed by a facility owner in Michigan to enhance safety.

The use of a single locator to locate multiple facilities is analogous to the use of one-call systems to handle locate requests from excavators. The use of a one-call system allows locate requests for multiple facilities at an excavation site to be issued through a single point of contact, simplifying communications. The use of a single locator to carry out locate requests for multiple facilities further simplifies communications, with fewer links needed between excavator and locator.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes.
2. Feasibility (cost): Lower administration, operating and exposure costs.
3. Public Safety: Yes.
4. Employee Safety: Yes.
7. Conformance with Existing Standards: Increasingly becoming the standard in practice around the industry.

5. Locators are properly trained. Locator training is documented.

Practice Description: Minimum training guidelines and practices are adopted for locator training. These guidelines and practices include the following:

- Understanding System Design/Prints/Technology
- Understanding Construction Standards and Practices for all Types of Facilities
- Equipment Training and Techniques
- Plant Recognition Training
- Theory of Locating
- Daily Operations
- Facility Owner/Excavator Relationships and Image
- Safety Procedures Per OSHA Regulations/Federal, State and Local Laws
- Written and Field Testing
- Field Training
- Annual Retesting.

The NULCA *Locator Training Standards and Practices*[15] represent an accepted model within the locate industry.

Documentation of all training is maintained to ensure that facility locators have been properly trained.

[15] National Utility Locating Contractors Association, 1996. *Locator Training Standards and Practices*, Spooner, WI.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes. Locating by a knowledgeable and well trained locator is less likely to lead to errors. Fewer errors, in turn, results in a lower likelihood of damages.
2. Feasibility (cost): Implementation of an effective training program; including trainers, materials and testing costs.
3. Public Safety: Yes.
4. Employee Safety: Yes, locators trained in current federal, state and local safety regulations would have a reduced risk of injury.
5. Conformance with Existing Standards: Yes, NULCA and industry standards.

6. Locates are performed safely.

Practice Description: It is the responsibility of the owner/operator and locator to establish when and how the underground facility will be identified. All hazards associated with a performing a locate are identified. Appropriate measures conforming to federal, state, local and industry standards are established. Employees are made aware of these hazards and properly trained in worker safety standards.

A. Pre-Work Safety Considerations

1. Site Background Data. Site information is gathered to determine hazards, exposures, and/or other potential safety problems that might be encountered in connection with on-site locate work. This information may be gathered from the facility records and from visual inspection.

2. Site Familiarization. Site characteristics which could affect locate work are analyzed. Areas to be considered include:

   a. Obstructions. The site is analyzed to determine if physical obstructions are present on the property which would make locate work unsafe. Means for working around such obstructions are defined.
   b. Traffic. Vehicular arteries (highways, roadways, railways, etc.) at the work site are identified to determine if such traffic would pose any safety hazard to locating the site.
   c. Physical Site Conditions. Soil conditions and other factors (such as trenches, pits, bores, standing water, etc.) that could affect the safety of the job site are identified. Methods are developed to identify and safely work around these hazards.

3. External Resources. Information is gathered about safety-related resources that might be required in the event of an accident or other problem (such as an employee illness). Information needed includes location and contact information

for nearest hospital, fire department, police department, and any other public emergency response organization. In addition, access routes and travels plans to emergency response facilities are defined.

4. Work Plan. A work plan in which procedures, employee roles, equipment requirements, time requirements, and other factors are considered is developed to define the most efficient means for safely accomplishing required locate work. This work plan considers all of the safety related information developed in connection with items #2 and #3.

5. Job Briefing. Information developed as discussed in preceding items #1 through #4 is used to conduct a job briefing prior to commencement of on site locate work. The job briefing focuses on safety aspects of the required work.

B. Locate Work Safety Considerations

1. Personnel Protection. Watchman/lookout capabilities are provided to ensure the safety of personnel in cases where locate work requires that working individuals disrupt traffic flow or otherwise occupy hazardous positions. All working individuals wear proper safety attire. Such attire provides for adequate visibility of the worker and personal protection against hazards.

2. Equipment. All equipment used in connection with locate work is suitable for the intended uses. Items such as ladders, electrical test devices, and other instruments and items are inspected from a safety perspective prior to use. Safety features such as locking devices, grounding, insulation, etc., are thoroughly inspected.

3. Exposures. In cases where locate work requires personnel to enter into spaces with potentially unsafe conditions, appropriate testing is accomplished prior to entry. During times when such spaces are occupied, adequate monitoring and/or ventilation devices are present and properly operating during occupancy.

4. Work Activities. All locate work activities are conducted with safety given first priority. All employees are thoroughly trained and briefed regarding safety measures such as minimizing exposures to potentially hazardous conditions, avoiding unnecessary risks, and giving priority to personal safety.

C. Post Work Safety Considerations

1. Termination of Work Activities. After locate work is completed, the site is restored and left in such a condition that no safety hazards associated with the locate work activities remain. All personnel and equipment utilized in connection with the work are accounted for and no unsafe conditions remain at the site. Any safety-related equipment used in connection with the work is returned/restored to pre-work status.

2. Debriefing. After completion of locate work, a debriefing safety review of work activities is conducted. This review is conducted with the objective of looking at the safety aspects of all involved work practices as necessary to see where unnecessary exposures may have occurred and where improvements could be made.

Evaluation According to Selection Criteria:

1. Probability of damage reduction: Minimal.
2. Feasibility (cost): Minimal - Included in employee training.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with existing standards: Meets current industry standards.

7. A visual inspection is completed during the facility locating process.

Practice Description: This inspection includes the following:

- all facilities within a facility owner/operator's service area (to evaluate the scope of the locate request),
- identification of access points,
- identification of potential hazards, and
- assurance that plant facilities shown on records match those of the site.

The primary reason for a visual inspection is to determine if there are facilities placed that are not on record. It is very important that visual inspections be completed in areas of new construction, where records may not indicate the presence of a facility. The visual inspection is necessary because the time it takes for a facility placed in the field to be placed on permanent records varies by facility owner/operator and location. Evidence of a facility not on record includes, but is not limited to, poles, dips, enclosures, pedestals (including new cables found within the pedestals), valves, meters, risers, and manholes.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes.
2. Feasibility (cost): Minimal.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: No standard set.

8. Facilities are adequately marked for conditions.

Practice Description: Facility locators match markings to the existing and expected surface conditions. Markings may include one or any combination of the following: paint, chalk, flags, stakes, brushes or offsets. All marks extend a reasonable distance beyond the bounds of the requested area.

Proper training for all facility locators includes properly identifying the varying surface and environmental conditions that exist in the field and what marking methods should be used. Conditions which may affect markings are rain, snow, vegetation, high traffic, construction, etc.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes.
2. Feasibility (cost): Cost to mark facilities will increase. However, this will be offset by the reduction in damages and in the reduction in return trips to the job site due to destroyed marks.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Conforms to existing NULCA Standards and accepted industry standards.

9. Positive response is provided to facility locate requests.

Practice Description: All facility locate requests result in a positive response from the facility owner/operator to the excavator. A positive response may include one or more of the following: markings or documentation left at the job site, callback, fax, or automated response system.

A positive response allows the excavator to know whether all facility owners/operators have marked the requested area prior to the beginning of the excavation.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes. Any establishment or relaying of information between a locator and an excavator lessens the chances for miscommunication and, subsequently, lessens potential facility damages.
2. Feasibility (cost): The method of providing positive response may be established to be cost-effective for the specific situation involved in the locate request.
3. Public Safety: Yes. Any open lines of communication between an excavator and a locator should result in less potential for facility damages, ensuring an increased level of public safety.
4. Employee Safety: Unknown. While no direct result on a locator's level of job safety can be seen, it does not adversely affect their working environment.
5. Conformance with Existing Standards: Yes. Most states have implemented positive response systems and have made their use mandatory through legislation.

10. Multiple facilities in the same trench are marked individually and with corridor markers.

Practice Description: In general, the number of lines marked on the surface equal the number of lines buried below. "All facilities within the same trench should be individually marked and identified. In situations where two facilities share the same color code (such as telephone and CATV) both facilities should be identified and the marks placed parallel, but with enough separation so that they may be readily identified." [16] In circumstances where the total number of lines buried in the same trench by a single facility owner/operator may not be readily known, a corridor marker is used. The corridor mark indicates the width of the facility.

Evaluation According to Selection Criteria:

1 Probability of Damage Reduction: Yes, a standard for marking multiple facilities in the same trench will help eliminate excavator confusion and lessen the chances of a facility damage.
2. Feasibility (cost): Nominal.
3. Public Safety: Yes. Improved awareness of what is below the surface will reduce damages and increase public safety.
4. Employee Safety: No effect seen on employee safety.
5. Conformance with Existing Standards: Yes. Many states have adopted some method of identifying multiple facilities in the same trench.

[16] National Utility Locating Contractors Association, 1998. *Underground Facility Marking Standards,* Spooner, WI.

11. Information on abandoned facilities is provided when possible.

Practice Description: When the presence of an abandoned facility within an excavation site is known, an attempt is made to locate and mark the abandoned facility. When located or exposed, all abandoned facilities are treated as live facilities. Information regarding the presence or location of an abandoned facility may not be available because of updating or deletion of records. In addition, the process of abandoning an existing facility, damage to an abandoned facility, or limited or non-existing access points may render an abandoned line non-locatable.

It should be emphasized that recommendation of this practice is *not* an endorsement of the maintenance of records for abandoned facilities.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes. The more facilities located, whether abandoned or not, lessens the chances of live facilities being damaged.
2. Feasibility (cost): Slight additional cost, offset by reduced damages and responses to damaged abandoned lines by repair crews.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Yes. Many states already require the location of abandoned facilities.

12. When locating electro-magnetically, active/conductive locating is preferable to passive/inductive locating.

Practice Description: The preferred method of actively applying a signal onto a facility is to use direct connection. Direct connection is the process of connecting a direct lead from the transmitter to the target facility, and connecting a ground lead from the transmitter to a ground point in order to complete a circuit. This process provides the strongest signal on the line and is less likely to "bleed over" to adjacent facilities than other methods of applying a signal. This method allows a greater range of frequency and power output options. It is good practice to use the lowest frequency possible at the lowest power output possible to complete the locate.

If direct connection is not possible, use of an induction clamp (coupler) is the most effective method of applying a locate signal onto the target conductor. This method is more limiting for the choices of frequency and power outputs than direct connection. Using an induction clamp is not as effective at transmitting a signal as direct connection, can only be used within certain frequency ranges, and must use a higher power output.

The least preferred method is induction or broadcast mode on a transmitter. This usually results in a weak signal that will "bleed over" to any conductor in the area.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes. Establishing best methods of locating facilities assures greater accuracy and reduced damages.
2. Feasibility (cost): Nominal, possibly additional training of locators.
3. Public Safety: Yes.
4. Employee Safety: Yes. Proper knowledge of how to connect to a facility should reduce the risk of injury.
5. Conformance with Existing Standards: Yes. Conforms to standards and practices within the locate industry and manufactures guidelines.

13. The facility owner/operator is identified.

Practice Description: When feasible, the owner/operator of a facility is identified by markings at the time the facility is located. This practice facilitates a positive response for all facilities within the requested area.

The NULCA Marking Standards recommends "In situations where two facilities share the same color code (such as telephone or CATV) both facilities should be identified. . . ." [17]

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes. Establishing a positive response avoids confusion with excavator, all of which contributes to damage prevention.
2. Feasibility (cost): Nominal, slight increase in time to identify facility owner.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Yes. Conforms to standards and practices within the locate industry.

14. Communication is established between all parties.

Practice Description: One-call centers, facility owners/operators, and excavators all have clearly defined processes to facilitate communication between all parties. If the complexity of a project or its duration is such that a clear and precise understanding of the excavation site is not easily conveyed in writing on a locate request, then a pre-location meeting is scheduled. This pre-location meeting is on-site to establish the scope of the excavation. Written agreements between the excavator(s) and the locator(s) include:

[17] National Utility Locating Contractors Association, 1998. *Underground Facility Marking Standards,* Spooner, WI.

- date,
- name,
- company,
- contact numbers for all parties,
- a list of the areas to be excavated,
- a schedule for both marking and excavating the areas, and
- any follow up agreements that might be necessary.

Any changes to the areas that are to be located are in writing and include all parties responsible for the excavation and marking of the excavation sites. Locators also schedule meets if the complexity of the markings requires further explanation.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes, better communication will reduce confusion and increase cooperation between excavator and locator.
2. Feasibility (cost): Minimal; additional time spent with excavators may be offset by more even distribution of work on large projects made possible by written agreements.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Yes, many states already have criteria established for the scheduling of meets prior to locating work areas.

15. Documentation of work performed on a locate is maintained

Practice Description: A facility locator always documents what work was completed on a locate request. This assists in the locate process by making a locator review what was located and then verify that all facilities within the requested area were marked. Careful documentation helps ensure that there is an accurate record of the work that was performed by the locator and helps eliminate confusion over what work was requested by the excavator.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes, proper documentation establishes accountability for performing locate work accurately. If locates are accurate, the likelihood of damage is reduced.
2. Feasibility (cost): Minimal; this is currently the practice for most companies.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Yes, locators generally perform some type of documentation.

16. A damaged facility is investigated as soon as possible after occurrence of damage.

Practice Description: Any time a damage occurs, a proper investigation is performed. This is to determine not only the responsible party but also the root cause of the damage. The information gathered from damage investigations is essential in preventing future damages.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes, information can be used to help prevent future damages.
2. Feasibility (cost): Minimal. Any cost is offset by the ability to prevent future damages.
3. Public Safety: Yes.
4. Employee Safety: Yes.
5. Conformance with Existing Standards: Yes, most locators and facility owner/operator companies perform damage investigations.

17. Forecasting/Planning for Predictable Workload Fluctuations. A plan is developed for dealing with unpredictable fluctuations.

Practice Description: Facility owners/operators and/or their representatives develop methods to sufficiently forecast and plan for future workloads in order that ticket requests may be completed in a timely manner. This will ensure that adequate personnel and equipment will be available to complete all locate requests.

It should be noted that this practice does not involve limiting the number of one-call requests from excavators.

Evaluation According to Selection Criteria:

1. Probability of Damage Reduction: Yes. The ability to plan for workloads means that potential shortages in equipment and manpower will be avoided and all requested locates can be completed within the prescribed time limit.
2. Feasibility (cost): Minimal (dependent on number of changes); most changes are procedural. Some cost savings may actually be achieved because of better forecasting and manpower utilization.
3. Public Safety: Yes.
4. Employee Safety: Yes. Adequate personnel to cover the workloads means the locators will not be working beyond their normal work hours. This reduces the chances of fatigue and errors.
5. Conformance with Existing Standards: Yes. Many facility owners/operators and locate companies already use forecasting to predict future manpower and equipment needs.

4.5.2 Candidate Practices not Adopted by Consensus

The Task Team discussed and evaluated twenty-nine candidate best practices. Seventeen practices were designated best practices by Task Team consensus, as noted above. Four practices were combined with others in the consensus best practice list. The Team did not reach consensus that the remaining eight candidates were Locating and Marking best practices. In some of these cases, the Team concluded that the practice was more appropriate for consideration by one or more of the other Task Teams. The eight practices that did not receive Team consensus are listed below. The Team recommended these practices should be considered by a different Task Team(s). The recommended Task Team(s) to consider the practice is indicated in parentheses:

1. Mark new facilities at time of installation/construction (Excavation, Mapping);
2. Adequate hand-dig buffer zone (Excavation, Compliance);
3. Potholing when necessary (Excavation);
4. Definite size of locate request (One-Call);
5. Utilizing best available technology (e.g., locating instruments, vacuum excavating equipment, ticket tracking and management software) (Emerging Technologies);
6. Drug testing of employees (Compliance);
7. Identify facilities installed using directional boring; accurate records of type of installation (Excavation, Planning and Design, Mapping); and
8. Permanent markers (Planning and Design).

4.6 TASK TEAM ISSUES

The process followed by the Task Team for identifying Locating and Marking best practices, as described in Section 4.4, included the consideration of issues at Task Team meetings. The Team determined that the following issues were either addressed by a candidate locating and marking best practice or could not be addressed by a current practice.

1. Conflicting state laws,
2. Unlocatable facilities (depth),
3. Inaccurate or no records,
4. Common grounding,
5. Fluctuating workloads,
6. Locating for design/engineering,
7. Maintenance of marks,
8. Determining life of marks,
9. Reporting depth,
10. Facilities installed with directional boring, and
11. Marking/removal of marks after damage.

In addition, the Team identified issues related to damage prevention that were more pertinent to one of the other Task Team focus areas, rather than locating and marking. Those issues are listed below, along with the Task Team(s) they relate to.

1. Lag time between construction and mapping (Mapping),
2. Facility owners/operators area definition (Mapping and One-Call),
3. Workload fluctuations (One-Call),
4. Limit to size of locate request (One-Call),
5. White-lining (Excavation),
6. Locate request clarity/standardization (One-Call),
7. Overlapping one-call center coverage (One-Call),
8. Establish plan for facility protection during construction (Planning and Design),
9. Avoid excessive depth (Planning and Design, Excavation),
10. Excavators should report to facility owners/operators any errors found in records and any new facilities (Excavation), and
11. Records need to be updated if errors are found by locators or excavators (Reporting and Evaluation, Compliance).

4.7 MEASURING IMPROVEMENTS

To measure whether the best practices result in improvements, baseline statistics should be established. These baseline statistics could then be compared to changes that may occur over time as these best practices are implemented. Once a standard set of reference data has been established, methods should be in place to track, store, and report data in a useful and timely manner. All data should be reviewed at regular intervals to determine whether improvements have resulted from the best practices and, if possible, identify which best practices were most effective. These statistics could be found within the DOT, one-call centers, trade organizations, facility owner/operator company published statistics, and industry research groups.

Data that could be used for the baseline statistics and for tracking over time includes:

- U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety (damages to pipeline systems);
- Network Reliability Steering Committee (damages to fiber optic/carrier cables);
- Federal Aviation Administration (damages to air traffic control system communications cables);
- Bellcore (damages to fiber optic and carrier cables);
- One-call centers (complaints from excavators and facility owners/operators; number of recalls);
- Gas Research Institute (damages to pipeline systems); and
- Insurance Industry Data Bases (damages to gas, water, electrical, and communications systems).

4.8 PATH FORWARD

The Task Team reached consensus that the following actions could be important to further promote the prevention of damage to underground facilities. Unlike the best practices included in Section 4.5, the following actions are not necessarily current practices. They represent the Task Team's suggestions for desirable future actions.

1. It is important for the Task Team to maintain involvement to preserve the integrity and intent of this Locating and Marking chapter of the Best Practices Report.

2. Continue development and commercialization of locating technology, improving accuracy, including depth (e.g., GPR, Defense Department imaging technology, GPS).

3. Develop grants dedicated to the improvement of locating technology.

4. Improve the accuracy of records, including the use of:

   - A common data base,
   - GPS, and
   - other evolving technologies.

5. Improve the accuracy of information provided on a locate request, including the use of:

   - A common data base,
   - GPS, and
   - other evolving technologies.

6. Establish a real-time link between excavator and specific locator (e.g., radio, cell phone).

7. Develop an automated system for providing information to facility owners/operators to correct errors or omissions in facility records.

8. Promote the development and use of biodegradable marking flags and paint.

9. Promote the development and use of intelligent marking systems for underground facilities.

10. Develop and apply methods for identifying unknown infrastructure.

11. Automate documentation of locate performed (e.g., using GPS).

12. Encourage the formation of "Utility Coordinating Committees," "Damage Prevention Committees," etc., to improve communications among stakeholders.

13. Tie due dates for completing locates to the actual excavation start date.

4.9 ACKNOWLEDGMENTS

The Task Team would like to acknowledge the work of Morgan Abele of STS, Inc., whose efforts were instrumental in completing this chapter.

CHAPTER 5
Excavation Task Team Best Practices

5.1 CHAPTER SUMMARY

The United States is experiencing one of the largest economic expansions in history. New facilities must be put in place to meet the growing need of everyday services that industry and the general public rely on. New roads must be built to handle increased traffic. New cables, pipelines, sewers and other utility lines must be installed to handle increased volumes. Old facilities that are undersized, deteriorated or of old technology need to be upgraded. All of these require excavation, safe excavation.

There are hundreds of thousands of miles of underground facilities in the United States. Many of these are potentially dangerous or even deadly to the excavator that might hit them accidentally when excavating. This includes danger to professional excavators, homeowners, and others. The importance of safe excavation practices cannot be overstated. In addition to the safety hazards encountered when excavating around buried facilities, there are serious potential service outages that could occur if a facility is damaged or severed. Critical emergency services, general aviation, and transactions among financial institutions are just a few. The homeowner and many hundreds of others are affected by the loss of those services.

The Excavation Practices Task Team identified and described practices used during excavation of, and around, underground facilities. Those practices can contribute to the reduction in the possibility and/or severity of damages or intrusions to those facilities.

The Excavation Team focused on the practices used during the various phases of an excavation project that would contribute to minimizing or preventing damage to underground facilities and promote safety for all personnel working within the excavation area. The Team broke these practices into the following categories:

Project Preparation

1. One-Call Facility Location Request.
2. White Lining.
3. Locate Reference Number.
4. Pre-excavation Meeting.
5. Facility Relocations.
6. Separate Location Requests.
7. One-Call Access (24x7).
8. Positive Response.

On-Site Preparation/Ground Breaking

9. Facility Owner/Operator Failure to Respond.
10. Locate Verification.
11. Documentation.
12. Work Site Review with Company Personnel.
13. One-Call Reference Number at Site.
14. Contact Names and Numbers.
15. Facility Avoidance.

On-Going Excavation

16. Federal and State Regulations.
17. Marking Preservation.
18. Excavation Observer.
19. Excavation Tolerance Zone.
20. Excavation Within the Tolerance Zone.
21. Mis-Marked Facilities.
22. Exposed Facility Protection.
23. Locate Request Updates.
24. Facility Damage Notification.
25. Notification of Emergency Personnel.
26. Emergency Excavation.
27. Backfilling.

Project Completion

28. As-Built Documentation.

Implementation of these practices by any individual, company, or other excavating organization would greatly reduce damages to underground facilities, injuries to excavating personnel, injuries of the public at large, and damage to private and public property.

5.2 BACKGROUND AND MOTIVATION

5.2.1 Excavation Mission Statement

The mission of the Excavation Team was to identify and describe preventive and safe practices for the construction and maintenance of, and around, buried facilities. The Team attempted to provide a collection of practices in the full range of underground excavation activities, including initial project preparation, on-site preparation/breaking ground, on-going excavation procedures, and project restoration/completion.

5.2.2 Goals

The goals of the Excavation Team were to:

1. Identify actual practices that can be used to minimize the potential of damage to underground facilities during the excavation process.

2. Encourage partnerships between the facility owners/operators, excavators, one-call centers and locators.

5.3 TEAM MEMBERS

The Excavation Team was composed of representatives from one-call centers, excavators, locators, facility operators, trade associations, and federal and state government agencies. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	**Representing**[18]	**Employer**
Nathan Beil	ARTBA	KCI Technologies
Fred Boley	INGAA	Southern Natural Gas
Deborah Clark	NUCA	C & B Associates II, Ltd.
Jack Connolly	NCTA	Cox Cable
Roy Dahl	AAR	BNSF Railway
Walter Gainer, Co-Chairperson	NUCA	W. F. Wilson & Sons, Inc.
James Geromette	NULCA	MichCon, Coolidge Region
Corky Hanson	State Governments	Arizona Corporation Commission
Jim Harrison, Co-Chairperson	NUCA	Pauley Construction
George Kennedy	NUCA	NUCA
Max Nichols		Jomax Construction Co.
Terry Pollak	NTDPC	Ameritech
Melanie Powers	AGA	Columbia Gas of Ohio

[18] See Appendix D for a detailed list of acronyms.

Team Member (cont.)	**Representing** (cont.)	**Employer** (cont.)
Scott Sands	U.S. DOT	FHWA, Colorado Division
Gary Schulman	NTDPC	Bellsouth
Charlie Scott		SubSite Electronics
Tom Shimon	OCSI	Kansas One-Call Systems, Inc.
David Spangenberg	States' DOT	Michigan DOT
Loren Sweatt	AGC	AGC
Jeff Vaughter	AGC	Craft Construction Co. of Starr

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	**Representing**	**Employer**
Chuck Cohen, Emerging Task Team Liaison	NUCA	Tires N Tracks, Inc.
Rich Maxwell, Linking Team Liaison	Independent Contr.	A & L Underground, Inc.

5.4 DATA COLLECTION AND EVALUATION PROCESS

5.4.1 Information Sources

The Task Team drew heavily on the collective experience and expertise of its Team members. Team members solicited opinions from their affiliated or sponsoring organizations and brought those diverse points of view to the discussions and evaluations in the Task Team meetings. Various state one-call laws, federal regulations, industry standards, company guidelines and operating practices, and other documents were reviewed and referenced during the Task Team's efforts. Some specific sources included:

- Occupational Safety and Health Administration (OSHA) Subpart P - Excavation Standard 29 CFR 1926.651.
- CNA, "Minimum Damage Prevention Guidelines" (August 1998).
- National Transportation Safety Board (NTSB), "Protecting Public Safety Through Excavation Damage Prevention" (1997).
- American Public Works Association (APWA), "Guidelines for Uniform Temporary Marking of Underground Facilities."

- Telecommunications Industry Association and Electronic Industry Association (TIA/EIA), "Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant" (ANSI/TIA/EIA-590-A-1996).

5.4.2 Process for Collecting Information

Excavation Task Team members brought forward issues and practices based on their professional experience. In addition, input was collected from peers, various professional and industry organizations, other Task Teams, and from the general public through the OCSS Information System on the Internet. A Task Team member volunteered to research each issue and provided objective information about that issue for Team discussion.

5.4.3 Process for Selecting Issues

Using an outline developed by the Linking Team, the Excavation Team brainstormed and identified issues and candidate practices early in its initial meeting. After that initial meeting, Team members went to their various constituencies for input. In consideration of feedback received, items were reworked and external input was again solicited. Members actively interacted with their peers to discuss the issues and practices identified as part of this Study.

5.4.4 Process for Evaluating Practices

The Excavation Task Team developed the following criteria to determine which practices should be considered as best practices:

1. Best practices must be actual activities that are being used somewhere and could be documented. Industry standards, company policies and procedures, federal/state/local regulations and various other sources can be used to review and document issues and practices.

2. Best practices must be practical and cost effective with current technology.

3. Best practices must be considered reasonable by the majority of the constituency that would be asked to implement the practices.

5.5 ISSUES IDENTIFIED

The Excavation Team identified and evaluated many issues related to damage prevention during the actual excavation process. In almost all cases, best practices were developed to address those issues.

The Excavation Team identified one issue that was discussed at several of the Team's meetings but that has not been resolved. That issue is "Depth Requirements." Due to the complexity and controversial aspects of the issue, the Task Team determined there was insufficient time to reach a consensus on any potential

best practices. The Team did reach consensus that this is an important issue and that further discussion and development work is warranted.

5.6 FINDINGS

The best practices for excavation have been divided into four phases of the excavation project: Project Preparation, On-Site Preparation/Breaking Ground, On-going Excavation Procedures, and Project Restoration/Completion. The Task Team agreed on the following best practices:

Project Preparation

1. One-Call Facility Locate Request.
2. White Lining.
3. Locate Reference Number.
4. Pre-Excavation Meeting.
5. Facility Relocations.
6. Separate Locate Requests.
7. One-Call Access (24x7).
8. Positive Response.

On-Site Preparation/Ground Breaking

9. Facility Owner/Operator Failure to Respond.
10. Locate Verification.
11. Documentation of Marks.
12. Work Site Review with Company Personnel.
13. One-Call Reference Number at Site.
14. Contact Names and Numbers.
15. Facility Avoidance.

On-Going Excavation

16. Federal and State Regulations.
17. Marking Preservation.
18. Excavation Observer.
19. Excavation Tolerance Zone.
20. Excavations within Tolerance Zone.
21. Mis-Marked Facilities.
22. Exposed Facility Protection.
23. Locate Request Updates.
24. Facility Damage Notification.
25. Notification of Emergency Personnel.

26. Emergency Excavation.
27. Backfilling.

Restoration/Completion

28. As-Built Documentation.

5.6.1 Project Preparation

1. One-Call Facility Locate Request

Practice Statement: The excavator requests the location of underground facilities at each site by notifying the facility owner/operator through the one-call system. Unless otherwise specified in state law, the excavator calls the one-call center at least two working days and no more than ten working days prior to beginning excavation.

Practice Description: Currently 48 states have passed one-call legislation and have established one-call notification systems recognizing that excavation performed without prior notification poses a risk to public safety, excavators, the environment, and disruption of vital services provided by facility operators. Increased participation in this one-call notification system provides for improved communication between excavators and facility operators necessary to reduce damage. Laws in 41 states call for a minimum of 2 days prior and laws in 16 states call for no more than 10 days.

Reference:
Existing state laws, including Ohio and West Virginia.

2. White Lining

Practice Statement: When the excavation site can not be clearly and adequately identified on the locate ticket, the excavator designates the route and/or area to be excavated using white pre-marking prior to the arrival of the locator.

Practice Description: The route of the excavation is marked with white paint, flags, stakes, or a combination of these to outline the dig site prior to notifying the one-call and before the locator arrives on the job. Pre-marking allows the excavators to accurately communicate to facility owners/operators or their locator where excavation is to occur. The 1997 safety study "Protecting Public Safety Through Excavation Damage Prevention" by the NTSB reached the conclusion that pre-marking is a practice that helps prevent excavation damage. Maine was one of the first states to have mandatory pre-marking for non-emergency excavations. Connecticut has also adopted a pre-marking requirement; however, the law provides for face-to-face meetings between operators and excavators on projects that are too large for or not conductive to pre-marking. Facility owners/operators can avoid unnecessary work locating facilities that are not associated with planned excavation.

Reference:
Existing state laws, including California, Missouri, New Jersey and others.

3. Locate Reference Number

Practice Statement: The excavator receives and maintains a reference number from the one-call center that verifies the locate was requested.

Practice Description: All calls from excavators processed by the one-call center receive a unique message reference number, which is contained on all locate request messages. The excavator records this number; it is proof of notification to the members. The computer generated request identifies the date, time, and sequence number of the locate request.

Each locate request ticket (notification) is assigned a unique number with that one-call center, the requestor and the facility owner/operator. This number separates this ticket from all other tickets so that it can be archived and recalled upon request with the details of that request only.

References:
- Existing state laws, all 50 states have one-call centers and/or state statues.
- Existing operating procedures from various states one-call centers.

4. Pre-Excavation Meeting

Practice Statement: When practical, the excavator requests a meeting with the facility locator at the job site prior to the actual marking of facility locations. Such pre-job meetings are important for major, or unusual, excavations.

Practice Description: The meeting will facilitate communications, coordinate the marking with actual excavation, and assure identification of high priority facilities. An on-site pre-excavation meeting between the excavator, the facility owners/operators and locators (where applicable) is recommended on major or large projects. This include projects such as road, sewer, water, or other projects that cover a large area, progress from one area to the next, or that are located near critical or high priority facilities. Such facilities include, but are not limited to, high-pressure gas, high voltage electric, fiber optic communication, and major pipe or water lines.

References:
- Existing insurance carrier guidelines.
- Existing practice among excavators, including Pauley Construction and W.F. Wilson & Sons, Inc.

5. Facility Relocations

Practice Statement: The excavator coordinates work which requires temporary or permanent interruption of a facility owner/operator's service with the affected facility owner/operator in all cases.

Practice Description: Any temporary or permanent interruption requires the active participation by the facility owner/operator and the excavator to ensure protection of facilities through a joint preplanning meeting or conference calls. One-call centers note special contractor requests for a joint meeting on the ticket to the facility owner/operator to initiate the process.

Reference:
Existing practice among one-call centers.

6. Separate Locate Requests

Practice Statement: Every excavator on the job has a separate one-call reference number before excavating.

Practice Description: Often, there are several excavators on a job site performing work. The construction schedule may dictate different types of work requiring excavation from different specialty contractors simultaneously. In these situations it is imperative for each excavator to obtain a one-call reference number before excavation to ensure that the specific areas have been appropriately marked by any affected underground facility owner/operator.

Reference:
Existing state laws, including Ohio, Kansas, Michigan, Maryland, Illinois and others.

7. One-Call Access (24x7)

Practice Statement: The excavator has access to a one-call center 24 hours per day, 7 days a week.

Practice Description: Utilities service the public needs 24x7 and thus should be protected the same amount of time. Certain conditions exist which requires excavators to work during off-hours (city/road congestion, off peak utility service hours). While most excavators are on the job site during regular work hours, the ability to call in future work locations after five p.m. allows more flexibility to schedule work, not to mention getting around peak hours of locate requests at the one-call center.

Reference: Existing states laws, including Texas, Idaho, Minnesota, Pennsylvania, and others. There are 25 participating states or one-call centers with 24x7 access.

8. Positive Response

Practice Statement: The excavator is notified by the underground facility owner/operator of the tolerance zone of the underground facility by marking, flagging, or other acceptable methods at the work site, or is notified that a no conflict situation exists. This takes place after notification from the one-call center to the underground facility owner/operator and within the time specified by state law.

Practice Description: If a facility owner/operator determines that the excavation or demolition is not near any of its existing underground facilities, it notifies the excavator that no conflict exists and that the excavation or demolition area is "clear." This notification by the facility owner/operator to the excavator may be provided in any reasonable manner including, but not limited to: face-to-face communications; phone or phone message, facsimile or other electronic means; posting at the excavation of demolition area; or marking the excavation or demolition area. If an excavator has knowledge of the existence of an underground facility and has received an "all clear," a prudent excavator will attempt to communicate that a conflict does indeed exist and the locator should make marking these facilities a priority before excavation begins.

More communication between the excavator and the facility owner/operator is a growing necessity as the area of excavation is getting more crowded everyday with new underground facilities. Positive response is a term used to describe the two types of action to be taken by a facility owner/operator after it has received notification of intent to excavate. The facility owner/operator is required to 1) mark its underground facilities with stakes, paint or flags or 2) notify the excavator that the facility owner/operator has no underground facilities in the area of excavation. This process allows the excavator to begin work on time or in a timely manner.

When the excavator makes the request to the one-call center, he/she is told which facility owners/operators will be notified. The excavator logs these facilities on his/her job sheet so that he/she can identify which facility owners/operators have responded by marking and which ones have cleared the area. On the flip side, when a facility owner/operator does not respond by marking or clearing, this could signal that the facility owner/operator did not receive a locate notice. It could also indicate that the facility owner/operator data base used at the one-call center is either corrupt or lacking the correct information to process the request at the location, which could result in calamity. Once the excavator has all of the information needed for the work area, he/she can then excavate with confidence with safety in mind for the work crew and the public at large.

References:

- Existing state laws, including California, Maryland, Nevada and others.
- Existing operating procedure for various one-call centers. (Number of participating states or one-calls: 31.)

5.6.2 On-Site Preparation/Ground Breaking

9. Facility Owner/Operator Failure to Respond

Practice Statement: If the facility owner/operator fails to respond to the excavator's timely request for a locate (e.g., within the time specified by state requirements) or if the facility owner/operator notifies the excavator that the underground facility cannot be marked within the time frame and a mutually agreeable date for marking cannot be arrived at, the excavator re-calls the one-call center. However, this does not preclude the excavator from going on with the project. The excavator may proceed with excavation at the end of two working days, unless otherwise specified in state law, provided the excavator exercises due care in his endeavors.

Practice Description: It is determined that the facility owner/operator and the excavator will partner together to ensure facilities are marked in an acceptable time frame to allow for underground facility protection.

Reference:
Existing state laws, including Ohio, Kansas, South Carolina, Michigan and others.

10. Locate Verification

Practice Statement: Prior to excavation, excavators verify they are at the correct location and verify locate markings and, to the best of their ability, check for unmarked facilities.

Practice Description: Upon arrival at the excavation site prior to beginning the excavation, verify that the dig site matches the one-call request and is timely. Verify that all facilities have been marked, reviewing color codes if in doubt. Verify all service feeds from buildings and homes. Check for any visible signs of underground facilities, such as pedestals, risers, meters, and new trench lines. Check for any facilities that are not members of the one-call and contact someone to get them located. Use of a pre-excavation checklist is recommended by insurers and practiced by responsible excavating contractors.

Reference:
Existing practice by excavators, including Pauley Construction and W.F. Wilson & Sons, Inc.

11. Documentation of Marks

Practice Statement: An excavator uses dated pictures, videos, or sketches with distance from markings to fixed objects recorded, to document the actual placement of markings.

Practice Description: In most situations when underground facilities are not properly marked, excavators have no way of knowing where underground utilities are located. If locate markings are adequately documented through the use of photographs, video tape, or sketches before excavation

work begins, it will be easier to resolve disputes if an underground facility is damaged due to improper marking, failure to mark, or markings that have been moved, removed, or covered. It is important for excavators and locators to document the location of markings before excavation work begins. The primary purpose of this best practice is to avoid unnecessary litigation and expensive legal fees for all parties involved.

Reference:
Existing practice by excavators, including Pauley Construction.

12. Work Site Review with Company Personnel

Practice Statement: Prior to starting work, the excavator reviews the location of underground facilities with site personnel.

Practice Description: Sharing information and safety issues during an on-site meeting between the excavator and his excavating crews will help to avoid confusion and needless damage to underground facilities.

Reference:
Existing practice by excavators, including Pauley Construction, A&L Underground, W.F. Wilson & Sons, Inc.

13. One-Call Reference Number at Site

Practice Statement: The excavator's designated competent person at each job site has the one-call ticket number.

Practice Description: This serves as constant reminder that all excavators will be required to call the one-call center to request a locate before they start excavation. If a representative for the facility owner/operator sees work being conducted and is unaware of the work being done, he/she can 1) stop and verify that the excavator does indeed have a valid ticket number or 2) check the third-party locator's work. If an excavator is found working without a valid one-call ticket number, he/she should be requested to stop work immediately and appropriate actions should be taken.

Another positive aspect of this practice will be that it should speed up the notification process back to the one-call center should the excavator find a facility incorrectly marked or not marked at all. Requiring personnel at the job site to have this number should minimize or eliminate calls to a supervisor, foreman, dispatcher, or other personnel to find the correct number if a problem is encountered. When multiple crews are working on the same project at separate locations, each crew should be responsible for having a designated competent person responsible for having this one-call ticket number in their possession.

References:

- Existing practices by excavators, including Pauley Construction and W.F. Wilson & Sons, Inc.
- Existing practices by facility owners/operators, including Ameritech.

14. Contact Names and Numbers

Practice Statement: The excavator's designated competent person at each job site has access to the names and phone numbers of all facility owner/operator contacts and the one-call center.

Practice Description: Situations arise on the job site that require immediate notification of the facility owner/operator, one-call center or local emergency personnel. To avoid costly delays, the excavator ensures the designated job site personnel have all appropriate names and phone numbers. If telephone communication is unavailable, radio communication to the "home office" is available so that timely notification can be made. The "home office" also has immediate access to all appropriate names and telephone numbers.

Reference:
Existing state regulations, including Michigan DOT.

15. Facility Avoidance

Practice Statement: The excavator uses reasonable care to avoid damaging underground facilities. The excavator plans the excavation so as to avoid damage or minimize interference with the underground facilities in or near the work area.

Practice Description: Foremost on any construction project is safety. Excavators using caution around underground facilities significantly contribute to safe excavation of existing facilities.

Reference:
Existing state laws, including Kansas, Ohio, West Virginia and others.

5.6.3 On-Going Excavation

16. Federal and State Regulations

Practice Statement: The excavator adheres to all applicable federal and state safety regulations, which includes training as it relates to the protection of underground facilities.

Practice Description: Although most existing state damage prevention legislation does not include reference to federal and state regulations, it is important to include reference to worker safety and training in the best practices. Excavators are required to comply with federal and state

occupational safety and health requirements to protect employees from injury and illness. These regulations include reference to training each employee in how to recognize and avoid unsafe conditions and the regulations applicable to his/her work environment to control or eliminate any hazards or exposures to illness or injury. Therefore, the excavator's crew, as part of its safety training, is informed of the best practices and regulations applicable to the protection of underground facilities.

References:

- Required by federal and state law.
- Existing practice by excavators and facility owners/operators.

17. Marking Preservation

Practice Statement: The excavator protects and preserves the staking, marking, or other designations for underground facilities until no longer required for proper and safe excavation. The excavator stops excavating and notifies the one-call center for re-marks if any facility mark is removed or no longer visible.

Practice Description: During long complex projects, the marks for underground facilities may need to be in place far longer than the locating method is durable. Paint, staking and other marking techniques last only as long as the weather and other variables allow. When a mark is no longer visible, but work continues around the facility, the excavator requests a re-mark to ensure the protection of the facility.

Reference:

Existing state law, including Ohio.

18. Excavation Observer

Practice Statement: The excavator has an observer to assist the equipment operator when operating excavation equipment around known underground facilities.

Practice Description: The observer is a worker who is watching the excavation activity to warn the equipment operator while excavating around a utility to prevent damaging that buried facility. This is common practice among excavators and large facility owners/operators. Further, some state laws suggest the same, for example, Ohio law.

References:

- Existing state law, including Ohio.
- Existing practice among large facility owners/operators, including Southern Natural Gas, Bell South, and Columbia Gas.

19. Excavation Tolerance Zone

Practice Statement: The excavator observes a tolerance zone which is comprised of the width of the facility plus 18" on either side of the outside edge of the underground facility on a horizontal plane. This practice is not intended to preempt any existing state requirements that currently specify more than 18".

Practice Description: (See Practice Description for #20 below.)

References:

- Existing state laws, including New Mexico, Pennsylvania, South Dakota and others.
- Telecommunications Industry Association and Electronic Industry Association (TIA/EIA), "Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant" (ANSI/TIA/EIA-590-A-1996).
- American Public Works Association (APWA), "Guidelines for Uniform Temporary Marking of Underground Facilities."

20. Excavation within Tolerance Zone

Practice Statement: When excavation is to take place within the specified tolerance zone, the excavator exercises such reasonable care as may be necessary for the protection of any underground facility in or near the excavation area. Methods to consider, based on certain climate or geographical conditions, include: hand digging when practical (pot holing), soft digging, vacuum excavation methods, pneumatic hand tools, other mechanical methods with the approval of the facility owner/operator, or other technical methods that may be developed. Hand digging and non-invasive methods are not required for pavement removal.

Practice Description: Safe, prudent, non-evasive methods that manually determine a facility are considered "safe excavation practices" in a majority of state laws (38 states). A majority of states outline safe excavation practices to include hand digging or pot holing (16 states). Some states specifically allow for the use of power excavating equipment for the removal of pavement. Each state must take differing geologic conditions and weather related factors into consideration when recommending types of excavation within the tolerance zone.

Reference:

Existing state laws, including Arizona, New Hampshire, Pennsylvania and others.

21. Mis-Marked Facilities

Practice Statement: The excavator notifies the facility owner/operator directly or through the one-call system if an underground facility is not found where one has been marked or if an unmarked underground facility is found. Following this notification, the excavator may continue work if the excavation can be performed without damaging the facility, unless specified otherwise in state law.

Practice Description: When an excavator finds an unmarked or inaccurately marked facility, excavation stops in the vicinity of the facility and notification takes place. If excavation continues, the excavator plans the excavation to avoid damage and interference with other facilities and protects facilities from damage.

References:

- Existing state/local laws, including Arizona.
- Existing practice among excavators, including W.F. Wilson & Sons, Inc.

22. Exposed Facility Protection

Practice Statement: Excavators support and protect exposed underground facilities from damage.

Practice Description: Protection of exposed underground facilities is as important as preventing damage to the facility when digging around the utility. Protecting exposed underground facilities helps to insure that the utility is not damaged and at the same time protect employees working in the vicinity of the exposed facility.

Exposed facilities can shift, separate, or be damaged when they are no longer supported or protected by the soil around them. Excavators support or brace exposed facilities and protect them from moving or shifting which could result in damage to the facility. This can be accomplished in different ways, for example, by shoring the facility from below or by providing a timber support with hangers across the top of an excavation to insure that the facility does not move or bend. In addition, workers are instructed not to climb on, strike, or attempt to move exposed facilities which could damage protective coatings, bend conduit, separate pipe joints, damage cable insulation, damage fiber optics, or in some way affect the integrity of the facility.

The Occupational Safety and Health Administration (OSHA) has also addressed this issue in Subpart P - Excavation Standard 29 CFR 1926.651(b)(4) which states: "While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard employees." For example, an unsupported sewer main could shift causing the pipe joints to separate which could result in the trench where employees are working to flood, endangering the safety of employees.

Reference:

Existing state/local laws, including Washington, DC, Idaho, Utah, Arizona, Virginia, Pennsylvania, New York and others.

23. Locate Request Updates

Practice Statement: The excavator calls the one-call center to refresh the ticket when excavation continues past the life of the ticket (sometimes, but not always, defined by state law). This recognizes that it is a best practice to define ticket life. If not currently defined in state law, ticket life would best be 10 working days but not to exceed 20 working days.

Practice Description: Refreshing the ticket recognizes that markings are temporary and provides notification to facility owners/operators of ongoing excavation when a job is started but not completed as planned. Any excavation not begun during the life of the ticket is recalled to the one-call center. Any excavation that covers a large area and will progress from one area to the next over a period of time is broken into segments when notifying the one-call center in order to coordinate the marking with actual excavation. The possibility exists that new facilities have been installed in the area where the excavation is to be conducted after the original notification and marking.

This practice also helps in situations where multiple excavators are working in the same area at essentially the same time. An example of when this can occur is when two facility owners, such as a cable television company and the telephone company, are planning to serve a new section of a subdivision. In their pre-planning process, they see a vacant space in the right-of-way to place their new facility. Each excavator (internal or external) calls the one-call center for locates and each facility owner/operator comes and marks their respective facilities indicating that nothing exists. For one reason or another, one of the excavators gets delayed and does not start construction as planned, and when returning to the job site to place the new facility, finds new lines have been installed in the previously vacant space.

Many facility owners/operators do not perform their own locates and utilize the services of a contracted facility locator. These contracted facility locators may not be aware of work planned in the near future. By excavators refreshing the locate ticket, the contract locator has another opportunity to identify newly placed facilities. This practice also gives the facility owner/operator another chance to identify the location of their facilities and to avoid a possible damage and disruption of service should something have been marked incorrectly or missed on a previous locate.

Reference:
Existing state laws that specify 10 working days include Kansas, Ohio, Wisconsin, Pennsylvania, and Texas. Existing state laws that specify 15 working days include Virginia and Tennessee.

24. Facility Damage Notification

Practice Statement: An excavator discovering or causing damage to underground facilities notifies the facility owner/operator and the one-call center. All breaks, leaks, nicks, dents, gouges, groves, or other damages to facility lines, conduits, coatings or cathodic protection will be reported.

Practice Description: A majority of states require notification for damage or substantial weakening of an underground facility (27 states). The possibility of facility failure or endangerment of the surrounding population dramatically increases when a facility has been damaged. While the facility may not immediately fail, the underground facility owner/operator should have the opportunity to inspect the damage and make appropriate repairs.

Reference:
Existing state laws, including Arkansas, Idaho, Maryland and others.

25. Notification of Emergency Personnel

Practice Statement: If the protective covering of an electrical line is penetrated or gases or liquids are escaping from a broken line which endangers life, health or property, the excavator immediately contacts local emergency personnel or calls "911" to report the damage location.

Practice Description: This practice is already required by a majority of the states' one-call legislation. This practice minimizes the danger to life, health or property by notifying the proper authorities to handle the emergency situation. In these situations, local authorities are able to evacuate as appropriate and command substantial resources unavailable to the excavator or underground facility owner/operator.

Reference:
Existing state laws, including Kansas, Ohio, Oregon and Minnesota.

26. Emergency Excavation

Practice Statement: In the case of an emergency excavation, maintenance or repairs may be made immediately provided that the excavator notifies the one-call center and facility owner/operator as soon as reasonably possible. This includes situations that involve danger to life, health or property, or that require immediate correction in order to continue the operation of or to assure the continuity of public utility service or public transportation.

Practice Description: This allows excavation to begin immediately to restore service or stop a hazardous situation from getting worse in the case of gas or pipeline leak, telephone cable cut, or other facility damage.

Reference:
Existing state laws, including Colorado, Nevada, West Virginia and others. (Number of participating states or one-calls = 49.)

27. Backfilling

Practice Statement: The excavator protects all facilities from damage when backfilling an excavation. Trash, debris, coiled wire, or other material that could damage existing facilities or interfere with the accuracy of future locates are not to be buried in the excavation.

Practice Description: Extra caution must be taken to remove large rocks, sharp objects, and large chunks of hard packed clay or dirt. No trash or pieces of abandoned lines are backfilled into the trench. This will avoid any inadvertent damage to the facility during the backfill process.

References:
- Michigan DOT specification.
- Existing insurance carrier guidelines.

5.6.4 Restoration/Completion

28. As-Built Documentation

Practice Statement: Contractors installing underground facilities notify the facility owner/operator if the actual placement is different from expected placement.

Practice Description: In order for a facility owner/operator to maintain accurate records of the location of their facilities, it is critical that the contractor installing the new facility be required to notify the facility owner/operator of deviations to the planned installation. Some facility owners/operators do not require a full time inspector and use a sampling process to insure the new facilities are being installed correctly and in adherence to the specifications. When this occurs, it becomes much more critical for the contractor to notify the facility owner/operator of changes. For example, it is common for the contractor to make adjustments in the location of the new facilities when rocks or other underground obstructions are encountered or the location of the new facility conflicts with another existing underground facility.

This change in plan can be both changes in horizontal or vertical distances from the specified plans. The facility owner/operator should establish standards that require notification if a deviation is beyond specified tolerances, such as changes in depth of 6 inches or more and lateral measurement changes of greater than 1 foot. Once these changes to the expected location are communicated to the facility owner/operator, it is their responsibility to take appropriate action to update their records so that an accurate locate can be conducted in the future.

Reference:

Existing operating practice among facility operators, including Ameritech, Sprint, Columbia Gas and others.

CHAPTER 6
Mapping Task Team Best Practices

6.1 CHAPTER SUMMARY

The Mapping Task Team identified and described practices used to graphically indicate the location of subsurface facilities as they relate to the surface of the earth.

The Mapping Task Team focused on the mapping practices of one-call centers, locators, facility owners/operators, project owners, and excavators. The Team researched and documented the best mapping practices under each of these areas. Section 6.6 outlines the Team's findings and collective opinion of the best mapping practices in use today.

6.2 BACKGROUND AND MOTIVATION

Accurate and up-to-date maps are not always used or available in locating facilities and this factor can be a cause of facility damage.

6.2.1 Scope and Mission

The scope of the Team was to identify and describe practices used to graphically indicate the location of subsurface utilities as they relate to the surface of the earth. It was decided that the scope of the Mapping Team was not limited to the one-call center but was inclusive of mapping in every area, including as-builts, facilities, one-call centers, locators, project owners, and excavators.

The mission of the Mapping Team in preventing damage to existing underground facilities was to provide a collection of Mapping best practices in the areas of One-Call Center, Locating, Excavating, Facility Owner/Operator, and Project Owner.

6.2.2 Goals

- Eliminate damage to existing underground facilities.
- Encourage partnerships between the facility owners/operators, excavators, one-call centers and locators.
- Encourage facility owners/operators to keep accurate and up-to-date records.

- Encourage facility owners/operators to provide the one-call center with sufficient information to notify the operator when their underground facilities are in the area of excavation.
- Encourage the project owners to supply accurate mapping data to the excavator.
- Encourage the one-call centers to accept and exchange data in a variety of formats with update capabilities.
- Encourage locators and excavators to identify mapping and location discrepancies to the facility owners/operators and one-call centers.
- Encourage facility owners/operators, excavators, locators, and one-call centers to maintain, accept, and transfer data in an electronic format.
- Encourage excavators to provide complete and accurate information to one-call centers.

6.3 TEAM MEMBERS

The Mapping Task Team was composed of representatives from one-call centers, excavators, locators, facility owners/operators, trade associations, and federal and state government agencies. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	**Representing**[19]	**Employer**
Carolyn Carter	OCSI	North Carolina One-Call
Don Carter	AGA	Atlanta Gas Light Co.
Gary Craig	OCSI	OCSI
Terry Leppla	API	ARCO Pipe Line
Mike McGrath	NARUC	Minnesota Office of Pipeline Safety
Bill Pauley, Co-Chairperson	NUCA	Fishel Co.
Christina Sames, Co-Chairperson	OPS	Office of Pipeline Safety, HQ
Perly A. Schoville	AAR	Union Pacific Railroad
Craig Sewell	NULCA	One Call Concepts
James Glyn Smith	OCSI	Palmetto Utility Protection Service

[19] See Appendix D for a detailed list of acronyms.

Team Member (cont.)	**Representing** (cont.)	**Employer** (cont.)
Terry Zachman	TIA/EIA	Sprint Long Distance
John Ziakas	INGAA	Questar Regulated Services

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	**Representing**	**Employer**
Ben Heise, Emerging Technology Liaison	TIA/EIA	AT&T
Russ Kopidlansky, Linking Team Liaison	AGA	Wisconsin Public Service Corporation

6.4 DATA COLLECTION AND EVALUATION PROCESS

6.4.1 Sources

- Company Procedures
- Regulations
- Operating Practices
- Expert Opinions
- State Laws

6.4.2 Process for collecting information

A Task Team member most familiar with each issue was assigned the task of researching that issue and providing objective information about that issue for Team discussion.

6.4.3 Process for Selecting Issues

Using an outline developed by the Linking Team, the Task Team discussed and identified mapping issues in the categories of one-call, locator, excavator, facility owner/operator, and project owner. The Team then agreed upon the most important issues under each category.

6.4.4 Process for evaluating practices

The Mapping Task Team developed the following criteria to determine which practices were mapping best practices.

- Contributes to Damage Prevention
- Feasible
- In Use
- Transferable
- Maintainable
- Available
- Promotes consistency between one-call centers

6.5 ISSUES IDENTIFIED

6.5.1 One-Call

- The flexibility of a one-call center to accept and distribute location information in a variety of formats.

- Some one-call centers do not accept or use digital mapping data.

6.5.2 Locator

- Locators may not use accurate and up-to-date maps.

- Locators may not be properly trained to interpret maps.

- Locators may not provide mapping and location discrepancies to the one-call center.

- Locators may not provide facility mapping and location discrepancies to the facility owners/operators.

6.5.3 Excavator

- The excavator may not receive complete or correct information concerning the excavation area from the project owner.

- The excavator may not provide complete location data to the one-call center.

- The excavator may not provide correct location data to the one-call center.

6.5.4 Facility Owner/Operator

- The facility owner/operator may not always keep accurate and up-to-date maps.

- The facility owner/operator may not always provide accurate or up-to-dates maps to the locator.

- The facility owner/operator may not maintain records for abandoned facilities.

- The facility owner/operator may not transfer or retain records for abandoned or sold facilities.

6.5.5 Project Owner

- The project owner may not provide accurate and up-to-date information needed to identify the area of excavation.

6.6 FINDINGS

A decision was made by the Mapping Team to look at mapping practices from the viewpoint of the different areas represented by the Team members. Therefore, the best practices for mapping are listed in five distinct areas: One-Call Center, Locator, Excavator, Facility Owner/Operator, and Project Owner. By consensus of the Mapping Task Team, all of the findings listed below are best practices.

One-Call Center

1. The land base should be accurate.
2. The land base and database uses latitude/longitude.
3. The land base is up-to-date.
4. The database is updated by information from facility owners/operators.
5. The electronic mapping system can produce a ticket for the smallest practical geographical area.
6. The land base is available to the public.

Locator

7. Locators are trained in map reading and symbology.
8. The locator provides precise facility location to the facility owner/operator when there is a discrepancy.
9. The locator supplies feedback to the one-call center.

Excavator

10. The excavator provides accurate location information to the one-call center.
11. The excavator provides basic attributes to the one-call center.

Facility Owner/Operator

12. The facility owner/operator provides mapping data to the one-call center.

13. The facility owner/operator provides mapping data access.
14. Mapping standards are adhered to.
15. Consistent, current information is provided to the one-call center.
16. Detailed mapping information is collected.

Project Owner

17. The project owner provides accurate information.
18. The project owner determines basic coordinates.

6.6.1 One-Call Center

A one-call center uses an electronic mapping database system that includes the following:

1. Accuracy - The land base is the most precise geographical information available to the center. The one-call centers in the following states follow this practice: Arizona, Minnesota, North Carolina, Texas, and Wisconsin.

2. Latitude/Longitude (Lat/Long) - The land base and database are able to produce Lat/Long information based upon street address, street/road name, intersection, milepost marker, etc. It is also possible to determine the street address, street/road name, intersection or milepost based upon Lat/Long information. The translation of Lat/Long information is automatic. A map point (i.e., a rural area not in the immediate vicinity of a road or known map landmark) can be identified by Lat/Long information. The one-call centers in the following states follow this practice: Ohio, South Dakota, New Jersy, Missouri, and Tennessee.

3. The land base is kept up-to-date, including a process that periodically adds new street information, name changes, aliases, and municipal boundaries. The one-call centers in the following states follow this practice: Arizona, Ohio, and New Jersey.

4. The database is promptly updated as information is provided or becomes available from the facility owner/operator. The system is able to accept information in standard file format with minimal human intervention. The one-call centers in the following states follow this practice: Arizona, North Carolina, Ohio, New Jersey, and Wisconsin.

5. Location Area - The electronic mapping system is able to produce a ticket for the smallest practical geographical area. The one-call centers in the following states follow this practice: Arizona, Tennessee, Minnesota, Oregon, and Wisconsin.

6. Availability - The land base is available to the public for the identification of the excavation area. The land base and database are available to the one-call center membership for the update of member database information. The one-call centers in the following states follow this practice: North Carolina, Ohio, and South Dakota.

6.6.2 Locator

Locators use maps to assist in finding the excavation site and to assist in determining the general location of the buried facility.

7. Locators are trained in map reading and symbology to assist in determining the location of the buried facility. The following association trains its members to carry out this practice: NULCA.

8. The locator provides to the facility owner/operator the most precise facility location information obtained from a locate when there is a discrepancy. The following state carries out this practice: Arizona Blue Stake law.

9. The locator provides feedback to the one-call center on land base mapping and location discrepancies. The following states carry out this practice: Ohio, Tennessee, and North Carolina.

6.6.3 Excavator

10. The excavator takes responsibility for giving accurate location information to the one-call center. This information includes street address, street intersection, legal description, or other acceptable one-call format and latitude/longitude if feasible.

11. The excavator provides a starting point and ending point, and on which side of the property (North, South, East, West, front, back, rear, sides, etc.) or street the excavation area is located.

If the excavator can not meet the above criteria, the excavator directly coordinates with the one-call center to establish the excavation area.

References:

- Michaels Pipeline Company, Brownsville, Wisconsin.
- Hooper Corporation, Pewaukee, Wisconsin.
- Intercon Construction, Madison, Wisconsin.

6.6.4 Facility Owner/Operator

12. The facility owner/operator provides the one-call center with data that will allow proper notification of excavation activities near the facility owner/operators' infrastructure. Facility owners/operators in all mandatory one-call states follow this practice.

13. The facility owner/operator provides access to a mapping system that can be utilized by both the locator and the facility owner/operator. The following facility owners/operators

follow this practice: Atlanta Gas Light, Sprint Long Distance, AT&T, Questar Regulated Services.

14. The facility owner/operator requires the designer to adhere to the facility owner/operator's mapping standards. The following facility owners/operators follow this practice: AT&T, Sprint Long Distance.

15. The facility owner/operator provides consistent, current information to the one-call center for the proper receipt of ticket notification. Basic information should include latitude and longitude and should be tied to a physical attribute where available, such as milepost marker. The following facility owner/operator follows this practice: Sprint Long Distance.

16. The facility owner/operator captures the following information to ensure project safety in the plan, design, construction, documentation, location, and maintenance of their longitudinal utility.

    1. Any new construction into the electronic mapping database at the time of installation
    2. The location of abandoned or sold facilities is retained in the database.
    3. The electronic mapping database includes the following detailed information:
        a) Engineering stationing and milepost/marker post location, with latitude and longitude. Common mapping coordinate systems that allow conversion to latitude and longitude are used.
        b) Alignment of the utility with engineering stationing at each running line change or PI (point of inflection) including signs and markers.
        c) Bridges, culverts and rivers.
        d) All road crossings, overhead viaducts and underpasses, including name of the street (public or private) and mile marker/marker post designation.
        e) Small scale maps showing the overall utility route.
        f) Physical characteristics and attributes of the system such as: pedestal, pole, transformer, meter numbers, anode bed, size, material, product and pressure.
        g) The number of utility lines or conduits owned by the facility owner/operator in a corridor or the size of the duct package/bank.

    This is universally a general practice of major pipe line and long distance telecommunication operators and railroads.

6.6.5 Project Owner

17. The project owner provides the excavator with accurate location information on the proposed excavation area using mapping information utilized by the one-call center. This information includes: a street address, street intersection, legal description, or other acceptable one-call format and latitude/longitude if feasible.

18. The project owner determines a starting point, ending point and on which side of the property (North, South, East, West, front, back, rear, sides, etc.) or street the excavation area is located.

Reference:
These are general practices of the State DOTs on Highway projects.

These are general practices of most NUCA members. The references listed in each best practice are not all inclusive.

6.7 EMERGING TECHNOLOGIES

Technology is rapidly changing. Many of the best practices identified in this chapter could be obsolete in the near future. Although the following technologies are now used in other applications, their use is not widespread in the damage prevention field.

- Geographic Information System (GIS)
- Advances in Location Technology
- The Global Positioning System (GPS)
- Orthographic and Satellite Images

GIS allows the integration of digital maps with other databases to view the relationship of physical features, conducts relational queries, and obtains additional information on a particular feature. The GIS infrastructure or base will support all of the advanced technologies of GPS, Ortho and Satellite Images.

Combining Orthographic and Satellite images with an overlay of a line map, street names, addresses and GPS coordinates of utility lines will allow one-call centers, excavators, locators, facility owners/operators, and project owners to view the accurate and relative location of utility lines.

Advanced use of these technologies in combination with advances to locating technologies is expected to reduce damage to underground facilities.

Chapter 7
Compliance Task Team Best Practices

7.1 CHAPTER SUMMARY

Over the course of the Common Ground Study, the Compliance Practices Task Team debated dozens of issues associated with damage prevention - many directly related to compliance practices and others not. It was through the course of debating specific requirements of various laws that the Team realized that it was not charged with determining what should be required of a particular stakeholder (that was for the other task teams), but with simply how to encourage all stakeholders to comply with the requirements of the laws and regulations, whatever they may be.

So, how does a state encourage compliance by all stakeholders (facility owner/operator, excavator, designer, and one-call center) with the damage prevention laws and regulations? The Team concluded that compliance practices begin with education - educating the affected stakeholders about the requirements of laws and regulations with which they are to comply and on the benefits (positive incentives) of compliance and consequences (negative incentives) resulting from failure to comply with the laws and regulations. For those who comply with the law, compliance practices end with education. For those who are alleged to have violated the law, compliance practices involve the equitable and impartial investigation and review of the alleged violation. Following this rationale, the Compliance Practices Task Team identified existing practices (Section 7.5) that are meant to offer a pro-active and just means of encouraging compliance with damage prevention laws and regulations.

The ability of the Compliance Practices Task Team to achieve consensus on the contents of this Chapter illustrates another best practice applicable to all areas of damage prevention, including compliance. That is:

> Communication and cooperation among stakeholders with an eye toward safety and damage prevention is always a best practice.

It is a best practice that cannot be legislated, but that will continue to be practiced by the stakeholders who have participated in the Common Ground Study.

7.2 BACKGROUND AND MOTIVATION

7.2.1 Particular Motivation for this Task Team – Mission Statement

The Compliance Practices Task Team's mission statement was to "identify existing best practices for bringing facility owners/operators, excavators, one-call centers and other affected stakeholders into compliance with existing damage prevention program laws and regulations."

A primary motivating factor behind the Compliance Practices Task Team's work was a desire to avoid endorsing "existing" practices that have been adopted by one state simply because another state, with an earlier damage prevention program, had included the practice. Stakeholder feedback obtained during the Study suggests that state legislators may have done so due to a lack of empirical evidence of the effectiveness of a particular practice. Further complicating the Team's task was the fact that few states enforce their existing one-call laws. Thus, the Team was challenged in its mission to identify a broad spectrum of quantifiable "best practices." By interviewing stakeholders in the few states that do enforce the damage prevention laws, and applying their collective common sense and experiences, the members of the Compliance Practices Task Team identified a range of "existing" best practices.

7.2.2 Goals for the Compliance Practices Task Team

Members of the Compliance Practices Task Team represented the natural gas and liquid petroleum industries, federal and state regulatory authorities, excavators, railroads, one-call centers, the telecommunications industry, road builders, and rural and municipal utilities. Despite diverse and sometimes conflicting viewpoints, each Team member had the same goals in mind - safety and damage prevention.

The Team also recognized that a sea of laws and regulations coupled with the proverbial big stick is not necessarily the most effective means of achieving compliance. A law or regulation is only as sound and strong as the number of people who are aware of it and comply with it. Worker and public safety as well as underground infrastructure protection and reliability can best be achieved through voluntary compliance with damage prevention laws and regulations by the one-call center, designer, excavator, and the facility owner/operator. Effective compliance programs, therefore, are designed to promote voluntary compliance and do not create an environment that discourages or frustrates the stakeholders. Thus, in identifying existing best practices, the Team sought to:

- have safety be the heart of any damage prevention program,
- encourage cooperation among all stakeholders,
- ensure all stakeholders have a voice in the process,
- add a common sense element to the enforcement process, and
- underscore the importance of accountability by and equitability for all stakeholders in the compliance (enforcement) process.

To achieve these goals, the Team focused on compliance mechanisms that encourage correct behavior by all stakeholders to avoid violations. Primary among those mechanisms was education; compliance cannot be achieved without stakeholders having knowledge of the law. For those situations where stakeholders refuse to comply with the damage prevention laws and regulations of which they have knowledge, the Team recommended practices that should ensure a just resolution of the enforcement proceedings.

Whatever follows the Study, be it federal legislation (which is favored by some Team members and not by others), improved state statutes and regulations, or simply more open communication among all stakeholders, the Team's ultimate goals were:

- a safer environment around underground facilities and an efficient means of accomplishing planning, design, installation and repair of those facilities;
- voluntary compliance with damage prevention laws and regulations by all stakeholders;
- clear, effective and equitable enforcement processes;
- adequate voices in the one-call system by all stakeholders; and
- an environment where all stakeholders work in concert to achieve safety and damage prevention, and treat one another equitably and honestly.

7.2.3 Organization of Document

The Compliance Task Team identified five subject areas that fall under the compliance umbrella:

- Public and Enforcement Education,
- Incentives,
- Penalties,
- Damage Recovery, and
- Enforcement.

The "Findings" section (Section 7.5) of this chapter is organized according to these subject headings, with practice statements, descriptions and sources of the existing practices identified for each.

7.3 DATA COLLECTION AND EVALUATION PROCESS

7.3.1 Information Sources/Process of Collecting Information

Collectively, the members of the Compliance Practices Task Team reviewed one-call statutes of 49 states and the District of Columbia, and the implementing regulations, if any, that existed during the course of the Study, November - April 1999. Attempts were made to learn of all one-call center policies and procedures that do not have the effect of law but are voluntarily followed by the stakeholders in the states that have a mechanism in place for the enforcement of the one-call law. Representatives of the one-call centers, excavators, facility owners/operators and the enforcement agencies in the states that enforce the one-call laws (Arizona, Connecticut, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania and Virginia) were interviewed by members of the Compliance Practices Task Team in order for the Team to understand exactly how the one-call system works in practice – whether it works in accordance with and/or in despite of the one-call laws and implementing regulations.

7.3.2. Process for Selecting and Evaluating Issues

The old adage, "What is good for the goose is good for the gander," was a recurrent theme of the Compliance Practices Task Team's discussions. Members of the Team went to great pains to understand many of the current inequities in the language and enforcement of existing one-call laws and to emphasize the importance of all stakeholders being held equally accountable for safety and damage prevention and treated equitably when a violation occurs.

The following criteria statement, considered when drafting the practices, illustrates the Team's theme:

> *Compliance Practices promote consistent adherence to one-call statutes and rules. Best practices do so in a manner that is efficient, equitable and reasonable and that promotes safety.*

7.4 TEAM MEMBERS

The Compliance Practices Task Team was composed of the following individuals representing the industries noted. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	Representing[20]	Employer
Karen A. Bane	API	Plantation Pipe Line
Terri J. Binns	DOT, RSPA, OPS	DOT, RSPA, OPS
William P. (Bill) Boswell	OCSI	Peoples Natural Gas
Louis (Lou) Cerny	AAR	Private Consultant
Paul J. Cloran	NTDPC	Bell Atlantic
Alex Dankanich	NAPSR	Maryland Public Service Commission
Robert E. (Bob) Foster	OCSI	NY - Underground Facilities Protection Organization
Kathleen A. Fournier	OCSI	MISS DIG Systems, Inc
Janice Gambill	NTDPC	Ameritech
Amy Griffith, Co-chairperson	NUCA	NUCA
Brian Holmes	ARTBA	Connecticut Road Builders Assoc.

[20] See Appendix D for detailed list of acronyms.

Team Member (cont.)	**Representing** (cont.)	**Employer** (cont.)
Lew Hurlbutt	AGA	Southern California Gas Co./Sempra Energy
William G. (Bill) Kiger	OCSI	Pennsylvania One Call system, Inc.
Richard G. (Rick) Marini, Co-chairperson	NAPSR	New Hampshire Public Utilities Commission
Truman Murray	A.G.A.	Jackson Utility Division
Harry Short	NRWA	Van Buren Municipal Utilities
Robert F. (Bob) Smallcomb	NAPSR	Massachusetts Department of Public Utilities
John Sterrett	INGAA	Tennessee Gas Pipeline
George Trujillo	NUCA	Trujillo Construction, Inc.
Lynn Whitford	State DOTs	OK Dept. of Transportation

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant (cont.)	**Representing** (cont.)	**Employer** (cont.)
Glynn Blanton, Linking Team Liaison	NARUC	Tennessee Regulatory Authority

7.5 FINDINGS - BEST PRACTICES

Note: By citing a particular state and/or a particular section from a state's one-call statute or regulations as the source of the best practice, the Compliance Team is not endorsing a particular state's entire one-call statute or system, nor is it rejecting a similar provision in a state statute that is not included as a source. The citations are simply evidence of the existence of such a practice and should be considered solely for the concept or procedure described irrespective of other provisions of the particular state's one-call law or system.

Following is the list of practices developed by the Compliance Task Team for which consensus among the Task Team members has been achieved.

1. Public and Enforcement Education
2. Incentives
3. Penalties
4. Damage Recovery
   - Right of Recovery
   - Alternative Dispute Resolution
5. Enforcement

- Authority
- Structured Review Process

1. Public and Enforcement Education

A. Public Education

Practice Statement: Public education programs are used to promote compliance.

Practice Description: A single entity is charged to promote comprehensive and appropriate programs to educate all stakeholders about the existence and content of the damage prevention laws and regulations. This is not meant to discourage individual stakeholders from providing educational programs.

Reference:
New York: *"Each one-call notification system shall perform the following duties: ...(b) Conduct a continuing program to: (1) Inform excavators of the one-call notification system's existence and purpose and their responsibility to notify the one-call notification system of proposed excavation and demolition and to protect underground facilities. (2) Inform operators of the responsibility to participate in the one-call notification system, to respond to a notice relating to a proposed excavation and demolition and to designate and mark facilities according to the provisions of this Part."* New York Code, 16 NYCRR Part 753, § 753-5.3(b)(1)-(2).

B. Enforcement Education

Practice Statement: Mandatory education is considered as an alternative or supplement to penalties for offenders of the damage prevention laws and regulations.

Practice Description: Once a violation of the damage prevention laws or regulations has occurred, mandatory education is an effective alternative or supplement to civil penalties. Mandatory education as an enforcement tool promotes compliance with damage prevention laws and regulations.

References:

- **Arizona:** *"When a notice of violation (N.O.V.) is issued, the following may be followed: 1. First Time Offenders: A. May be given a warning letter and Item C below...C. Given the opportunity to attend Blue Stake Training Course provided by the Arizona Corporation Commission's Pipeline Safety Section."* Arizona Corporation Commission policy, "Notice of Violation," § 1(A) and (C).

- **New Hampshire:** *"Any excavator or operator who does not comply with RSA 374:51-54 shall be required on first offense to go through either a Digsafe training program or be subject to a civil penalty..."* New Hampshire Code, RSA 374, § 374:55(VIII).

2. Incentives

Practice Statement: Damage prevention programs include incentives to promote compliance with laws and regulations.

Practice Description: Incentives can include, but are not limited to, ease of access to one-call system, membership and participation considerations, representation on one-call boards, reasonable enforcement of regulations, safety and liability protection, access to alternative dispute resolution (ADR), and public education.

Incentive – Membership: Membership facilitates communication between an excavator and facility owner/operator, which helps prevent damage to underground facilities.

References:

- **Arizona:** *"If the owner or operator fails to locate or incorrectly locates the underground facility, pursuant to this article, the owner or operator becomes liable for resulting damages, costs and expenses to the injured party."* Arizona Code, Article 6.3, § 40- 360.27(C).

- **Minnesota:** *"Reimbursement is not required if the damage to the underground facility was caused by the sole negligence of the operator or the operator failed to comply with section 216.04, subdivision 3."* Minnesota Code, Chapter 216D.06, Subd. 2(b).

- **Pennsylvania:** Stakeholders who do not join the one-call system in violation of state law are not permitted to recover damages for injury to their property: *"If a facility owner fails to become a member of a One Call System in violation of this act and a line or lines of such nonmember facility owner are damaged by a contractor by reason of the contractor's failure to notify the facility owner because the facility was not a member of a One-Call System serving the location where the damage occurred, such facility owner shall have no right of recovery from the contractor of any costs associated with the damage to its lines. The right herein granted shall not be in limitation of any other rights of the contractor."* Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 2(9).

Incentive – Membership Accommodations: To avoid cost being a barrier to membership, several states have made membership accommodations for smaller municipals and authorities.

References:

- **Arizona:** *"Each one-call notification center shall establish a limited basis participation membership option, which may be made available to all members, but which must be made available for any member serving less than one thousand customers or any member irrigation or electrical district. A facility owner who elects limited basis participation membership will provide to the one-call center the location of its underground facilities by identifying the incorporated cities and towns, or for unincorporated county areas, by identifying the townships, in which it has facilities. The service level provided to the limited basis participation members by the one-call notification center is limited to providing excavators with names and telephone numbers the excavator should contact to obtain facilities location. Each one-call center shall establish fair and reasonable fees for limited basis participation members, based on customer count, areas occupied or miles of underground facilities."* Arizona Code, Article 6.3, § 40-360.32. *Note, Arizona's system somewhat defeats the purpose of "one-call", but is successful because the Arizona Blue Stake, the one-call center, goes the extra mile to assist the excavator in contacting the small facility owners, many of which do not have a manned telephone line.

- **Minnesota:** The Gopher State One-Call Center instituted a no-locate-required policy, which credits the facility operator those charges for "not-involved" tickets. It results in cost savings to the facility owners/operators because one-call membership rates are based on the number of tickets received by the facility owners/operators.

- **New York:** *"3. Costs. The costs of operating the system shall be apportioned equitably among the members of the system, with the exception of municipalities and authorities that operate underground facilities and any operator of underground facilities that provides water service to less than four thousand customers. In apportioning such costs, the system shall take into account the number of customers, extent of underground facilities and frequency of use."* New York General Business Law Article 36, § 761.

- **Pennsylvania:** *"Operation costs for the One Call System shall be shared, in an equitable manner for services received, by facility owner members as determined by a One Call System's board of directors. Political subdivisions with a population of less than two thousand persons or municipal authorities having an aggregate population in the area served by the municipal authority of less than five thousand persons shall be exempt from payment of any service fee."* Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 2(8).

Incentive – One-Call Center Board of Directors: Boards are composed of representatives of all stakeholders. Representation of all stakeholders in the governance of the one-call system (although not necessarily in the administration of the one-call center) assures that the viewpoint of all stakeholders will be considered in the policies and programs of the one-call system.

References:

- **Minnesota:** *"The nonprofit corporation must be governed by a board of directors of up to 20 members, one of whom is the director of the office of pipeline safety. The other board members must represent and be elected by operators, excavators, and other persons eligible to participate in the center..."* Minnesota Code, Chapter 216D.03, Subd. 2(a).

- **Pennsylvania**: *"A one-call system shall be governed by a board of directors, to be chosen by the facility owners. No less than twenty percent of the seats shall be held by municipalities or municipal authorities. The board shall include the following: (1) The Chairman of the Pennsylvania Public Utility Commission or his designee. (2) The Director of the Pennsylvania Emergency Management Agency or his designee. (3) The Secretary of Labor and Industry or his designee. (4) The Secretary of Transportation or his designee. (5) A contractor or industry representative. (6) A designer or industry representative."* Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 7.1(b).

Incentive – Safety and Liability Protection: Compliance with one-call system requirements promotes worker safety, public safety and reduces exposure to liability.

References:

- **NewYork**: *"The penalties provided for by this article shall not apply to an excavator who damages an underground facility due to the failure of the operator to comply with any of the provisions of this article nor shall in such instance the excavator be liable for repairs as prescribed in subdivision four of this section."* New York Code, 16 NYCRR Part 753, § 765(b).

- **Pennsylvania**: *"The designer who has complied with the terms of this act and who was not otherwise negligent shall not be subject to liability or incur any obligation to facility owners, operators, owners or other persons who sustain injury to person or property as a result of the excavation or demolition planning work of the designer."* Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 3(7).

Incentive – Reasonable Enforcement of Regulations: Reasonable enforcement of regulations refers to actions by enforcement authority officials and enforcement processes, both of which aim to fairly arrive at rational outcomes, such as education and penalties that correspond to the gravity of the violation, without imposing unnecessarily high transaction costs on any participant, including the enforcement authority.

Reference: In **Massachusetts**, a state where a violator's "history" is considered when addressing a violation, repeat offenders of the one-call law can attain first-time offender status if they demonstrate compliance for a solid year. *"Any person, contractor, excavator or company found by the Department to have violated any provision of the Dig Safe law or regulation adopted by the Department thereunder shall be subject to a civil penalty not to exceed $500*

for the first offense and not less than $1,000 nor more than $5,000 for any subsequent offense within a 12 month period after the Department issues a remedial order or executes a consent order for the first offense. Any excavator whose subsequent violation occurs after 12 consecutive months of no violations shall be subject to a civil penalty of $500." Massachusetts Regulation, 220 C.M.R. §99.12(1).

3. Penalties

Practice Statement: Compliance programs include penalties for violations of the damage prevention laws or regulations.

Practice Description: Within the context of one-call statutes, there exists specific provisions for penalties for failure to comply with the damage prevention laws and regulations. Performance and penalty incentives are equitably administered among stakeholders subject to one-call provisions.

A penalty system includes education as an alternative or supplement to civil or other penalties.

Reference: **New Hampshire**: *"Any excavator or operator who does not comply with RSA 374:51-54 shall be required on first offense to go through either a 'Digsafe' training program or be subject to a civil penalty..."* New Hampshire Code, RSA 374, § 374:55(VIII).

A penalty system also uses a tiered structure to distinguish violations by the level of severity or repeat offenses (e.g., warning letters, mandatory education, civil penalty amounts).

References:

- **Arizona:** *"When a notice of violation (N.O.V.) is issued, the following may be followed: 1. First Time Offenders: A. May be given a warning and Item C below or B. May be fined $250 per violation and C. Given the opportunity to attend a Blue Stake Training Course provided by the Arizona Corporation Commission's Pipeline Safety Section. Note: The investigator may use the N.O.V. as a warning, if they feel a warning would suffice. 2. Second Offense: A. May be fined $250 per violation and B. Given the opportunity to attend a Blue Stake Training Course provided by the Arizona Corporation Commission Pipeline Safety Section. 3. Repeat Offenders: A. Third Time: May be fined $500 per violation. B. Four or More Times: Could be fined up to $2000 per violation. Flagrancy or magnitude of offense could cause pipeline safety to deviate from this policy. Any deviation to the above-state police will jointly be determined by the Chief of Pipeline Safety and the Investigator."* Arizona Corporation Commission policy, "Notice of Violation," section 1-3.

- **New York:** *"Warning letters: Upon determining that a probable violation(s) of a provision of Part 753 has occurred or is continuing, the Department may issue a warning letter notifying the Respondent of the probable violation and advising him*

or her to correct it, if it is correctable, and to comply henceforth, or be subject to enforcement actions under this Part." NY Public Service Commission policy (proposed code § 753-6.3).

A penalty system also establishes mitigating and aggravating factors for determining the penalty for a violation by statute or regulation.

References:

- **Massachusetts:** *"In determining the amount of the civil penalty, the Department shall consider the nature, circumstances and gravity of the violation; the degree of the respondent's culpability; the respondent's history of prior offenses; and the respondent's level of cooperation with the requirements of this regulation."* Massachusetts Regulation, 220 C.M.R. §99.12(2).

- **Minnesota:** *"In assessing a civil penalty under this part, the office shall consider the following factors: A. the nature, circumstances, and gravity of the violation; B. the degree of the person's culpability; C. the person's history of previous offenses; D. the person's ability to pay; E. good faith on the part of the person in attempting to remedy the cause of the violation; F. the effect of the penalty on the person's ability to continue business; and G. past reports of damage to an underground facility by a person."* Minnesota Rules, 7560.0800, Subpart 3.

- **New Hampshire:** *"In determining the assessment, the following factors shall be considered: (1) Severity of the consequences resulting from the violation: the more severe the consequences, the higher the civil penalty; (2) Mitigating circumstances: i.e., how quickly actions were taken to rectify the situation, how much control the company had over the situation, and other circumstance which would tend to less fault; and (3) Prior violations of Puc 800."* New Hampshire Regulation, Chapter Puc 800, § Puc 805.06(b)(1)-(3).

- **New York:** *"...the commission shall determine the amount of the penalty after consideration of the nature, circumstances and gravity of the violation, history of prior violations, effect on public health, safety or welfare, and such other matters as may be required and shall send a copy of its determination to the excavator, operator, commissioner of labor and attorney general."* New York Public Service Law, § 119-b(8).

- **Virginia:** *"In determining the amount of any civil penalty included in a settlement, the nature, circumstances and gravity of the violation; the degree of the Respondent's culpability; the Respondent's history of prior offenses; and such other factors as may be appropriate shall be considered."* Virginia "Rules for Enforcement of the Underground Utility Damage Prevention Act," § 6.

A penalty system does not allow any violator or class of violators to be shielded from the consequences of a violation (i.e., all stakeholders should be accountable).

Reference: **New Hampshire:** *"Any excavator or operator who does not comply with RSA 374:51-54 shall be required on first offense to go through either a 'Digsafe' training program or be subject to a civil penalty..."* New Hampshire Code, RSA 374, § 374:55(VIII).

4. Damage Recovery

Practice Statement: State damage prevention laws and regulations recognize the right to recover damages and costs resulting from non-compliance.

A. Right of Recovery

Practice Description: The statute recognizes an injured party's right to recovery when damages and/or costs are incurred as the direct result of an entity's failure to comply with the one-call laws and regulations. For example, Arizona endorses an injured party's right to recover damages when the other party has failed to comply with the one-call law.

References:

- **Arizona:** *"If an underground facility is damaged by any person as a result of failing to obtain information as to its location, failing to take measures for protection of the facilities or failing to excavate in a careful and prudent manner as required by this article, the person is liable to the owner of the underground facility for the total cost of the repair of the facility."* Arizona Code, Article 6.3, § 40-360.26(A).

- **Arizona:** *"If the owner or operator fails to locate or incorrectly locates the underground facility, pursuant to this article, the owner or operator becomes liable for resulting damages, costs and expenses to the injured party."* Arizona Code, Article 6.3, § 40-360.28(C).

B. Alternative Dispute Resolution

Practice Description: Avenues for settlement of disputes include alternative dispute resolution. Minnesota endorses ADR through the state court system, New Jersey endorses ADR in construction contract documents, and the federal government endorses ADR through the federal courts.

References:

- **Minnesota**: *"The Supreme Court shall establish a statewide alternative dispute resolution program for the resolution of civil cases filed with the*

courts. The supreme court shall adopt rules governing practice, procedure, and jurisdiction for alternative dispute resolution programs established under this section. Except for matters involving family law the rules shall require the use of nonbinding alternative dispute resolution processes in all civil cases, except for good cause shown by the presiding judge, and must provide an equitable means for the payment of fees and expenses for the use of alternative dispute resolution processes." Minnesota Code, Chapter Title: District Courts, § 484.76.

- **New Jersey**: *"All construction contract documents entered into in accordance with the provisions of P.L. 1971, c. 198 (C.40A:11-1 et seq.) after the effective date of P.L. 1997, c.371 (C.40A:11-50) shall provide that disputes arising under the contract shall be submitted to a process of resolution pursuant to alternative dispute resolution practices, such as mediation, binding arbitration or non-binding arbitration pursuant to industry standards, prior to being submitted to a court for adjudication. Nothing in this section shall prevent the contracting unit from seeking injunctive or declaratory relief in court at any time. The alternative dispute resolution practices required by this section shall not apply to disputes concerning the bid solicitation or award process, or to the formation of contracts or subcontracts to be entered into pursuant to P.L. 1971, c. 198 (C.40A:11-1 et seq.)."* New Jersey Code, Title 40A, § 40A-11-50.

- **Federal:** *"Congress finds that-- (1) alternative dispute resolution, when supported by the bench and bar, and utilizing properly trained neutrals in a program adequately administered by the court, has the potential to provide a variety of benefits, including greater satisfaction of the parties, innovative methods of resolving disputes, and greater efficiency in achieving settlements; (2) certain forms of alternative dispute resolution, including mediation, early neutral evaluation, minitrials, and voluntary arbitration, may have potential to reduce the large backlog of cases now pending in some federal courts throughout the United States, thereby allowing the courts to process their remaining cases more efficiently; and (3) the continued growth of Federal appellate court-annexed mediation programs suggests that this form of alternative dispute resolution can be equally effective in resolving disputes in the federal trial courts; therefore, the district courts should consider including mediation in their local alternative dispute resolution programs...Each United States district court shall authorize, by local rule adopted under section 2071(b) 2071(a), the use of alternative dispute resolution processes in all civil actions, including adversary proceedings in bankruptcy, in accordance with this chapter, except that the use of arbitration may be authorized only as provided in section 654 [(1) the action is based on an alleged violation of a right secured by the Constitution of the United States; (2) jurisdiction is based in whole or in part on section 1343 of*

this title; or (3) the relief sought consists of money damages in an amount greater than $150,000.]." Alternative Dispute Resolution Act of 1998, enacted October 1998.

5. Enforcement

A. Authority

Practice Statement: An authority is specified through state statutes and given the resources to enforce the law.

Practice Description: The enforcement authority in each state has the resources to enforce the laws and regulations. Experience has demonstrated that enforcement of the one-call laws and regulations that did not identify a specific authority other than the attorney general has not been effective.

Characteristics of such an authority include:

- a process for receiving reports of violations from any stakeholder;
- an operating budget source other than fine revenue, such as a line item in the state budget, excluding fines as a source of income for the authority;
- stakeholder involvement in periodic review and modification of enforcement processes;
- resources to respond to notifications of alleged violations in a timely manner;
- a method of investigating alleged violations prior to issuing a notice of probable violation;
- impartial authority adjudicating violations;
- an initial informal means of contesting a notice of violation; and
- a published violation review process and violation assessment considerations.

References:

- **Arizona**: The Pipeline Safety Division of the Arizona Corporation Commission is funded by the Commission budget. *"Any penalties received by the state shall be deposited in the general fund."* Arizona Code, Article 6.3, § 40-360.28.

- **Massachusetts**: *"... Any other person may report a suspected violation of M.G.L. c. 82 s. 40 to the Department. All such reports shall be in a form deemed appropriate and necessary by the Department."* Massachusetts Regulation, 220 C.M.R. §99.01(1).

- **Massachusetts**: The Massachusetts Department of Telecommunications and Energy investigates all complaints received from excavators and facility owners/operators and conducts random field investigations. The Department then issues a Notice of Probable Violation if, based on the investigation, it has reason to believe that a violation has occurred or is occurring. *"The Department may begin a proceeding by issuing a notice of probable violation ("NOPV") if the Department has reason to believe that a violation of the M.G.L. c. 82, § 40, has occurred or is occurring...The NOPV shall state the factual basis for the allegation of a violation..."* Massachusetts Regulation, 220 C.M.R. §99.07(1).

- **Minnesota**: *"The office shall issue a notice of probable violation when the office has good cause to believe a violation of Minnesota Statutes, sections 216D.01 to 216.D.09 or this chapter has occurred...A notice of violation must include: A. a statement of the statute or rule allegedly violated by the person and a description of the evidence on which the allegation is based."* Minnesota Rules, 7560.04000, Subp.1 - Subp. 2(A).

- **Minnesota:** See also Minnesota Rules, 7560.0400, Subp. 1, *Notice of Violation;* 7560.0500 *Response Options;* 7560.0600, *Director Review;*7560.0800 Civil Penalties; Subp. 3, *Assessment considerations.*

- **New Hampshire**: *"Upon receipt of a the NOPV [Notice of Probable violation] the respondent shall either: (1) Submit in writing, within 30 days, evidence refuting the probable violation referenced in the NOPV; or (2) Request in writing within 30 days, an informal conference with commission staff to examine the basis of the violation, at which time the respondent may be represented by an attorney or other person; or (3) Waive procedural schedule by signing a consent agreement."* New Hampshire Regulation, Chapter Puc 800, § Puc 805.02.

- **New Hampshire:** See also New Hampshire regulations, Chapter Puc 800, sections Puc 805.01, *"Notice of Probable Violation";* Puc 805.02, *Alternative Responses to Notice of Probable Violation*; Puc 805.03, *Notice of Violation*; Puc 805.04, *Response to Notice of Violation*; Puc 805.05 *Commission Action*; Puc 805.06, *Civil Penalties.*

- **Virginia**: The Advisory Committee, which is established by statute to include "representatives of the following entities: Commission staff, utility operator,

notification center, excavator, municipality, Virginia Department of Transportation, Board of Contractors and underground line locator," meets one day annually (in addition the monthly hearings) for "issue day," a day to discuss issues and make recommendations to the State Corporation Commission (SCC) administrative 3-judge panel on issues related to damage prevention. Subteams of the Advisory Committee are also formed to develop recommendations. "*The purpose of the Committee is to ...make recommendations with regard to Public Education and Awareness Programs that further public safety by the reduction of damage to the underground utility facilities in the Commonwealth and to monitor, analyze, influence, propose, support or oppose programs or regulations that directly affect damage to underground facilities serving the citizens of the Commonwealth.*" Bylaws of the Advisory Committee, Article II.

- **Virginia**: "*Upon receipt of a report of a probable violation, the Commission Staff ("Staff") shall conduct an investigation to examine all the relevant facts regarding the reported probable violation. The investigation may include, among other things, records verification, informal meetings, teleconferences and photo-documentation. Upon completion of the investigation, the Staff shall review its findings and recommendations with the Advisory Committee established in accordance with § 56-265.31 of the Act.*" Virginia "Rules for Enforcement of the Underground Damage Prevention Act," § 3.

B. Structured Review Process

Practices Statement: A structured review process is used to impartially adjudicate alleged violations.

Practice Description: Two types of review processes currently used are outlined below. These type of processes differ in terms of 1) who receives reports of alleged violations, 2) who investigates the reports, 3) possible outcomes of the investigation, 4) who conducts 1st tier (informal) hearings, 5) possible outcomes of 1st tier hearings, and 6) appeal rights following a 2nd tier (formal) hearing. It is important that review processes are constructed to avoid abuses of authority and prevent any individual, industry, stakeholder or agency from exercising undue power or influence over the process.

Type 1: Traditional Enforcement Authority - This system is currently used in Arizona, Connecticut, Massachusetts, Minnesota, New Hampshire, New Jersey, New York and Pennsylvania.

Reports of alleged violations are sent to the State Agency. A state investigator investigates the reports. If the investigator decides not to issue a NOPV (Notice of Probable Violation), the matter is concluded. If not, the NOPV is issued, and the investigator conducts an informal hearing or review. If the investigator determines that no violation was

committed the matter is concluded. If the investigator determines that a violation was committed, the NOV (Notice of Violation) is issued. If the alleged violator does not contest the NOV, the alleged violation is bound by the facts, findings, orders and penalties set forth in the NOV. If the alleged violator so requests, the State Agency conducts a formal hearing. The alleged violator may appeal the decision reached in the formal hearing to the state court system.

Type 2: Advisory Committee (made up of stakeholders) partnered with State Agency - This system is currently used in Virginia.

Reports of alleged violations are sent to the State Enforcement Agency. The State Agency investigates the alleged violations and reports to an advisory committee.

The Committee is made up of stakeholders representing the following statutorily mandated fields: excavators, facility owners/operators, notification centers, contract locators, local governments, State Department of Transportation, the Board of Contractors, and the State Enforcement Agency.

If the advisory committee decides not to issue a NOPV (Notice of Probable Violation), the matter is concluded, possibly with a "letter of concern" containing one-call information. If the advisory committee decides to issue an NOPV, it is issued by the State Agency. If the alleged violator does not request a hearing, the alleged violator is bound by the enforcement action set forth in the NOPV. If the alleged violator so requests, an informal hearing is held by the advisory committee. If the advisory committee decides that no violation was committed, the matter is concluded, subject to the right of the State Agency to contest that decision in an administrative proceeding conducted by the agency. If not, the NOV is issued. If the alleged violator then settles the matter with the advisory committee, the settlement is subject to approval by the State Agency in an administrative proceeding. If there is no settlement, the State Agency conducts a formal administrative hearing. The alleged violator may appeal the decision reached in the formal hearing to the state court system.

7.6 PATH FORWARD

The overall goal of the Common Ground Best Practices Study is to establish effective damage prevention partnerships. Means by which the U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety may determine whether such partnerships have been attained may include:

- identify an entity to measure improvements following issuance of the Study results,
- monitor number of state laws revised based on the Common Ground Study best practices,
- monitor changes in call volume to one-call centers,
- monitor changes in "one-call system" stakeholder membership,

- monitor frequency of damage to all underground facilities,
- monitor stakeholder feedback to ensure fair treatment by the system,
- monitor stakeholder feedback regarding communication among industry, and
- monitor positive/adverse safety effects of damage prevention programs.

CHAPTER 8
Public Education and Awareness Task Team Best Practices

8.1 CHAPTER SUMMARY

Public education and awareness must be more than just "Call Before You Dig." In support of this belief, the scope of the Public Education and Awareness Task Team focused on overall underground damage prevention. The Task Team's mission was to identify practices that promote awareness of damage prevention and the use of one-call systems.

The Task Team identified and described nine best practices to educate the public and promote awareness of damage prevention and the use of one-call systems. These are:

1 Use of a Marketing Plan
2 Target Audiences and Needs
3 Use of Structured Education Programs
4 Target Mailings
5 Use of Paid Advertising
6 Use of Free Media
7 Use of Giveaways
8 Establishing Strategic Relationships
9 Measuring Public Education Success

Implementation of these practices will help to ensure that all participants in the excavation process understand the applicable laws, rules and regulations. It will also help to achieve the best utilization of available educational resources and prevent damage to all underground and submerged facilities. A successful damage prevention education program will result in a significantly enhanced level of safety for the public and the excavator, a reduction in environmental damage, and improved service reliability.

An existing, joint government/industry Damage Prevention Quality Action Team (DAMQAT), organized by the U. S. Department of Transportation, Research and Special Programs Administration (RSPA), Office of Pipeline Safety (OPS), looked at many current public education practices to determine the best course of action to implement a damage prevention public education campaign. The DAMQAT developed and implemented the **Dig Safety** public education campaign. A successful, six-month pilot of the **Dig Safely** campaign was conducted in three states: Georgia, Tennessee, and Virginia. A nationwide roll-out of the campaign began in June 1999.

The Public Education Task Team was linked closely with the DAMQAT and utilized many of its findings. The primary focus of the DAMQAT **Dig Safely** campaign is on four key messages:

- Call Before You Dig
- Wait the Required Time
- Respect the Marks
- Dig with Care

The Public Education and Awareness Task Team agreed with these messages. However, the practices evaluated by the Task Team are *methods* of public education (i.e., how to get the message out) rather than a specific message. Public education and awareness of underground damage prevention is a major marketing effort involving the identification of target audiences, unique characteristics of different geographic regions, and specific practices and goals.

8.2 TEAM MEMBERS

The following people participated as Task Team members in the identification, evaluation and selection of Public Education and Awareness Best Practices. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	**Representing**[21]	**Employer**
Bill Bertges	DOT, RSPA, OPS	DOT, RSPA, OPS, Southwest Region
Bob Cave	APGA	APGA
Mary-Jo Cooney, Co-chairperson	DOT, RSPA, OPS	DOT, RSPA, OPS, HQ
Morris Dock	AGC	Mo Do Co, Inc.
Ronald G. (Ron) Embry	API/ AOPL	Exxon Pipeline Company
Mark Frost	OCSI	JULIE, Inc.
Pat Kirchberg	OCSI	US West
Craig Linn	INGAA	Williams Gas Pipeline - Transco
Stu Megaw	AGC	AGC
N. Allen Robertson	NULCA	Byers Locate Services, LLC
Larry Shamp, Co-Chairperson	API	Equilon Pipeline Company
Dan Simpson	NTDPC	Worldcom Network Services
Pamela Wagner	NUCA	NUCA

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

[21] See Appendix D for a detailed list of acronyms.

Team Particpant	Representing	Employer
Glynn Blanton, Linking Team Liaison	NARUC	Tennessee Regulatory Authority
Willard S. Carey, Steering Team Liaison	AGA	AGA
Richard Rapposelli	AMTRAK	AMTRAK
Claudette Campbell, Linking Team Liaison	OCSI	Utilities Protection Center of Georgia, Inc.
Massoud Tahamtani, Linking Team Liaison	NAPSR	Virginia State Corporation Commission

8.3 DATA COLLECTION AND EVALUATION PROCESS

8.3.1 Information sources

The Task Team drew heavily on the collective experience and expertise of Team members as well as the previous efforts of the Damage Prevention Quality Action Team.

8.3.2 Process for collecting information

The process began with discussions of the components of current damage prevention education efforts. "Brainstorming" sessions were conducted among Team members to identify target audiences. Additional brainstorming sessions resulted in the identification and association of methods and materials currently being used to convey the damage prevention message to the target audiences. As noted above, these discussions utilized many of the DAMQAT findings. Each Team member also was charged to interact with his/her represented constituent organizations to get input regarding current education practices.

8.3.3 Process for selecting and developing practices

The Team discussed the criteria to be used in determining "what is a best practice" and agreed on the following characteristics:

- It is being done today.
- It is cost efficient.
- It is effective.
- It should respect the past.
- It should applaud the present.
- It should look to the future.
- It is flexible and adaptable.
- It can be implemented across a wide spectrum [of industry].
- It should be available to and supported for use by stakeholders.

Positive feedback from some of the represented constituents was received on the criteria.

The Task Team agreed on an outline to be used in the discussion of best practices that involved the mix of target audiences, materials, and methods. After further evaluation, it was agreed that the major items of the discussion outline represented the best practices to be used in damage prevention education. These are:

1 Use of a Marketing Plan
2 Target Audiences and Needs
3 Use of Structured Education Programs
4 Target Mailings
5 Use of Paid Advertising
6 Use of Free Media
7 Use of Giveaways
8 Establishing Strategic Relationships
9 Measuring Public Education Success

A format was adopted by the Task Team for documenting best practices. The format is as follows:

Practice Title: A brief title to identify the practice (e.g., "Disaster Recovery")

Practice Statement: One or more sentences that provide a brief and concise statement of the practice (e.g., "Each one-call center should have a disaster recovery plan . . .")

Practice Description: One or more paragraphs that more fully describe the practice, along with the intent, purpose, basis, etc. of the practice

References: Identifies the references used to identify and document the practice

"Practice Advocates" were identified to take responsibility for the development and documentation of the practice statements and descriptions for each practice. The practice advocates were also responsible for identifying and preparing material to support the inclusion of the current practices. The material prepared by the practice advocates served as the basis for discussion and further development of the practice language that was agreed to by consensus among the Team members.

After the Task Team created a thorough draft of the nine practice statements (noted in Section 8.4, "Findings"), a survey was sent to all one-call centers in the United States. (The survey was sent independently by team member Mark Frost, representing One Call Systems International.) The survey requested each Call Center Executive Director to indicate which of the nine practices were currently in use at their respective center. It also allowed space for respondents to provide examples or further information explaining how the center puts the statement into practice.

The following twenty (20) one-call centers responded to the survey:

Alabama Line Location Center, Inc.(AL)	Arizona Blue Stake, Inc. (AZ)
Utility Notification Center of Colorado (CO)	Connecticut Call Before You Dig (CT)
Utilities Protection Center of Georgia, Inc. (GA)	Dig Line-Idaho (ID)
JULIE, Inc.- Illinois (IL)	Iowa Underground Plant Location Service (IA)
Kentucky Underground Protection Inc. (KY)	Mississippi One-Call System, Inc. (MS)
Missouri One-Call System, Inc. (MO)	New Mexico One-Call System, Inc. (NM)
New York City-Long Island One-Call Center (NY)	North Carolina One Call Center, Inc. (NC)
Ohio Utilities Protection Service (OH)	Oklahoma One-Call System, Inc. (OK)
Oregon Utility Notification Center (OR)	Texas One-Call System (TX)
Miss Utility of West Virginia, Inc. (WV)	Wisconsin Diggers Hotline, Inc (WI)

Results from the survey are incorporated into the references for each best practice noted below, by indication of the states responding positively to the related question.

8.4 FINDINGS

The Task Team agreed on the following Public Education and Awareness Best Practices:

1 Use of a Marketing Plan
2 Target Audiences and Needs
3 The Use of Structured Education Programs
4 Target Mailings
5 The Use of Paid Advertising
6 The Use of Free Media
7 The Use of Giveaways
8 Establishing Strategic Relationships
9 Measuring Public Education Success

1. <u>Use of a Marketing Plan</u>

Practice Statement: An effective damage prevention education program includes a comprehensive, strategic marketing/advertising plan.

Practice Description: A comprehensive, strategic marketing/advertising plan enables better implementation, control, and continuity of advertising/public relations programs and ensures the most effective and efficient use of limited resources. These plans focus on setting realistic goals and allocating sufficient resources required to achieve those goals within a specified time frame. The marketing plan is a set of action steps based on a comprehensive situation analysis that clearly states:

- **What** is to be achieved,
- **How** it will be achieved,
- **When** it will be achieved,
- **Who** is responsible for achieving each goal, and
- **What** amount of resources (time, people, and money) will be allocated to achieving each goal.

References:

- Louisiana One Call Systems, Inc. Project 2000, 1998 Marketing Plan.
- Public Awareness Marketing Plan for Underground Utility Damage Prevention, prepared for the Damage Prevention Quality Action Team by the daily planit, November 20, 1997.
- Underground Protection Center (UPC) of Georgia.
- Various one-call centers including: AL, AZ, CT, GA, IL, IA, KY, MO, NM, NY (City), NC, OK, OH, OR, WV, and WI.

2. Target Audiences and Needs

Practice Statement: An effective damage prevention education program includes identification of target audiences and their individual needs.

Practice Description: Identification of target audiences will ensure maximum impact for the dig safely message. The following target audiences have been identified as examples:

- Construction management
- Excavation equipment operators
- Excavators
- Public works excavators
- Locators
- Railroads
- Participating facility owners/operators
- Non-participating facility owners/operators (i.e., not one-call members)
- Marine operations
- Children

- Property owners/tenants
- Emergency responders/local emergency planning committees
- News media

When target audiences are identified, their specific needs can be more readily addressed. This will allow the identification of media (e.g., free advertising, advertising, brochures, meal meetings, handouts, etc.) which can most effectively be used to deliver the message. This will also allow customization of the message itself. Coordination with other strategic partners can assist in reaching the greatest number of people.

References:

- Various one-call centers including: AL, AZ, CO, CT, GA, ID, IL, IA, KY, MS, MO, NM, NY (City), NC, OK, OH, OR, TX, WV, and WI.
- NUCA and various NUCA state chapters.
- API, INGAA, and AGA member companies.
- AGC chapters.

3. The Use of Structured Education Programs

Practice Statement: An effective damage prevention education program is structured to accommodate the needs of individual audiences.

Practice Description: Damage prevention education programs that are structured to accommodate the needs of individual audiences are essential to effectively communicate the message of damage prevention for underground facilities. For example:

- Structured education presentations in association with meal functions are an effective method to communicate with organized groups such as emergency responders and equipment operators.

- Guest speaker appearances are effective with property owners groups, civic clubs, etc.

- Awareness videos are effective education tools for children's groups such as scout troops and schools.

- One-call center tours are effective for educating the public, news media, facility locators, excavators and operators on the overall one-call system and damage prevention process.

- Contractor and construction trade shows are unique opportunities to deliver the damage prevention public education message.

- Training videos and multi-media presentations are effective to reach facility owner/operator locating staffs, customer service personnel, and one-call center liaisons.

References:

C Various one-call centers including: AL, AZ, CO, CT, GA, ID, IL, IA, KY, MS, MO, NM, NY (City), NC, OK, OH, OR, TX, WV, and WI.
C Current industry materials, programs, and practices.
C National Land Improvement Contractors Association.
C API, INGAA, and AGA member companies.
C Industry associations including: AGC chapters, NUCA, and NTDPC.
C Various contract locating firms.

4. Target Mailings

Practice Statement: An effective damage prevention education program communicates vital damage prevention, safety, and emergency response information to target audiences through periodic mailings.

Practice Description: Target mailings can effectively communicate essential damage prevention, safety, and emergency response information. Direct mailings, with local information, are useful with residents and businesses that lie within a specified area. Such mailings are especially useful for reaching those residents and businesses that are in the corridor of the underground facility or proposed excavation route. Some examples are listed below:

- Direct mailed billing statements are ideal for including inserts provided by the one-call center, since the connection between underground facilities and **Dig Safely** can be readily made by the consumers.

- Additionally, space for a damage prevention message can be dedicated on the facility owners/operators' newsletters that are often included with the billing statements.

- Direct mailings, either in the form of letters or newsletters, are effective in targeting audiences such as lumber yards and stores, hardware stores, heavy equipment sellers, and rental equipment stores. These mailings can offer support materials such as point-of-purchase brochure displays for sales counters, posters for retail aisles where digging equipment is found, and key chains for rental equipment ignition keys.

- An annual excavator newsletter, originated and mailed directly by the one-call center to all identifiable excavators in the call center's jurisdiction, keeps the customer base involved and informed of changes to the damage prevention system.

- Specialized brochures or letters can be mailed directly to address such issues as: failure to follow local damage prevention laws, guidance to homeowners to understand the damage

prevention process, and special requirements when excavations occur in agricultural or rural settings.

Target mailing lists are developed using a combination of facility owners/operators' and one-call center internal sources, support partner mailing lists, and zip-code + 4/SIC code mailing lists. There are numerous software applications and databases available in the marketplace to support this.

References:

- Various one-call centers including: AL, AZ, CT, GA, ID, IL, IA, KY, MS, MO, NM, NY (City), NC, OK, OH, OR, WV, and WI.
- API Recommended Practice 1123.
- 49 CFR Parts 192, 194, and 195.

5. The Use of Paid Advertising

Practice Statement: An effective damage prevention education program includes paid advertising to increase damage prevention awareness and practices.

Practice Description: Paid advertising through event sponsorships, radio, television, and print media is an effective means for communicating one-call system information and safe-digging requirements to target audiences. Paid advertising is particularly effective for reaching general excavators, construction designers and managers, equipment operators, property owners and tenants, farmers, facility owners/operators, and the general public. However, the use of paid advertising can be very costly and a measurement for success should be implemented early in the advertising campaign to gauge effectiveness. Measurements could include increased locate ticket volume or increased number of first-time callers to a one-call center. Additionally, creative placement of the message can ease the expense of paid advertising and enhance its effectiveness. Examples include transit system signs, sponsorship of news and weather reports on radio and television, industry trade exhibits and events, and print messages in trade publications.

References:

- Various one-call centers including: AL, CO, CT, GA, ID, IL, IA, KY, MS, MO, NM, NY (City), NC, OK, OH, OR, WV, and WI.
- Current facility owner practices, including various oil pipeline companies such as Marathon-Ashland Pipeline Company, Northwest Pipeline Company, and Equilon Pipeline Company.

6. The Use of Free Media

Practice Statement: An effective damage prevention education program utilizes all available free media.

Practice Description: When identified and used correctly, free media can be highly effective to communicate the **Dig Safely** message at minimal cost. For organizations with limited budgets, use of free media should be emphasized.

Press Releases: This tool is the preferred method to communicate "newsworthy" information about your damage prevention program to newspapers, trade publications and radio stations. Examples of occasions/events that are appropriate for press releases are:

- Call-Center milestones (millionth call, record month, record day),
- Year in Review (call volume statistics, damage reduction/increases),
- Election of New Board Members,
- Announcement of Excavator Safety Program Schedule,
- Announcement of New Utility Member,
- Changes to the State/Local Damage Prevention Law, and
- Seasonal "Call Before You Dig" Reminders.

A basic press release, containing the **Dig Safely** message and fundamental information about the damage prevention program is on file for distribution to newspapers and other periodicals who often run special sections o.n topics such as home improvement and safety around the home. Following is a sample press release.

JULIE, INC., 3275 EXECUTIVE DRIVE
JOLIET, IL 60435-8434 (815) 741-5000

NEWS

Contact: Mark A. Frost, Public Relations Manager
Monday-Friday 8:00 a.m. - 4:00 p.m. (815) 741-5005
After 5:00 p.m. (815) 439-6727
FAX (815) 741-5958

FOR IMMEDIATE RELEASE

January 1999

JULIE, INC./ LOCAL UTILITIES TO SPONSOR EXCAVATOR SAFETY BREAKFASTS

JULIE, Inc., the Illinois One-Call System serving all of the state excluding the City of Chicago, in conjunction with local underground facility companies, is sponsoring twenty-four excavator safety breakfast meetings across Illinois. The breakfasts are being held to increase excavator awareness of

the underground facility dangers that exist and to encourage use of Illinois' facility notification system prior to the start of any project involving digging. Area breakfasts include . . . (please refer to attached list).

Each meeting will begin at 7:45 AM with a free breakfast buffet and will conclude by 9:30 AM. Attendees will view the latest JULIE safety video, "It's Where Safe Digging Starts," see local underground facility company displays, hear about the latest changes at JULIE, and have the chance to address their concerns and questions to JULIE and local underground facility company representatives. Every attendee will receive a free gift and one cash attendance drawing of $100 will occur at each breakfast.

For more information and/or to reserve a seat contact the JULIE, Inc. Public Relations Department at (815) 741-5000.

# # #

Not-for-Profit Public Service Announcements (PSAs): Television and radio stations, as well as billboard companies, are often willing to donate air time or space for Public Service Announcements (PSAs) to not-for-profit organizations. To qualify, the organizations must have a safety-related message that benefits the general public.

Member Facility Owners/Operators: The member facility owners/operators of the damage prevention system are, in effect, another source of free media for the **Dig Safely** message:

- Major facility owners/operators that purchase paid advertising on television, radio, and billboards can require that free **Dig Safely** PSAs be included in any media buy they make.
- Cable TV members should be provided copies of any **Dig Safely** commercial and encouraged to run it as a PSA on their system. (Many cable members have created their own messages for this purpose!)
- All members facility owners/operators should be offered vehicle bumper stickers and posters to place on their locating and service vehicles promoting the "Call Before You Dig" phone numbers.

State/Local Government: State and local governments can be yet another source of free media for your damage prevention education program. The following are successful examples of their use:

- Proclamation by Governor of "Call Before You Dig" Month.
- Inclusion of safe-digging messages on state tollway/highway electronic message boards.
- Damage prevention messages in community newsletter of member municipal facility operators.

References:

- Various one-call centers including: AL, AZ, CO, CT, GA, ID, IL, IA,KY, MS, MO, NM, NY (City), NC, OK, OH, OR, TX, WV, and WI.
- Various one-call center member companies, such as Media-One, GTE, TCI Cable Co., Ameritech, and others.

7. The Use of Giveaways

Practice Statement: An effective damage prevention education program uses promotional giveaway items to increase damage prevention awareness.

Practice Description: Effective damage prevention education programs use giveaways to reach targeted audiences. Examples include notepads, pens, rolodex cards, mouse pads, ignition protectors, clipboards, and magnets. Items used should reflect the unique needs and interests of the target audiences and the regions served. For example, sports towels work in many areas and with many audiences. However, beach towels are probably only effective in states or areas near beaches. Giveaways can be distributed via awareness and safety meetings, targeted mailings, sponsored events, trade shows, and other methods. In all cases, items should be usable both for work and recreation.

Reference:

Various one-call centers including: AL, AZ, CO, CT, GA, ID, IL, IA, KY, MS, MO, NM, NY (City), NC, OK, OH, OR, TX, WV, and WI.

8. Establishing Strategic Relationships

Practice Statement: An effective damage prevention education program establishes strategic relationships.

Practice Description: Strategic relationships can be defined as "Making Friends Before You Need Them." This means having working relationships in place to leverage common resources. Successful damage prevention education programs establish strategic relationships with governmental agencies, emergency responders, associations of all types, media outlets, grass roots

organizations, and others. These relationships involve partnering to further damage prevention education efforts.

One example of such strategic relationships includes partnering with the state bureau of utilities, one-call centers, OCSI members, the Equipment Manufacturers Institute (EMI) and original equipment manufacturers to install "North American Equipment Decals" on the dashboards of new excavating equipment. Another example is the One-Call Systems Study (OCSS) for which this Report is written. The OCSS represents the establishment of a strategic relationship among various one-call systems stakeholders to further damage prevention education and awareness.

References:

- Various one-call centers including: AL, AZ, CO, CT, GA, ID, IL, IA, KY, MS, MO, NY (City), NC, OK, OH, OR, TX, WV, and WI.
- Illinois Commerce Commission.
- Existing strategic relationships, such as APWA/AGC and API/NTDPC.

9. Measuring Public Education Success

Practice Statement: An effective damage prevention education program includes structured annual or biennial (every two years) measurement(s) to gauge the success of the overall program.

Practice Description: Damage prevention education program effectiveness can be gauged in several ways. For example:

- Use of a direct mail or telephone survey to effectively determine how one-call center and/or member facility customers are hearing and recalling the damage prevention message.

- Use of Arbitron Areas of Dominant Influence (ADI) boundaries to measure increases in one-call center call volume and/or member facility owners/operators' one-call messages is also an effective measurement. For a given area, these can be compared against the money and resources used in that area for further indications of program effectiveness.

- The collection and tracking of individual or collective facility owners/operators' damage information from year to year is another outstanding method of measuring success, providing that other internal factors at a given facility owner/operator remain constant.

References:

- Various one-call centers including: CT, GA, IL, IA, KY, MS, MO, NC, OK, OH, and WI.
- API Data Collection Initiative.
- INGAA Foundation Pipeline Safety Awareness Material Focus Group Research Report.

- "Presentation of Findings: OPS/DAMQAT Underground Facility Damage Prevention Study" (nationwide survey).
- "Presentation of Findings: DAMQAT Pilot Evaluation Study" (regional survey).
- Great Lakes Common Carrier Committee Six-State Survey.
- Virginia State Corporation Commission survey on why damages occur.

8.5 MEASURING IMPROVEMENTS

The Task Team included a best practice (Practice #9, above) to address "Measuring Public Education Success." The Damage Prevention Quality Action Team recognized the need for a Nationwide Damage Prevention and Awareness Survey and implemented it to serve as a benchmark to measure and validate future public education efforts. The Public Education and Awareness Task Team supports the use of surveys to establish benchmarks for evaluating future public education efforts on a regional/state level.

8.6 PATH FORWARD

The Public Education and Awareness Task Team discussed and considered many aspects of damage prevention education. The best practices selected and included in this chapter were considered to be the most important. Other damage prevention education practices are currently in use. These practices should continue where they are proven effective.

The Task Team considers underground damage prevention and, especially damage prevention education, a critical initiative that should continue beyond the conclusion of the Common Ground One-Call Systems Study. The Task Team recommends that RSPA supply the necessary support to continue the process. A permanent, government/industry damage prevention council should be a goal. This would provide a continuing communication vehicle to identify and encourage the implementation of additional best practices.

The Task Team recognizes that the DAMQAT will soon issue a report recommending the continuing implementation of the nationwide **Dig Safely** damage prevention education campaign. The Task Team supports this effort and encourages RSPA and Congress to recognize the benefits to be achieved by funding the implementation of that campaign. Similar to "Smokey the Bear" and other national campaign efforts, the **Dig Safely** campaign will serve to focus attention on the need for damage prevention awareness on an unprecedented level. The nationwide campaign will support and enhance parallel regional and state damage prevention education efforts.

The Task Team further recognizes current efforts to promote the North American Equipment Decal Program. The equipment decal in pictogram form provides the national one-call referral number for excavators who are not aware of the one-call center number in the particular area where they are working. The Task Team supports this effort, which combines several of the identified Public Education Best Practices, including Target Audiences and Needs, Use of Structured Education Programs, and Establishing Strategic Relationships.

The Task Team recommends that the use of the Internet be explored to further damage prevention education and awareness. Many one-call centers currently have Internet/Web pages that provide useful information. The OCSS Information System has also provided a very useful vehicle for conveying such information. Technology such as the OCSS Information System should also be considered to enhance future communications among government and industry constituents in the damage prevention process. Continuation of the current OCSS Information System would provide immediate and ongoing support for this effort.

8.7 ACKNOWLEDGMENTS

Acknowledgment is given to:

- All Task Team members that actively participated in the Team's efforts.
- All industry and government organizations that supported the effort by providing Task Team members the opportunity to participate.
- Janice Morgan, RSPA Staff, and Chris McClymont, Cycla Corporation, for their support in handling the arrangements and logistics for the Task Team's meetings.
- Herb Wilhite, Cycla Corporation, for facilitation and general support of the Task Team's efforts.

CHAPTER 9
Reporting and Evaluation Task Team Best Practices

9.1 CHAPTER SUMMARY

With representation from utilities, contractors, locators, one-call centers, and regulatory agencies, the Reporting and Evaluation Task Team was faced with a challenge to formulate best practices that are practical and useful for all stakeholders involved with damage prevention.

The main obstacle for the Team was to develop best practices for a process that is not universally used. The Team found numerous examples of reporting and evaluation practices, but a limited number reached a state-wide basis that fully included **all** stakeholders.

As a foundation, the Team used examples of practices that are currently utilized to develop best practices for reporting and evaluating damage prevention data. The Team also developed a sample form for reporting damage prevention information. The form represents a composite of the best reporting information currently being gathered by utilities, contractors, locators, one-call centers, regulatory agencies, and industry groups.

Once a baseline for reporting is established, data can be evaluated to create a continuous improvement environment for the mutual benefit of decreasing and eliminating damage to underground facilities.

9.2 BACKGROUND AND MOTIVATION

The motivation for this project was to specifically identify those practices concerning reporting and evaluation that are most effective in preventing damage to underground facilities. The mission of the Reporting and Evaluation Task Team was, "To Develop Best Practices for Reporting and Evaluation of Data Relative to Damage Prevention Effectiveness and Damage Statistics."

The Reporting and Evaluation Task Team established goals for the project. These goals included the following:

- Assure that input is received from each effected industry type (utilities, contractors, locators, insurance companies, one-call notification centers, and regulatory agencies).
- Define minimal/critical data reporting requirements.

- Recommend a data evaluation process.
- Produce 'easy to use' form(s) and methods for adoption.

9.3 TEAM MEMBERS

The Reporting and Evaluation Task Team was composed of individuals who represent groups having an interest in preventing damage. These individuals had previous knowledge of aspects affecting damage prevention, including collecting and evaluating damage data. During the project, Team members had the means and ability to communicate to the groups they represent. A brief biographical sketch of each Team member, that serves to validate their participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	**Representing**[22]	**Employer**
Dave Barnes	API, AOPL	Amoco Pipeline Company
Raul Bernal	NTDPC	Pacific Bell
James Book	Mississippi DOT	Mississippi DOT
Amy Brox, Co-Chairperson	NARUC	Missouri Public Service Commission
Ted Eynon	NULCA	Heath Consultants, Inc.
Ronny Jones	NUCA	Ronny D. Jones Enterprises, Inc.
Bill Turner, Co-Chairperson	OCSI	Tennessee One Call System, Inc.
John Zizolfo	AGA	Con Edison of New York

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	**Representing**	**Employer**
Donna Erat, Linking Team Liaison	APWA	APWA
John Healy, Steering Team Member	NTDPC	Telcordia
Angela Wallace, Emerging Technologies Liaison	OCSI	Utilities Protection Center, Inc. of Georgia

[22] See Appendix D for a detailed list of acronyms.

9.4 DATA COLLECTION AND EVALUATION PROCESS

The Reporting and Evaluation Task Team conducted a review of current practices concerning reporting and evaluation of data related to damage prevention. Existing damage prevention reporting and evaluation practices, processes, and forms were collected from major industry groups, including utilities, excavators, one-call notification centers, insurance companies, locating companies, and regulatory agencies. (The complete list of references assembled by the Task Team is provided in Appendix E.) This data was reviewed and evaluated by the Team during its meetings and served as the foundation for the issues and findings that are provided in Sections 9.5 and 9.6.

To objectively evaluate potential best practices, the Reporting and Evaluation Task Team established selection criteria. These criteria were considered before the Team reached consensus on any best practice. These selection criteria for best practices include the following:

- The practice is practical and useful.
- The practice is easy to implement.
- There is evidence that the practice works; the practice has been implemented by an organization.
- The practice promotes consistency between one-call notification centers.
- The practice is supported by industry.
- The practice is cost effective.

9.5 ISSUES IDENTIFIED

9.5.1 Purpose for Improving the Reporting and Evaluation of Data Relating to Damage Prevention

Several issues drive the need to improve the reporting and evaluation of data related to excavation damage prevention. At this time, few performance-based measures are available and useful for assessing excavation damage prevention programs. Existing measures are specific to selected states or industries, or are maintained by individual companies for a specific underground system. Data concerning underground damage for all types of systems is needed to:

- Determine if changes to state damage prevention programs are effective in decreasing underground facility damages.

- Assess the benefits of different practices followed by one-call notification centers.

- Identify the risks and benefits of different field practices used by facility owners/operators, locators, and excavators.

- Allow facility owners/operators to evaluate their company's excavation damage prevention programs.

- Assess the needs and benefits of training.

- Perform risk assessment for the purposes of business, insurance, and public policy decisions.

Reference: National Transportation Safety Board Safety Study: Protecting Public Safety Through Excavation Damage Prevention (NTSB/SS-97-01).

9.5.2 Issues that Define Data Reporting and the Evaluation Process

The Reporting and Evaluation Task Team defined several topics related to the reporting and evaluation process. These topics are delineated and discussed below.

1. Who should report facility damage data?

- To fully understand which problems need attention, each stakeholder involved in the excavation process needs to report the damage prevention information.

- There are few universal and comprehensive programs where all groups with an interest in underground damage prevention report qualified information on incidents that could have, or did, lead to a damaged underground facility.

2. What data should be reported?

- It is difficult to track and evaluate data that is not consistent. Not all companies, excavators, or states have a reporting program. Those persons who collect data are not collecting the same information.

- If the requested data on the form does not gather enough data, then the data cannot be properly analyzed.

- To prevent damage, it may be necessary to track problems before a hit has actually occurred. This data, strictly related to prevention, may be evident when near-misses or downtime have occurred.

- Excavators may be able to identify problems that will prevent future damage. A prudent excavator who continually encounters problems with the one-call system will find it beneficial to report those problems before damage occurs.

- Due to litigation or other reasons, some data may not be available at the time that the event is reported.

- Requested information, especially root causes, will change as the state's damage prevention program evolves and technology changes.

3. How do we get the data to be reported?

- There is no universally adopted standardized form or completion/returning methodology that has been distributed to all facility owners/operators, locators, excavators, and other appropriate stakeholders.

- Facility owners/operators, contractors and locators will need to be educated on how to submit information. This education can be provided by one-call notification centers and trade associations.

- To encourage the reporting of data, those persons providing the information need to be offered flexibility when completing the form. Current reporting programs offer this flexibility through several methods including providing self-addressed forms, offering fax numbers for returning completed forms, providing blank forms on a web page, or allowing an individual to report information over the phone by calling the one-call notification center or the state's commission.

- There is a limited number of formal requirements for damage reporting at local, state, or federal levels. Some states have reporting requirements, but not all groups with an interest in underground damage prevention, including contractors, are required to report qualified information. Some reporting of facility damage information is required at a federal level, but these reporting requirements are often based on monetary loses or fatalities.

- Often, companies that track damage prevention information do so at their own incentive.

- Incentives are needed to encourage stakeholders to submit the data. For example, stakeholders that submit information should know that their data will be used to promote better damage prevention.

4. Who should collect the data?

- Current programs that collect damage prevention data at a state level often utilize the state's commission or the one-call notification center.

- There are a limited number of comprehensive programs that use a centralized and independent organization or methodology to receive and accumulate completed

information forms from all groups with an interest in underground damage prevention.

- Whoever collects the data must have the resources to support the collection.

5. Who should evaluate the data and how should it be evaluated?

- Current programs that evaluate damage prevention data at a state level often utilize the state's commission or the one-call notification center.

- There are a limited number of comprehensive programs that use a centralized and independent organization or methodology to evaluate and publish evaluation data.

- Whoever evaluates the data must have the resources to support the evaluation.

- It would be beneficial for the evaluation to include recurring problems that have not yet, but may, lead to facility damages. This evaluation can be used to target public awareness/education resources, locate unmarked/abandoned facilities, identify stakeholders who are not performing well, or identify other problems with the one-call system process that can be improved before damage occurs.

9.6 FINDINGS

Reporting

1. All stakeholders report information.
2. Standardized information is reported.
3. Identify the non-compliant stakeholder.
4. Person reporting provides detailed information.
5. Requested information may change.
6. A standardized form is adapted.
7. The form is simple.
8. Training is provided.
9. Flexibility on completing and returning form is provided.
10. The form is one page.
11. Stakeholders complete the same form.
12. An organization is identified to receive the information.
13. The organization is able to interface with all stakeholders.

Evaluating

14. An organization evaluates the data.
15. The organization has representation from all stakeholders.
16. Data is used to improve damage prevention efforts.
17. Data is used to elevate underground damage awareness.
18. Data is summarized by key components.
19. Root causes are identified.
20. Results are quantified against a standardized risk factor.
21. Performance levels and trends are assessed.

9.6.1 Best Practices Associated with Reporting Damage Prevention Data

The following is a list of best practices related to the reporting of damage prevention data, as developed by the Reporting and Evaluation Task Team. Under each best practice is a list of references. These references were used as examples during the Task Teams discussions and may not be inclusive of all stakeholders that utilize the best practice.

1. All stakeholders report information.

Practice Statement: Facility owners/operators, locators, excavators, or stakeholders with an interest in underground damage prevention report qualified information on incidents that could have, or did, lead to a damaged underground facility.

References:

- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- Florida Sunshine State One Call.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.
- Tierdael Construction Company - General Contractors.
- United States Department of Transportation, Office of Pipeline Safety.
- Virginia State Corporation Commission.

2. Standardized information is reported.

Practice Statement: The requested data is standardized and consists of minimum essential information that can be analyzed to determine what events could, or did, lead to a damaged facility. This means that collected data should include damage information, downtime and near-misses.

References:

- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- Florida Sunshine State One Call.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.
- Tierdael Construction Company - General Contractors.
- United States Department of Transportation, Office of Pipeline Safety.
- Virginia State Corporation Commission.

3. Identify the non-compliant stakeholder.

Practice Statement: It is important to identify the non-compliant stakeholder (facility owner/operator, excavator, locator, or one-call notification center) so that this group can be targeted with education and training. It may not be necessary to pinpoint the names and addresses of the offenders for the purpose of improving the damage prevention program.

References:

- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- Florida Sunshine State One Call.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.
- Virginia State Corporation Commission.

4. Person reporting provides detailed information.

Practice Statement: If all of the requested data is not available, the person reporting the information provides the most complete information possible.

Reference: Consolidated Edison Company of New York, Inc.

5. Requested information may change.

Practice Statement: Requested information changes as additional or different data is deemed necessary for the evaluation process. The report is revised, as needed, to adapt to the changes in the state's statutes, the evolution of industry technology, and the awareness of root causes.

References:

- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Massachusetts Department of Telecommunications and Energy.
- Tennessee One-Call System, Inc.
- Virginia State Corporation Commission.

6. A standardized form is adapted

Practice Statement: A standardized form is adopted and distributed to all facility owners/operators, locators, excavators, and other appropriate stakeholders.

References:

- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.
- United States Department of Transportation, Office of Pipeline Safety.
- Virginia State Corporation Commission.

7. The form is simple.

Practice Statement: Data is reported using a simple, standardized form. By limiting the number of hand-written responses, the information is easy to complete. Check-boxes or other simple answering techniques help the person reporting the information and make the evaluation process easier.

References:

- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Florida Sunshine State One Call.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.

- United States Department of Transportation, Office of Pipeline Safety.
- Virginia State Corporation Commission.

8. Training is provided.

Practice Statement: Training and education on how and when to complete the form is made available.

References:
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.

9. Flexibility on completing and returning form is provided.

Practice Statement: Flexibility is provided for both completing and returning the form. This may include providing self-addressed forms, web page forms, faxing completed forms, and/or telephone reporting.

References:
- API/AOPL Voluntary Accident Tracking Initiative.
- Florida Sunshine State One Call.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.
- Virginia State Corporation Commission.

10. The form is one page.

Practice Statement: If possible, the form is limited to one page.

References:
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Tierdael Construction Company - General Contractors.

11. Stakeholders complete the same form.

Practice Statement: If possible, facility owners/operators, excavators, locators, and anyone else involved in the damage prevention process complete the same form.

Reference: Virginia State Corporation Commission.

12. An organization is identified to receive the information.

Practice Statement: A centralized and independent organization is identified to receive and process completed forms.

References:
- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Florida Sunshine State One Call.
- New Hampshire Public Utilities Commission.
- Pennsafe Bureau, Department of Labor and Industry.
- Tennessee One-Call System, Inc.
- United States Department of Transportation, Office of Pipeline Safety.
- Virginia State Corporation Commission.

13. The organization is able to interface with all stakeholders.

Practice Statement: The organization collecting the information is able to interface with all groups to promote completion and return of completed forms.

References:
- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
  Consolidated Edison Company of New York, Inc.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.

9.6.2 Best Practices Associated with Evaluating Damage Prevention Data

The following is a list of best practices related to evaluating damage prevention data, as developed by the Reporting and Evaluation Task Team. Under each best practice is a list of sources. These sources were used as examples during the Task Teams discussions and may not be inclusive of all stakeholders that utilize the best practice.

14. An organization evaluates the data.

Practice Statement: A centralized and independent organization, such as a Damage Prevention Committee, is identified to evaluate the completed forms and publish the data.

References:
- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.

15. The organization has representation from all stakeholders.

Practice Statement: The Damage Prevention Committee, with representation from all interested stakeholders, is utilized to assist in the evaluation process.

References:
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.
- Virginia State Corporation Commission.

16. Data is used to improve damage prevention efforts.

Practice Statement: The reported data is used to assess and improve underground damage prevention efforts.

References:
- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- Massachusetts Department of Telecommunications and Energy.
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.
- Virginia State Corporation Commission.

17. Data is used to elevate underground damage awareness.

Practice Statement: The reported data is not primarily used to penalized or punish; rather, it is used to elevate underground damage awareness through recommended training and education.

References:

- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Tennessee One-Call System, Inc.

18. Data is summarized by key components.

Practice Statement: The reported data is summarized by key components.

References:

- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.
- Virginia State Corporation Commission.

19. Root causes are identified.

Practice Statement: Root causes of damages or near damages are identified.

References:

- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- New Hampshire Public Utilities Commission.
- Massachusetts Department of Telecommunications and Energy.
- Virginia State Corporation Commission.

20. Results are quantified against a standardized risk factor.

Practice Statement: Results are quantified against a standardized risk factor. The risk factor considers an stakeholder's exposure to potential damage. This risk factor may be based on factors such as the number of miles of line installed or the number of one-call notification tickets. For example, a risk factor may compare how many underground damages occurred in a certain time period versus the total number of notification tickets issued.

References:

- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- National Transportation Safety Board Safety Study: Protecting Public Safety Through Excavation Damage Prevention (NTSB/SS-97-01).

21. Performance levels and trends are assessed.

Practice Statement: Performance levels and trends are assessed against other organizations.

References:
- API/AOPL Voluntary Accident Tracking Initiative.
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc.
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.

9.6.3 Sample Form for Reporting Damage Prevention Information

Using the best practices from one-call notification center, regulatory agency, facility, locator, excavator, and industry group report forms, the Reporting and Evaluation Task Team drafted a sample report form to demonstrate what data may be reported. This one page form would be used to gather data from all stakeholders involved in the damage prevention process, including facility owners/operators, excavators, and locators. The sample report form is shown on the next page in Figure 9-1. Following the report form is a brief explanation of each part of the form.

The following list of references were used as examples during the Task Teams' discussions and the development of the composite report. These sources do not include all stakeholders that may report any of the same information shown on the sample form.

References:
- Connecticut Department of Public Utility Control/Call Before You Dig, Inc.
- Consolidated Edison Company of New York, Inc
- Florida Sunshine State One Call.
- Massachusetts Department of Telecommunications and Energy.
- National Transportation Safety Board Safety Study: Protecting Public Safety Through Excavation Damage Prevention (NTSB/SS-97-01).
- New Hampshire Public Utilities Commission.
- Tennessee One-Call System, Inc.
- Tierdael Construction Company - General Contractors.
- Virginia State Corporation Commission.

Figure 9-1 Damage Prevention Reporting Information

Provide the following information as completely as possible.

PART A – WHO IS SUBMITTING THIS INFORMATION

Who is providing this information? ❑ Excavator ❑ Locator ❑ Facility owner ❑ Property Owner ❑ Other_____

Name of the person providing information: _____

PART B – DATE AND LOCATION OF THE EVENT

Location of the excavation and/or damage (include city and county): _____

Date the damage or downtime occurred: _____

PART C – AFFECTED FACILITY INFORMATION

What type of facility operation was affected?

❑ Telephone ❑ Water ❑ Petroleum Pipeline
❑ Gas ❑ Sewer ❑ Cable TV
❑ Electric ❑ Steam ❑ Other_____

What type of facility was affected?

❑ Transmission ❑ Service
❑ Distribution ❑ Other_____

Is the facility owner a member of one-call? ❑yes ❑no

PART D – EXCAVATION INFORMATION

Type of Excavator:

❑ Contractor ❑ Municipality ❑ Railroad ❑ Unknown
❑ Developer ❑ County ❑ Occupant ❑ Other _____
❑ Utility ❑ State ❑ Farmer

Type of Excavation Equipment:

❑ Explosives ❑ Hand Tools
❑ Mechanized Equipment
*type of mech equip:*_____

Type of work performed:

❑ Telecommunications ❑ Pole ❑ Waterway Improvement
❑ Sewer ❑ Storm Drain ❑ Petroleum Pipeline ❑ Fencing ❑ Traffic Signal/Sign ❑ Landscaping
❑ Gas ❑ Steam ❑ Curb/Sidewalk ❑ Street Light ❑ Bldg. Demolition ❑ Driveway
❑ Water ❑ TV Cable ❑ Transit Authority ❑ Drainage ❑ Bldg. Construction ❑ Lot Grade
❑ Electric ❑ Road Work ❑ Railroad Maintenance ❑ Agriculture ❑ Site Development ❑ Other _____

PART E– NOTIFICATION

Did the excavator notify the one-call notification center? ❑ yes ❑ no

If yes, provide the one-call notification ticket number. ticket number: _____

PART F – LOCATING AND MARKING

Type of locator: ❑ Utility Owner ❑ Contract Locator ❑ Other _____

Were facility marks visible in the area of excavation? ❑ yes ❑ no

Were the facilities marked correctly? ❑ yes ❑ no

PART G – DESCRIPTION OF EXCAVATOR DOWNTIME

Did the excavator incur downtime? ❑ yes ❑ no

If yes, how much time? _____

Estimated cost of the downtime: ❑ $0 – 5,000 ❑ Over $25,000 ❑ $5,000 – 25,000 ❑ Unknown

PART H – DESCRIPTION OF DAMAGE

Was there damage to a facility? ❑ yes ❑ no

Did the damage cause an interruption of service? ❑ yes ❑ no

If yes, duration of the outage: _____

Approximately how many customers were affected? _____

Estimated cost of damage and repair/restoration:

❑ $0 – 5,000 ❑ Over $25,000
❑ $5,000 – 25,000 ❑ Unknown

*Number of people injured:*_____ *Number of fatalities:*_____

PART I – DESCRIPTION OF THE ROOT CAUSE

What was the root cause of the damage, downtime, or near-miss?

❑ Facility marking or location not sufficient
❑ Facility was not located or marked
❑ Facility could not be located
❑ Abandoned facility
❑ Incorrect facility records/maps
❑ Wrong information provided
❑ Deteriorated facility
❑ No notification made to the one-call center
❑ Notification to the one-call center made but not sufficient
❑ Excavation practices not sufficient
❑ Previous damage
❑ One-call notification center error
❑ Other_____

PART J – ADDITIONAL INFORMATION

If useful, provide additional information to describe the details of the event.

- Provide a sketch or photographs.
- Provide additional written explanation.
- In your opinion, what could have prevented this event?

The following is a short explanation of each part from the report form.

Part A - Who is Submitting the Information
The person providing the information is described. The name of person providing the information is requested to improve the legitimacy of the report.

Part B - Date and Location of the Event
The location and date of the event are requested so that multiple reports of the same event can be correlated. The location is also requested to track areas that may have a higher occurrence of a problem than another area.

Part C - Affected Facility Information
The type of facility that was involved is described. This may be used to evaluate if a recurring problem involves one type of facility more than another. Facility terminology may vary.

Part D - Excavation Information
The type of excavator that was involved is described. This may be used to evaluate if a recurring problem involves one type of excavator more than another.

Part E - Notification
Requesting the ticket number helps limit duplications; if the same event is reported by more than one stakeholder then the forms can be correlated. This information also provides evidence that the one-call center was notified.

Part F - Locating and Marking
The type of locator that was involved is described. This may be used to evaluate if a recurring problem involves one type of locator more than another.

Part G - Description of Excavator Downtime
This part describes the downtime an excavator may incur.

Part H - Description of Damage
The part describes any damage incurred by a facility.

Part I - Description of the Root Cause
This part describes the root cause of the event. Care is taken when describing the root cause. For example, terms such as "miss-marks" or "line cut by excavator" are avoided. Many states may not be aware of their most frequent root causes because they have never had a reporting program in place. As root causes are recognized, this part is revised to include root causes that occur most often or warrant attention. A more detailed description of some of the root causes listed on the form is provided below.

Abandoned Facility: This event was caused by an abandoned facility issue. For example, the abandoned facility may have been located, instead of the active facility. Or, an abandoned facility may have been located, but it may have been found active after the excavation exposed the facility.

Incorrect Facility Records/Maps: Incorrect facility records or maps may have led to an incorrect locate.

Wrong Information Provided: This error may have occurred because an excavator provided the wrong excavation location to the notification center. Or, there may have been a mis-communication between two stakeholders.

Deteriorated Facility: An excavation disrupts the soil around a facility and a failure results. However, the failure was caused by the deterioration of the facility and not the excavation.

Notification to the One-Call Center Made But Not Sufficient: The excavator contacted the one-call notification center but did not provide complete information, or the excavator may not have given sufficient lead time notification according to state law.

Excavation Practices Not Sufficient: The excavator did not use proper care or follow the correct procedures when excavating near a facility.

Previous Damage: A significant amount of time has passed between the time the damage occurred to a facility and the time when the damage was found.

Part J - Additional Information

The final section of the report requests that the person reporting the information provide any additional details that may be useful. Especially important to improving damage prevention is asking the person reporting the information to describe what could have prevented the event.

9.7 MEASURING IMPROVEMENTS

Measuring improvements which may result from the implementation of these best practices can be viewed in several ways. Initially, improvement measures will be evident as we move from having no uniform data collection process (there being no standard format and content to reporting and evaluating data) to promoting a common framework for collecting relevant data. Once the initial baseline has been established, data can be evaluated from many perspectives and steps can be taken to create a continuous improvement environment for the mutual benefit of decreasing and eliminating damage to underground facilities. This forum will encourage shared learning as well as enable the identification of specific target areas to enhance damage prevention efforts.

9.8 PATH FORWARD

Within a year after publication of the *Common Ground: Study of One-Call Systems and Damage Prevention Best Practices*, it is recommended that an analysis be made on the implementation of the best practices concerning the reporting and evaluation of damage prevention data. The effectiveness of the best practices would be measured on its value to the damage prevention community, and its effect on actually reducing underground facility damages. The analysis would measure the use and significance of the Damage Prevention Reporting Form, and the successes or failures associated with collecting and evaluating field damage data. Revisions should be made to the process if it is determined to be necessary.

Future recommendations to encourage consistent damage reporting may include establishing state specific goals. This may include implementing incentive programs to reward and recognize those states, agencies, companies, or individuals responsible for a program's success.

9.9 ACKNOWLEDGMENTS

The Reporting and Evaluation Task Team would like to acknowledge the following persons:

- All industry and government organizations that supported this project by providing the Task Team members an opportunity to participate.
- Don Brown from CNA Commercial Insurance.

CHAPTER 10
Conclusions

10.1 STUDY PROCESS OVERVIEW

This section provides a brief summary of information contained in Chapter 1, "Common Ground Study Background and Process."

10.1.1 Common Ground Study Objective

The purpose of the Common Ground Damage Prevention Best Practices Study was to identify and validate existing best practices performed in connection with underground facilities damage prevention. The Study focused on gathering and assessing information to determine which existing one-call notification system practices were most effective in protecting the public, excavators, and the environment, and preventing disruptions to public services and underground facilities. All findings contained in this Study are intended for use by state agencies, one-call center operators, underground facility owners/operators, contractor organizations, and other stakeholders who are impacted by or have an impact upon underground facilities. The practices should be further examined and evaluated for incorporation into the development of or improvement to underground facilities damage prevention programs.

10.1.2 TEA 21 Authorization

This Report, *Common Ground: Study of One-Call Systems and Damage Prevention Best Practices*, was prepared in accordance with, and at the direction and authorization of, the Transportation Equity Act for the 21st Century (TEA 21), Public Law 105-178, that was signed into law on June 9, 1998.

10.1.3 Study Team Process

Over 160 Team members participated in the One-Call Systems Study, conducted from August of 1998 through June of 1999.

The Study process consisted of nine Task Teams focused on the various attributes of one-call systems and damage prevention processes. A Linking Team provided overview of the Task Team progress and assisted with the direction of issues that impacted more than one area. A Steering Team provided executive guidance for the Study process. To the extent possible, each Team was a diverse group of stakeholders involved in underground facility damage prevention.

10.1.4 Consensus Process

Each Task Team identified, collected, and evaluated numerous existing practices associated with one-call systems and damage prevention processes, with the intent of identifying the best of these within the

designated areas of focus. Using evaluation criteria developed by the Task Teams, best practices were identified through a process requiring consensus of all participating Team members.

10.2 STUDY FINDINGS

10.2.1 Common Ground Study Best Practices

A great number of sometimes differing or possibly conflicting damage prevention practices currently exist. Practices may differ due to geographical elements, weather patterns, areas of population, or specific types of underground facilities. It is through these differences, however, where the greatest opportunity to share information and learn from one another exists. Through the examination of these existing practices, the Task Teams identified and then selected the set of best practices for underground facilities damage prevention.

Chapters 2 through 9 of this Report contain the best practices identified by the Task Teams. The best practices are organized within the following Task Team focus areas: Planning and Design, One-Call Center, Mapping, Locating and Marking, Excavation, Reporting and Evaluation, Compliance, and Public Education and Awareness.

The Emerging Technologies Task Team was formed to investigate recently developed or promising technologies that will be beneficial in preventing underground facility damage. Although these could not be categorized as best practices, they are in keeping with the overall objective of this Study.

These best practices can now be shared among stakeholders involved with and dependent upon the safe and reliable operation, maintenance, construction, and protection of underground facilities. Moreover, these best practices contain validated experiences that can be further examined and evaluated, and which stakeholders should consider for incorporation into their own underground facilities damage prevention programs.

10.2.2 Measuring Performance Improvement

Measuring the long-term performance of the best practices is essential to assessing which practices are the most effective in damage prevention. Performance measurement is addressed in Chapter 9, "Reporting and Evaluation Task Team Best Practices."

10.2.3 Partnership

Among the lessons learned from this Study was the intangible value found in bringing together the various stakeholders involved in underground facilities damage prevention, and in having this group focus on solving common problems. In recent years, RSPA has successfully brought diverse stakeholders together to address different issues. For problem solving approaches to risk management, mapping, and most recently underground facility damage prevention, the Quality Action Team model has been an effective process for involving appropriate subject matter experts and stakeholders, data gathering, determining options and

collecting and addressing issues. Although the Common Ground Study Team was comprised of many more areas of interest and participants than in past quality teams, the concepts were similar. This effort has proven successful in terms of establishing and improving channels of communication among many stakeholders that historically have sometimes been more adversarial in their relationships. The Study participants shared a great deal of information with one another and realized significant benefits in working together in search of Common Ground. During the past year, various industry-sponsored conferences have further benefited from this new level of interaction among the damage prevention stakeholders.

The success of the increased levels of communication should be recognized not only for the purposes of this Study, but for future relationships among participating interests. New relationships have been forged during the development of this Study and should continue to grow. Shared responsibility among all stakeholders is a main theme found in this Study in preventing damages to underground facilities. The tremendous amount of communication that made consensus agreement possible among the participants in this Study must be recognized as a fundamental element of effective damage prevention. The successful interaction achieved between facility owners/operators, one-call centers, excavators, designers, contractor associations, and government agencies should be encouraged to carry forward. This will undoubtedly result in improvements in underground facility damage prevention.

10.2.4 Keys to Damage Prevention

The single most critical component of underground facility damage prevention is communication between all stakeholders. Although communication improvement is often cited as the solution to nearly every opportunity, it is nonetheless especially identified as a critical factor to successful application of the Common Ground Study findings. Underground facility damage prevention has a long list of stakeholders who are mutually dependent upon the successful execution of one another's roles in the overall process. The exchange of accurate and timely information during the damage prevention process, coupled with a genuine interest by all stakeholders for a successful outcome, is critical.

Communication is fundamental in the following basic premises of damage prevention:

1 Facility owners/operators are members of one-call centers, and
2 Excavators call before they dig.

Key elements for the prevention of excavation damage to underground facilities include:

- Facility owners/operators are members of one-call centers in the areas in which they have underground facilities (this includes active, out of service, and abandoned facilities).

- One-call centers maintain accurate mapping data files that reflect which facility owners/operators have underground facilities in the area of the proposed excavation.

- A notice of intent to excavate in an identified area in advance of an excavation is always made to the appropriate one-call center.

- One-call centers analyze excavation notices to identify members with facilities in the excavation area.

- One-call centers notify any potentially affected facility owners/operators.

- Underground facilities are accurately located and marked prior to excavation.

- Excavators exercise proper and safe excavation practices.

The benefits of following the **Dig Safely** approach to excavation activities cannot be underestimated. It is always best to "Call Before You Dig." Utilizing the one-call system is the best and most viable method to minimize the significant risks that can be involved in excavation activities.

10.3 REMAINING ONE-CALL SYSTEM OPPORTUNITIES AND ISSUES

Significant background information, knowledge sharing, idea generation, and a shared responsibility for awareness of existing opportunities and one-call system issues were gained as a result of the Common Ground Study. Some of those identified issues could not be solved through the examination and evaluation of best practices. Although considered to be outside the scope of this Study, the Linking Team felt it would be remiss to not raise the awareness of the various stakeholders to those issues and opportunities, and has consequently elected to summarize some of the more significant ones that were discussed.

The following issues currently impact or cause ongoing concern to underground facility damage prevention efforts and may result in injuries, fatalities, environmental insult, and loss of vital services.

- Peak Workload – Current trends in notifications of intent to excavate have resulted in peak workload issues that primarily affect the one-call centers and facility locating and marking personnel. The typical workweek for pre-planned excavation occurs from Monday through Friday. This results in excavation notifications often being received in high numbers to allow for the start of excavation on Monday of the following week. Staffing for peak workloads causes problems for one-call centers and facility locators, with a typical compromise being to staff for the slower periods and to work overtime during the peak times. Temporary workers often don't meet the necessary requirements, as both activities require significant training and on the job experience. The concern with this situation is that the resulting peak workload may cause rushed or hurried work, which increases the likelihood of human error and consequential facility damage.

- Seasonal Workload – Similar to "Peak Workload", excavation patterns typically follow weather patterns, with most work being scheduled to avoid frozen ground, crop damage, poor weather seasons, or other general periods of low construction efficiency. The burden again affects the one-call centers and the facility locators, who must handle the periods of high excavation activity and still be able to maintain financial profitability during the slower times.

- Unlocatable Facilities – Critical to the damage prevention process is the ability to accurately locate, mark, and identify the precise position and depth of underground facilities. Current technology limits and underground facility materials sometimes make this difficult or even impossible to determine.

- Abandoned or Unregistered Facilities – When facility owners/operators are not identified, or when the one-call centers do not have location information for abandoned facilities, locating personnel are disadvantaged in that they are unlikely to be looking for facilities that they are unaware of. Abandoned facilities are not necessarily safe facilities, and at a minimum they can cause significant delays and increased excavation costs when encountered. Abandoned or unregistered facilities that are damaged can cause environmental consequences, safety risks to excavation personnel, unanticipated repair costs, and possible disruption to vital services.

- Inaccurate Facility Owner/Operator Records – Inaccurate or out of date facility owner/operator records negatively impact the ability to locate underground facilities. Differing practices among facility owners/operators and other industries in areas of as-built drawings, mapping practices, and details of original construction configurations, when coupled with asset transfers and changes to facilities, over time present ongoing challenges in damage prevention.

- Emergency Excavation – When circumstances require emergency excavation, the one-call system and facility locating processes are sometimes bypassed, placing excavators and emergency personnel at risk.

- Urban Sprawl – Many underground facilities were installed years ago in rural or low population areas. Although these facilities were suitably installed and adequate for the original construction conditions, they are sometimes not ideal for the new conditions resulting from higher population and increased surface activity. If these same facilities were rebuilt today, there could likely be modifications in design depths, routing, mapping, or marking and identification practices to more ideally coexist with today's higher populations and land usage. Protecting these existing facilities presents new challenges.

- Human Error – The entire one-call system damage prevention process is heavily dependent upon accurate handling and communication of excavation information. Human errors at any step in the process in reporting and receiving, analyzing, and responding to information related to excavation activities can possibly result in facility damage.

- Conflicting and Inconsistent Laws and Practices – Each state has its own laws and practices governing excavation and damage prevention. Although similar in intent, the specific requirements vary from the slight to the extreme, with even some direct conflicts in laws and practices from an individual state to its adjoining neighbors. For facility owners/operators, locators, and excavators operating in multiple states, these variations can cause confusion and inefficiencies in safely performing excavation activities.

- State Allowed Exemptions – Some states allow one-call system exemptions to specific interest groups. These exemptions may have resulted in, or contributed to, damages of underground facilities.

- Weak Enforcement of Damage Prevention Laws – Some damage prevention efforts are limited by effectively having no teeth in damage prevention laws. This can result in inconsistent one-call system practices and the possibility of higher damage rates. State practices also vary greatly regarding which groups are responsible for the actual administration and issuance of damage prevention enforcement, with wide degrees of variation in program utilization and overall impact.

- Continuing Education – New stakeholders regularly become involved with some aspect of underground facilities. The burden of educating new stakeholders, as well as providing refresher training to others, is sometimes not consistently and effectively performed. The communication requirements are significant, yet in practice may be lacking in some areas, as central coordination of a damage prevention communication plan does not exist.

- Excavation without Calling – There continues to be some excavation activity commencing without the appropriate one-call notification being made. Some damages to facilities occur as a result of calls not being made.

- Small Facility Owners/Operators – Some small facility owners/operators are not currently members of one-call centers due to the financial costs involved (i.e., ticket costs and in-house labor costs associated with locating and marking their facilities). While understanding the financial impact of these non-participating facility owners/operators, a safety and economic burden is placed on the remaining stakeholders when these facilities are encountered.

The following subjects were not addressed by the Study Team as they were not considered to be within the One-Call Systems Best Practices Study scope. Although not evaluated, these general subjects have the potential to significantly impact the safe and reliable operation of underground facilities:

- Vandalism,
- Acts of Terrorism,
- Acts of Nature resulting in movement of land and facilities, and
- General facility maintenance and operation

10.4 PATH FORWARD

The best practices contained in this Report should be considered by all stakeholders involved in or affected by underground facility damage prevention laws and practices. Each state needs to evaluate these best practices, taking into consideration risks to public safety, environment, excavators and vital public services. Damage prevention laws should be upheld, and compliance by stakeholders should be encouraged and enforced as appropriate to ensure adherence.

As recommended by the Reporting and Evaluation Task Team, damage prevention performance records should be standardized and analyzed for directional improvement. Based upon data analysis, further opportunities for damage prevention improvement may be identified in the future. Analysis of consistently collected and analyzed data will help focus future targeted areas of damage prevention performance.

Today's best practice often originated as yesterday's educated guess or considered attempt to further enhance damage prevention results. Similarly, further advances and research for tomorrow's best practices should be continually encouraged. Damage prevention is not a stagnant field, and it is important to maintain an environment that allows for and promotes the search for even "better practices." Technological advancements, such as those identified in Appendix A, "Emerging Technologies," will hopefully lead to improved methods for denoting, locating, identifying, and marking underground facilities, which should lead to even greater reductions in underground facility damage and improved facility protection.

The items described in Section 10.3, were not resolved through the development of this Report. Over time, analysis of data, as recommended by the Reporting and Evaluation Task Team best practices in Chapter 9, will help to identify which of these are having the highest impact on underground facility damage prevention. Based upon the data analysis, the Study Team recommends that further review and consideration be performed on these items to determine whether new practices are warranted.

Finally, the Study Team recommends the continued future application of the RSPA "Quality Action Team" model. The process model has been successful in bringing together diverse stakeholders for purposes of effectively and efficiently collecting information, analyzing data, and making path forward recommendations. The Common Ground Study results further demonstrate the unmatched value of pursuing initiatives through a joint industry, stakeholder, and regulatory agency Quality Action Team model.

APPENDIX A
Emerging Technologies

A.1 SUMMARY

The Emerging Technologies Task Team was charged with the unique task of investigating the entire underground damage prevention process to determine how current or emerging technologies could be used to improve the best practices developed in each of the following Task Teams:

1. Planning and Design
2. One-Call Center
3. Locating and Marking
4. Excavation
5. Mapping
6. Compliance
7. Public Education and Awareness
8. Reporting and Evaluation

As this Appendix is multi-focused, the information for each of the eight Task Teams is addressed under separate headings.

Based upon current knowledge of evolving technologies, the Emerging Technology Task Team considered the anticipated impact upon or improvement to current best practices associated with damage prevention. The information provided in this section, therefore, offers the reader possible opportunities for the development of a utopian underground damage prevention process.

A.2 BACKGROUND AND MOTIVATION

The following mission statement was adopted by the Team:

> While performing the study of best practices in preventing damage to underground facilities, the Emerging Technologies Task Team will consider and evaluate technologies used in current practices from all aspects of the excavation process: planning and design, mapping, one-call, locating and marking, excavation, reporting and evaluation, compliance, and public education. The Task Team will evaluate how the application of existing, promising, or breakthrough technologies might affect and improve upon current practices. We will use our imaginations and venture outside of our current realms to develop ideas for potential, new technologies that will assist in a global plan to construct and maintain uninterrupted underground facility services with absolute safety in our working environment. Only after developing an understanding of what a totally uninterrupted

facility system incorporates technologically, can we define "perfection" in the workplace, enabling the industry to gauge its progress toward achieving it.

With imagination as our inspiration, an absolute safe working environment as our motivation, total availability of facility services will be our achievement.

A.3 TEAM MEMBERS

The Emerging Technologies Task Team members are listed below. A brief biographical sketch of each Team member, that serves to validate his or her participation in the Study effort, is included in Appendix F, "Common Ground Study Team Member Biographies."

Team Member	**Representing**[23]	**Employer**
John Archambeault	NULCA	
Jack Arseneau	ARTBA	Wisconsin Transportation Builders Association
Rick Canaday	Network Reliability Steering Committee-Facilities Solution Team	AT&T
Catherine Carver, Co-Chairperson	Public Education Research	Center for Construction Technology and Integration
Chuck Cohen	NUCA	Tires N' Tracks
Sandra Daziani, Co-Chairperson	OCSI	Arizona Blue Stake, Inc.
Ziyad Doany	Private Industry Research	3M Telecom Systems Division
Ben Heise	NTDPC	AT&T
George Ragula	AGA	Public Service Electric & Gas Company
Angela Wallace	OCSI	Utilities Protection Center, Inc. of Georgia

Others that participated in the Task Team's discussions but did not participate in the consensus decision process include:

Team Participant	**Representing**	**Employer**
Ken Naquin, Linking Team Liaison	AGC	AGC
Perly Schoville	AAR	Union Pacific Railroad

[23] See Appendix D for a detailed list of acronyms.

A.4 DATA COLLECTION AND EVALUATION PROCESS

1. Each Team member was assigned to one of the eight Task Teams as an Emerging Technologies Liaison.

2. Each Emerging Technologies Liaison attended scheduled meetings of the assigned Task Team to attain an understanding of the best practices being identified.

3. Best practices from each of the other task teams were brought to the monthly Emerging Technologies Team meetings to be discussed as a group.

4. Best practices that could effectively be enhanced with existing or emerging technologies were identified.

5. Team members performed research on existing technologies or investigated emerging technologies that might apply to improve current best practices.

6. Technologies were presented at monthly meetings of the Task Team and voted on for consensus by the Team as to how they could affect an existing best practice.

A.5 OPPORTUNITIES IDENTIFIED

The investigation and evaluation of the emerging technologies addressed below was for the purpose of providing an opportunity for improvement in each of the processes, *but no one process should be considered valid without having all of the other processes remain in place*. An example: an accurate map utilizing a standard mapping coordinate system and an excellent depiction of underground facilities should never replace the need for a locator to visit an excavation site to mark the location of such facilities.

The development of this Section was not intended to provide a thorough assessment of the value of a particular technology over another nor is it to predict their evolution and success. Hence, the focus was on identifying areas of importance as they relate to damage prevention in the hope of steering the direction of emerging technologies to ultimately provide a "better" solution.

A.6 FINDINGS

A.6.1 Planning & Design

Introduction

It is important for damage prevention that the engineer involved in planning and designing new projects have access to reliable and complete information on existing buried facilities in the early project stages. Identification of the facility owner/operator in a given area could be obtained from the one-call centers. The designer could then communicate directly with a succinct list of affected facility owners/operators to

obtain maps and/or physical markings on the proposed project site to determine the location if underground facilities.

Furthermore, the design specification could include the means to provide for the future prevention of damage to buried facilities especially when the materials used are non-metallic, such as plastic, which has traditionally been difficult to locate.

Finally, as-built drawings that reflect the actual route of the new facility instead of the planned route could be generated in order to improve accuracy.

Emerging Technologies

Emerging technologies that could enhance the communication between the stakeholders involved in the planning and design of a project, and facilitate the exchange of information in an efficient manner would have an important role in the damage prevention process.

Technologies that are used in mapping, locating, and one-call centers, which are described in detail in separate sections A.6.2, A.6.3, and A.6.4, could combine to benefit the engineer in the planning and design phase of a project.

A.6.2 Mapping

Introduction

The emerging technologies for enhanced mapping is represented by the integration of the detailed data gathered at each and every facility location and or installation with surface mapping that utilizes a standard mapping coordinate system. This information needs to be distributed through an open platform that provides the subscriber with the ability to define the level of detail provided to the various users.

Currently, the data gathered during the performance of routine locating of underground facilities are used to mark the buried facility. This information may be gathered and provided back to the facility owner/operator for the correction of blatant errors in facility drawings. It is not, however, routinely collected and transmitted back to the facility owner/operator for the purpose of correcting errors of less than a dramatic nature.

Locate equipment capable of collecting and storing all of the data from many locating operations is available today. The information may include, but not be limited to, signal strength, electrical current direction, depth estimate, type of locate, latitude/longitude and date/time. This emerging technology provides the opportunity to collect and transfer these data sets to a central database. The database can serve to enhance the overall knowledge of the embedded infrastructure utilizing a common mapping platform that could deliver the database in a cost-effective manner. The development required would include the implementation of a standard format for interchanging the information, the platform for transmitting and receiving it, and a vehicle for indexing the information to an open platform mapping system. Various manufacturers currently marketing locating equipment were contacted during the Study. Although none of those contacted were rigorously pursuing this mapping and storage capability, a few felt that the technology was easily within reach.

The following tasks and practices were considered before recommending the characteristics for the new technologies:

- Mapping is generally defined by the requirements of the user. Methods from using directions on the back of a napkin to using all the latest technology will need to live hand in hand for years to come. Emerging technologies will allow these extremes, and many combinations in between, to merge into a damage prevention methodology that allows users to upgrade their databases without losing their most important asset, accurate maps and databases.

- For damage prevention, the various users will define the level and indeed the requirements of their maps. Certainly, a facility owner/operator or right-of-way owner/landowner will always want their facility maps to be as accurate as possible. Typically, this requirement is passed on to their respective locator, when necessary. However, there is information that the owner/operator may not wish to pass on, and the ability to be selective can be just as important to damage prevention.
  Certainly, an effort to link mapping data to marketing and sales is a competitive issue that can make mapping data sensitive. A company may want its facility location known to a qualified excavator but not which customers might be served by that facility. One-call centers will be provided the level of information each facility owner/operator feels safe in providing, but that will undoubtedly be less than what the owner/operator will maintain. Emerging technologies has the ability to move past these issues to bring greater reliability and accuracy to all stakeholders involved.

Emerging Technologies

More than a mere mention of each mapping technology is difficult. However, since they exist, it is important that users explore the respective possibilities in their quest for maps that serve their existing needs, and will serve them tomorrow.

1. Global Positioning System (GPS)

Much has been made of this exciting technology already. Satellite locations can provide data from the type used in survey to general "where am I" requests. Using software that can force a match to an existing geocoded database allows the user to not worry about differential corrections, thereby allowing the use of cheaper units. A satisfactory geocoded or standard mapping coordinate database allows the user an ability to "find" a location with or without satellite communication. However, a few issues should be pointed out with respect to mapping. While the latitude and longitude with the associated elevation locations on the earth are empirical, the methods to determine and reflect these locations on the earth are not empirical. The ellipsoid definition for the earth, the respective projection and even the differential software used to correct the satellite data can produce a "different answer" for a satellite location. Even with SA turned off, the use of differential corrections will be a requirement if accuracy less than 10 feet is expected. The exciting part is that virtually all receivers will be standardizing and allowing users access to

previously proprietary code. Certainly, emerging technologies must be able to handle satellite GPS data.

2. Video technology

Video technology provides an ability to enhance damage prevention in some very obvious and perhaps not-so-obvious ways. The ability to generate text on video has always been available using title generators linked to computer generated text. The "Close Caption" option, used primarily for the hearing impaired, provides an ability to enhance mapping. Stationing in feet or meters, has long been an engineering standard used by most mapping concerns. These distances, along with a milepost value, allow each facility along a highway or railroad to have a unique stationing identifier. Video or pictures without some sort of identifier renders the video or pictures difficult to associate with GIS-type databases or maps in general. There are a couple of pieces of technology that offer potential in each of these cases. Specifically, one is the use of the "Vertical Interval" used in video for the "Close Captioning." This area can be shown or not shown by selecting a toggle on a monitor or television set. With a "Close Captioned Card," a user can generate text, such as stationing or milepost value, at each facility or as a video is operated while a vehicle traverses the area of interest. The distance can be edited by programming the "Close Captioned Card." This will allow the user to select a milepost value and the video will find the location and then display the video at that site. Loading these images to a GIS platform allows the user to see the ground that is of interest.

3. Video Mapping System (VMS)

The video mapping system, which lets you create interactive maps on your PC with links to video or still images taken with a camcorder, has also recently been developed. An example would be if you go to Paris and shoot a video of the Eiffel Tower. You could automatically create a map on your PC with a marker for the tower's exact location. Then, when you click on the marker, the video clip you took at the Tower will display on your monitor. First, you connect the video mapping system's black box/GPS receiver to your camcorder via a standard stereo cable and shoot the video just as you would ordinarily. The GPS data is collected from an internal receiver and recorded on an audio track of the videotape. Next, you connect the camcorder and the box to your PC's parallel port. When you press the play button on your camcorder, the VMS software creates a map on your PC of the GPS data stored on the videotape. Place a marker on any spot on the map (such as the Eiffel Tower) and the VMS system will find any segments of the tape that were shot at that location. Using the included video capture card, you can create video clips or still images and link them to the map or display the video directly off the camcorder onto your PC monitor. The VMS software also includes an HTML export format, allowing you to send your interactive maps to others for viewing via their Internet web browser.

4. Satellite and Digital Orthographic Imagery

Satellite and Digital Orthographic Imagery offers the damage prevention industry a range of opportunity. The low cost of this technology and the steady availability of data through USGS are making seamless Satellite and Digital Orthographic Imagery a real benefit. In

areas where the data has been flown at a low altitude, the benefits grow enormously. The low cost is attributed to the general fact that the data is not given digital attributes. The display becomes a background, properly projected so software can obtain measurements, but the user needs to digitize or observe in order to add information to their database.

5. Video Imagery

Numerous vendors with varied applications are using vehicles, such as trucks, for video stereo mapping and/or highway surface analysis. These vehicles use rectified imagery with stereo photography to collect and geocode information. The ability to simply record the information and then digitize or view the information at a later date at a level desired by the end user offers one more technology that should be taken into account. There are companies that offer the ability to load a digital image with a geocoded location to a database for mapping use.

6. Surface Survey Vehicles

Surface Survey Vehicles can range from a helicopter to a hy-rail track vehicle. Using helicopter laser imagery employs laser scanners along with video to build and enhance the digitizing process while creating mapping data. This is a post-processing application and allows the user to determine the level of processing for viewing or building a smart database. The uniquely equipped hy-rail has a real-time digital data collecting process that collects and defines the attribute data while providing geocoded data. Video is interfaced to allow linking and searching to geocoded data points by using mileposts, latitude/longitude, or stationing. The sophisticated hy-rail uses Global Positioning System receivers integrated to optical sensors, encoders, range finders, lasers and video. The resulting mapping database has attributed facility data created during the time of travel.

7. Existing Paper or Hard Copy Maps

There is existing software that allows existing paper or hard copy maps to be scanned and projected so that crude geocoding can occur. In addition, follow-up digitizing can add intelligence without forcing a complete re-survey of the data set.

8. Software

Software is perhaps the main focus for a mapping provision. Users will typically opt to use a type of GIS for their mapping applications. This is most evident by various one-call centers that may or may not need visual maps to accomplish this goal. GIS typically offers poor graphic capability but shines when it comes to manipulating attributed data for producing thematic maps and forced matching to geocoded data. For existing data sets, merging various projects with massive coverages, this offers a great solution. Other users require accurate maps using software by graphic vendors that provide highly versatile graphic capabilities but generally offer poor thematic map capabilities. Technology that must be considered includes the ability to take any mapping system, and virtually upgrade or transfer to any other system without translating data sets. This open architecture is imperative. The days of selecting or building a database, using proprietary software that creates a closed data set requiring modifications or upgrades only through that vendor, are over. Open architecture allows users to transfer only pertinent information to the end user

in a seamless method. The advice to users to consider this when building their system cannot be stressed enough. If Damage Prevention is to require that various facilities and right-of-way owners provide mapping data to multiple one-call centers, the one-call center should be able to handle data without going through a laborious or extensive translation process. This open architecture is available now, with numerous vendors providing this capability, to allow a company to use the package that best fits its requirements, provide timely updates and data sets to the one-call, continue protecting proprietary information, and still give accurate facility mapping data to the end user.

A.6.3 One-Call Center

Introduction

The one-call center continues to be the central hub of communications between all stakeholders involved in the damage prevention process. The opportunity exists to improve the damage prevention process at the one-call center by deploying an openly architected system using common, integrated communication devices and a standard mapping coordinate system. This system could provide continuous, seamless communication between all stakeholders involved in the design, placement, location & marking, maintenance, and excavation around underground facilities. Benefits that can be derived from the implementation of such a system are as follows:

1. Designer

The damage prevention process begins at the time an excavation project is designed. When the designer has the ability to identify the magnitude of facility conflicts early in the design process, the opportunity exists to either avoid them altogether or indicate, within the design, the appropriate methods of working around them.

A designer's ability to apply the above mentioned system to remotely register a proposed project with the one-call center's database offers the opportunity to identify, without guesswork, a succinct list of underground facility owners/operators specifically affected by the proposed project. Without having to waste valuable resources unnecessarily coordinating with facility owners/operators that are not involved, the designer's ability to focus on the inclusion of such additional information regarding existing facilities for use by future excavators on the project increases.

Once the designer has registered a proposed project with the one-call center, the opportunity further exists for the designer to receive electronic notifications of excavation activity or the placement of new facilities, that may occur within the geographic scope of the proposed project. With this additional knowledge, the designer/project owner has the opportunity to communicate and coordinate with the owner/operator of the new facility to possibly re-design the project to completely avoid the new facility before discovering its existence at the time of construction.

2. Excavator

The ability to utilize the above mentioned system offers the excavator an opportunity to:

- Control and track one-call notifications by virtually communicating directly with the affected underground facility owner/operator's locators, through the one-call center's database.
- Provide pertinent job site details, including the attachment of digital files such as voice, job site plans, and digital photographs to assist the facility owner/operator's locate personnel in the determination of which facilities are in conflict and need to be located and marked.
- Receive pertinent information (e.g., positive responses) directly from the facility owner/operator's locator personnel, through the one-call center's database, without unnecessarily requiring them to spend valuable time meeting on the job site.
- Process the one-call notifications at any time of the day or night (24 hours a day/7 days a week) that is most convenient to them without having to be dependent on the availability of the one-call center's personnel.

3. Underground Facility Owner/Operator's Locating Personnel:

The ability to utilize the above mentioned system offers the facility owner/operator's locating personnel an opportunity to:

- Receive, from the excavator through the one-call center's database, pertinent job site details, including the attachment of digital files (voice, job site plans, and photographs), which could assist in the locating and marking of buried facilities.
- Automatically and positively respond electronically to the excavator regarding the status of their markings for each and every excavation notification received from the one-call center.
- Control, track, and maintain digital information regarding the geographic area within which they wish to receive notifications from the one-call center. This digital information could include the capability of coordinating with the diverse systems used by various facility owners/operators and cross-referencing or merging data from various systems (i.e., latitude/longitude and/or highway/railroad mile markers).

A.6.4 Locating & Marking Technologies

Introduction

The field of locating buried facilities has always been referred to as an "Art" rather than an exact "Science." Perhaps this is true since there are rarely two instances that are the same, and that the locator has to get information from drawings and notes where available, and most of all the locator has to use training, experience, and common sense. One purpose of this section is to give a brief overview of the current technologies used in determining the approximate position and depth of buried facilities, as they relate to damage prevention. Another purpose is to identify critical areas that are currently deficient or could be improved by emerging and new technologies for reducing damage.

Considerations made in this section are as follows:

- **Existing Facilities vs. New Installations:** It is important to keep in mind that some of the methods and systems mentioned below must be planned for and applied at the time of facility installation. Hence, these methods may be applicable to new installations more than existing ones. However, if these methods are used consistently on new installations, they may provide an increasing future value.

- **Metallic vs. Non-Metallic (or Plastic):** In general, metallic facilities are easier to locate than non-metallic facilities. Where plastic or non-metallic facility is buried, a tracer wire or an electronic marker is typically used for future detection. Where such means are not provided, great difficulties are encountered in determining and identifying the location of non-metallic facilities.

- **Directional Drilling:** Directional drilling has created new challenges for locating technologies. One such challenge relates to improving the accuracy of estimating the depth of existing buried facilities under varying conditions. Another challenge is the ability to place facilities using directional drilling to very deep depths, which has a negative effect on location and depth accuracy for future locates.

Locating methods can be categorized as follows:

1. Magnetic Field Based Locators or Path Tracers
2. Buried Electronic Marker Systems (EMS)
3. Ground Penetration Radar Based buried-structure detectors (GPR)
4. Acoustics Based Plastic Pipe locators
5. Active Probes, Beacons, or Sondes for Non-Metallic Pipes
6. Magnetic Polyethylene (PE) Pipe

1. Magnetic Field Based Locators or Path Tracers:

General Description:

The most common technology used to determine the location and depth of a buried conductor (cable, pipe, or tracer wire with an electrically conductive element) is based on magnetic fields. When electrical current flows in a straight conductor, a vector magnetic field is generated around that conductor in the form of concentric cylinders. Magnetic Field (MF) based path tracers work on the principle of detecting the amplitude and/or direction of the magnetic field in order to approximate the location of the current carrying source. This current is usually actively induced or injected by a transmitter, which causes a loop current to flow in the conductor and return through the ground.

In the case of energized and loaded power cables, there is usually enough current at power frequency harmonics that can be detected. Also, all cables that are grounded on both ends carry

some circulating and induced power frequency currents from power cables, and low-frequency radio signals from powerful short wave transmitters operating between 15-30 kHz.

The locator's magnetic field sensor or antenna is typically an air coil or ferrite coil. The received signal is greater for higher electrical currents flowing in the conductor, higher locator trace frequencies, and closer distances from the source. Finally, the received signal strength is dependent on the orientation of the locator sensor with respect to the conductor, since only the magnetic vector lines that cross the surface of the sensor at 90 degrees would be detected.

Orienting the coil vertically or horizontally from the conductor path, then sweeping across the surface of the earth over an electrical-current-carrying buried conductor, produces a *minima* (null response) or *maxima* (peak response) over the conductor, respectively. Since the magnetic field behavior above the conductor is known, it would be simple to calculate the approximate depth of the conductor by taking two measurements: one at ground level and one at a known distance above the surface.

Limitations of Magnetic Field (MF) based methods:

Although magnetic field based locating equipment is the most commonly used technology in determining the location and depth of buried facilities (having metallic conductors), they do not provide 100% accuracy in location or depth estimate. As mentioned above, the position and depth is indirectly determined from the detected magnetic field at the sensors assuming ideal conditions; hence, errors will occur when there is congestion or less than ideal conditions. In general, the depth estimate from MF locators is much more susceptible to congestion than the horizontal indication.

The limitations associated with using magnetic field based path tracers can be divided into two main categories: Signal quality and congestion.

Signal quality refers to signal-to-noise ratios that depend on available signal that flows in the conductor and the ambient noise signals. Signal quality is affected by the amount of signal that can be injected or induced onto the conductor given access limitation and inconsistency of far-end grounding. The amount of signal and the depth of the conductor also influence it.

Congestion refers to the distortion of the magnetic field lines or deviation from the ideal set up, which is highly predictable. The electrical current that is flowing in the conductor has to complete the circuit and return to the transmitter. The return of electrical current may flow near the surface or get on other conductors in the ground and would produce an interfering response. In addition to the ground return currents and especially when using high frequencies, some of the main signal could be induced or coupled onto adjacent conductors causing further congestion.

Frequency Choices:

Active Frequencies

Low frequencies usually require a far-end ground for the electrical current path, but do not attenuate significantly with distance. There is typically more noise from power harmonics at low frequencies.

Medium frequencies share some of the strengths and weaknesses of both the high and low frequencies depending on the soil's resistance, conductor length, type, and construction.

High frequencies are more efficient for applying the signal by general induction without accessing the cable, or by an inductive coupler which does not require a metallic connection to the conductor. High frequencies also attenuate faster with distance and can couple to adjacent conductors more easily. Finally, the sensitivity of the receiver is typically greater at higher frequencies.

Passive Frequencies

Passive frequencies rely on detecting magnetic field generated by electric currents already flowing in the buried facility. Although this method does not provide a positive identification of a particular facility, it may be effective in detecting the presence of it as part of a general sweep.

Advantages:

- May be used on all existing buried metallic facilities
- Capable of providing adequate horizontal and vertical location in most situations
- Good target identification when a signal is applied directly to a single facility
- Provides depth estimation

Disadvantages:

- Tracer wires need to be installed together with plastic pipes and non-metallic cables
- It is an "Art," requiring the skill of a trained technician, and is susceptible to congestion
- Requires access to the cable or pipe for accurate performance

Emerging Technologies:

Emerging technologies on Magnetic Field based instruments for damage prevention, may provide more robust performance under congestion, including consistent accuracy of depth estimates.

2. Buried Electronic Marker Systems (EMS):

General Description:

Electronic markers consist of a passive resonant magnetic circuit that is buried along with the facility at the time of construction. The presence of such a marker is detected by using a marker locator.

The marker locator generates a magnetic field that couples to the marker and causes it to generate its own magnetic field. The magnetic field from the marker is detected from the surface and the location is identified. The detectable range increases with the size of the marker.

These electronic markers are used for underground marking of special buried features, such as splices, valves, etc., as well as non-metallic facilities.

Advantages:

- Unique signature, excellent location accuracy, very low susceptibility to congestion
- Ideal for buried special features
- Different frequencies are used for different facilities
- No physical access to the facility is required

Disadvantages:

- Requires installation at construction
- Depth indication is to depth of marker instead of the facility
- Does not provide continuous indication of path

Emerging Technologies:

Emerging technologies that are used in electronic tags could provide means for digital identification of such buried EMS markers. This digital information could assist in identifying the buried facility and link the physical marker position to an electronic map.

3. Ground Penetration Radar Based Buried-Structure Detectors (GPR):

General Description:

Ground Penetrating Radar works on the principle of radiating electromagnetic waves into the ground and analyzing the reflections from all the anomalies in the signal path over time. The instrument is typically dragged or swept over an area, and the cumulative data is processed and displayed for interpretation by the operator.

Any object in the ground that causes a change in the characteristics of the surrounding medium will cause a reflection, which is typically greater for larger objects over smaller ones, and metallic over non-metallic. Deeper objects produce smaller reflections than shallow ones.

"Clutter" is a term used to describe unwanted indications, similar to congestion in magnetic field locators. The source of this clutter or noise is primarily from the irregularity and non-uniformity of the soil. Hence, where there is a lot of clutter, especially in situations where the reflections from the buried facilities are small, the interpretations of the GPR traces become more difficult.

The depth of the object is inferred from the time that it takes the radiated wave to complete a round trip and the velocity of the wave in the soil. Since this propagation velocity depends on the soil characteristics, it is typically assumed or calibrated over a particular site, or calculated by using multiple readings across the buried facilities at known distances. Either method assumes uniform

soil, and hence an average velocity is used. Therefore, the depth accuracy would depend on the soil conditions.

The detection accuracy also depends on the resolution obtained which is a function of the frequency range of the instrument. Higher frequencies, or large bandwidths, would provide higher resolutions.

The detectable range into the ground depends on the frequency range used in the GPR instrument, the type of soil, and the moisture content. Some soils are almost opaque especially to higher frequencies, and would prevent very deep penetration of the signal for detecting deep objects.

Advantages:

- Capable of detecting plastic (non-metallic) and metallic buried objects under favorable soil conditions
- Does not require physical access to the pipes or cables for detecting them

Disadvantages:

- Very low penetration in other than favorable soil conditions
- Cannot be used to identify a specific facility
- Small cross sections are less detectable than large ones
- Deeper objects are less visible than shallow ones
- May be highly susceptible to clutter noise in areas with non-uniform soil
- Propagation velocity, which is used to determine depth, varies with soil type and condition
- Highly dependent on operator interpretation skill

Emerging Technologies:

GPR Technology provides some unique capabilities for locating non-metallic facilities. It is also useful for detecting unknown or abandoned facilities. However, GPR based instruments have traditionally been difficult to interpret. Emerging technologies and the application of software improvement could enhance signal quality and may reduce clutter and the dependence on operator interpretation.

4. Acoustics Based Plastic Pipe Locators:

General Description:

Acoustic based locators use sound waves to determine the location of a buried pipe. An active acoustic system utilizes an acoustic transducer that, when connected to an opening on a service or main line, applies a sound wave into the gas or water stream. The sound waves travel along the length of the pipe and attenuate through the pipe wall into the surrounding soil. Those sound waves that reach the surface may be detected using special sensors such as geophones or accelerometers.

The location of the buried facility is indirectly determined by monitoring the highest (peak) vibration amplitude at the surface.

Since the sound waves have to travel in the pipe and in the soil, the type of soil and its condition along with the size of the pipe and its content will affect the detection range at the surface from the acoustic transducer.

A particular difficulty arises when the sound waves from portions of the pipe that are at right angles interfere with each other. Along with reflected waves at certain points (valves, T's reducers, obstructions, etc.), the net result is analogous to congestion that is sometimes encountered when using magnetic field based locators. However, these interfering signals can also be a benefit to the locator if the above mentioned obstructions are the targets of the locate.

Finally, since the signals are detected by measuring small vibrations at the surface, it is important to assure good sensor-to-surface (soil or pavement) contact. The final determination of pipe location is based on the relative strength (amplitude) of the detected signal (compared to the adjacent measurements) and not on the absolute measurement.

Advantages:

- Effective on plastic pipes over limited distances and depths
- Provides identification of the facility
- No cross-over signals
- Works in all soils

Disadvantages:

- Requires physical connection to an open end of the facility
- Does not provide a depth estimate
- Signal attenuation varies in different soils
- Effective range decreases with the decrease of facility diameter

Emerging Technologies:

Improvements in the acoustic transmission and detection can increase locating accuracy and range under various soil conditions, along with a reliable depth estimate, and a non-intrusive means of applying the signal provided in an easy to use product would assist in damage prevention to buried plastic pipes.

5. Active Probes, Beacons, or Sondes for Non-Metallic Pipes:

General Description:

These devices typically consist of a battery-powered transmitter that is housed in a tubular enclosure, which is inserted in a pipe or conduit. These transmitters generate a magnetic field, at low frequencies (similar to magnetic field based locator frequencies) that may be detected at the surface.

Detecting the location of plastic pipe (and all non-metallic facilities) from the surface is achieved by inserting the active transmitter into the pipe and noting the located position at the surface. The device is then moved and relocated, until the whole path is marked. The device is pushed or pulled through the pipe, and cannot be steered.

The approximate depth is calculated using the detected signal levels at the surface.

Advantages:

- Can be used to determine the location of non-metallic pipe or conduit
- Excessive distance and depth with no signal loss

Disadvantages:

- Requires physical access to the internal pipe
- Can only locate over the sonde
- Limited capability
- No steering capability

Emerging Technologies:

None identified at this time.

6. Magnetic Polyethylene (PE) Pipe:

General Description:

Magnetic PE pipe is currently being developed as part of a Gas Research Institute project for the gas industry. It does have application in other industries wherever standard PE pipe is used. It is not commercially available at this time but is expected to be available some time in 2001.

The technology depends upon inducing a unique magnetic signature to PE pipe using a magnetic dopant (strontium ferrite). The magnetic signature becomes an easily detectable intrinsic property of the pipe. To aid in distinguishing buried magnetic pipe from other buried magnetic objects (i.e., iron pipe, cable, etc.) a technique has been developed to induce a unique spiraling magnetic signature to the pipe. This signature has the potential to describe the pipe diameter and the product the pipe is carrying. The locator used for detecting this material can determine pipe depth.

A high-power pulsing magnetizer has been developed to induce the spiraling magnetic signature to the pipe as it is manufactured. An advanced 3-axis locator based upon the use of a fluxgate gradiometer is used to locate the pipe. This locator enables both the magnitude and polarity of the pipe signature to be measured.

Advantages:

- Eliminates the need for tracer wire
- Simplified installation
- Unique magnetic signature aids locatability in cluttered environments

Disadvantages:

- Needs regulatory approval for use in gas distribution applications
- Needs special 3-axis locator

Comparison of Locating Technologies:

Widely-Used Technologies						Limited Use Technologies				Emerging Technologies Requirements	
	Magnetic Field Detectors	Passive/ Inductive Magnetic Field Detectors	Tracer Wire/ Conductive Tape	Electronic Marking System (EMS)	Active Probes, Beacons, Sondes	Acoustic Detector	Ground Penetrating Radar (GPR)	Magnetically Impregnated Pipe	Metal Detectors	Location & Identification	Detection
Existing Facility	Yes	Yes	Yes*	Yes*	Yes	Yes	Yes	No	Yes	Yes	Yes
New Facility	Yes	Yes	Yes*	Yes*	Yes	Yes	Yes	Yes*	Yes	Yes	Yes
Metallic	Yes	Yes	(N/A)	Yes*	(N/A)	(N/A)	Yes	(N/A)	Yes	Yes	Yes
Non-Metallic	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Access Required	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes	No
Identification of Facility	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No
Depth Estimate	Yes	Yes	Yes**	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Distance Range (low or high	High	High	High	High	High	Low	High	High	High	High	Medium
Depth Range (low or high)	High	Low	High	Medium	High	Low/ Medium	Low/ Medium	Low/ Medium	Low	High	Medium
Detects/ Identify Special Features	No	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes
Detects Facility Site	No	No	No	No	No	No	No	Yes	No	Yes	Yes

* Requires that tape, wire, electronic markers, or magnetized pipe be used at time of installation.
** Depth to conductor, which may not be the same as depth to the facility.

A.6.5 Excavation

Introduction

Excavation is the last step in the construction process that puts an existing facility at risk. Both new construction and restoration work are an integral part of damage prevention. Emerging technologies offers an opportunity to improve the process and prevent damages to underground facilities.

Excavation methods can be categorized as follows:

1. Excavation by Hand

- Hand Digging

2. Open Excavation by Machine

- Excavating by Backhoe
- Trenching
- Plowing/Planting
- Vacuum Excavating

3. Boring

- Directional Drilling
- Micro-tunneling
- Pipe-jacking
- Piercing

1. Excavation by Hand

Hand digging: A person excavates by hand using hand tools to remove earth without mechanized equipment.

Advantages:

- One of the least damaging excavation methods
- Easily and accurately controlled
- Excellent in confined areas
- One person operable
- Quiet

Disadvantages:
- Time consuming
- Risk of human injury
- Depth restrictions
- Limited to capacity of human strength
- Contingent on favorable weather conditions

2. Open Excavation by Machine

Excavating by Backhoe: Excavation as defined using backhoe machinery for material extraction and removal.

Advantages:
- Trench is open and exposed
- Time efficient
- One-person operable
- Good for large-scale projects
- Allows work to be customized to define width and depth
- Easily controlled
- Great capacity for strength
- Not limited by weather conditions

Disadvantages:
- Operator training is needed
- Limited to use in non-confined areas
- Not accurately controlled
- Depth restrictions
- History of damage to facilities

Trenching: Excavation as defined using trencher machinery for material extraction and removal.

Advantages:
- Time-efficient
- Trench is open and exposed
- Easily controlled
- Great capacity for strength
- Good for large-scale projects
- Not limited by weather conditions

Disadvantages:
- Two persons needed to properly operate
- Limited width and depth control
- Easily damage facilities
- Noisy

- Operator training required
- Limited to use in non-confined areas
- Requires additional planning time

Plowing/Planting: Horizontal excavation as defined using vibratory plowing equipment to displace material.

Advantages:
- Efficient
- Requires minimal clean-up
- One person operable

Disadvantages:
- Limited depth
- Limited by environmental obstacles
- Noisy
- Requires training
- Affected by weather conditions
- Easily damages facilities
- Cannot directly see equipment in operation underground
- Limited to use in non-confined areas
- Very difficult to control
- Application is limited to smaller diameter facilities

Vacuum Excavation: Excavating using an earth vacuum, which is hand controlled and is either hand-held or truck-mounted. Suction is used to remove material.

Advantages:
- One of the least damaging excavation methods
- Time efficient
- Good for use in confined spaces
- Minimal training required
- Not limited by weather conditions
- Easily and accurately controlled
- Minimizes excavation area

Disadvantages:
- Depth restrictions
- Noisy
- Not applicable for all soil conditions (i.e., rock or shale)

3. Boring

Directional Drilling: Horizontal excavation as defined using directional drilling equipment for displacement of material.

Advantages:

- Minimal clean-up and site disturbance
- Can achieve further distances at greater depths in a single equipment set-up
- Time-efficient
- Capable of precision accuracy
- Not limited by environmental or weather conditions
- Instrumentation available for locating and guiding boring head

Disadvantages:

- Requires a minimum of a two or three person crew
- Cannot directly see equipment in operations underground
- Easily damages facilities
- Requires extensive training
- Ability to place facility at depths which are difficult to locate and maintain
- Equipment has short life expectancy
- Machine must be properly sized for existing soil conditions and diameter of facility to be installed
- Fluid used in process can find a vein or fissure and seep to the surface

Micro-tunneling: The practice of closed excavation using a combination of vertical excavation to set-up for horizontal excavation for material removal.

Advantages:

- Wide range of diameter for facility installation
- Good for large scale projects
- Not limited by depth
- Not limited by weather conditions
- Not limited by soil conditions
- Capable of precision accuracy
- Ability to have extreme accuracy in line and grade
- Works well in high water table environments

Disadvantages:

- Very slow
- Not intended for projects of considerable length
- Very labor intensive
- Extensive vertical shaft work required
- Large amounts of spoil
- Requires extensive training

- Requires extensive planning and design
- Very equipment intensive

Pipe-jacking: A trenchless excavation method using a pneumatic hammer system to assist in forcing a rigid, large diameter, steel pipe through the ground, typically under a road.

Advantages:
- Limited soil displacement
- Generally approved method of boring

Disadvantages:
- Limited control
- Requires sending and receiving pits
- Typically requires shoring
- Easily damages underground facilities
- Limited to projects of short distances

Piercing: A trenchless excavation method for installing conduit or pipe using a bullet shaped tool containing an air assisted hammer action mechanism, which forces the piercing tool horizontally through the ground from sending pit to receiving pit.

Advantages:
- Minimal training required
- Good for short distances
- Quick set-up/breakdown

Disadvantages:
- Limited steering control
- Requires sending and receiving pits
- Limited to favorable soil conditions
- Easily damages underground facilities

Emerging Technology:

Currently in practice, laser equipment has been developed to attach to equipment to enable the operator to receive a more accurate line and grade. However, laser has no capability of identifying the presence of existing underground facilities.

Similarly, radar devices are being attached to equipment to detect existing facilities by scanning the ground prior to penetrating the earth.

In stages of Research and Development (R&D) are detection systems, which attach to the equipment and are designed to scan the area in front of the machine to detect any unidentified obstacles. Upon detection of the unidentified obstacles, the machine will be programmed to immediately shutdown.

Currently available for use is a software package, which enables the directional drilling machine to achieve Latitude/Longitude. In R&D is a device, which will enable equipment to sense obstacles in the bore path. It will signal the machine to shutdown automatically as a safety device.

A.6.6 Reporting and Evaluation

Emerging Technologies offer the opportunity for Reporting and Evaluating to construct a web site for the purpose of collecting information for an on-line survey, which can automatically update a central database. In addition, the information could then be extracted to create reports for all participants in the damage prevention process.

A.6.7 Compliance

Emerging Technologies offers opportunities for resolution when issues of compliance on a construction project arise. When damage occurs in the field, contracted companies may present recorded data from site videos, one-call ticket verifications, or even voice recorded request/call back information to determine whether or not a specific contracted company falls outside of the known best practices. It is thought that a well-documented job will reduce non-compliance. Therefore, the use of current and the integration of new emerging technologies by all involved in construction, will protect against accusation and validate a company's good work ethic.

A.6.8 Public Education

Emerging Technologies offers the opportunity for the education of all those involved in the construction or maintenance of the nation's buried infrastructure. The general public can be taught about the "Call Before You Dig" philosophy through a national campaign designed to target the complexity of the infrastructure that is buried in neighborhoods and on privately owned property. The high tech means for delivering the message is through interactive CD ROM software and the Internet. Training and education of the industry may fall into several phases of development. Initially, there is a need to educate the technicians in the field, whether it be a one-call system operator or a locate technician. These employees must stay abreast with the latest developments in technology. New technologies can be explored in such training programs and offer enhancements to current practices. Also, a curriculum of classes based on the industry's best practices needs to be offered at the high school or junior college level. It is believed that the earlier training and education begins, the safer our buried infrastructure will be against human/machine accidents.

A.7 CONCLUSION

Causes of underground facility damages are most attributed to incomplete information at the planning stage, excavation methods and techniques, lack of communication between stakeholders, and the accuracy of underground facility mapping, locating, and marking. The findings of the Emerging Technologies Task Team offer the industry information that will encourage and assist in the development of new software, better equipment, technologies and practices that can enhance the damage prevention process.

APPENDIX B
Transportation Equity Act for the 21st Century

TEA 21, Title VII, Subtitle C – Comprehensive One-Call Notification

(May 22, 1998 Congressional Record, pp. H 3889-H 3990)
H.R. 2400
H.Rept. 105 - 550
Public Law 105 - 178

Subtitle C - Comprehensive One-Call Notification

SEC. 7301. FINDINGS.

Congress finds that –

(1) unintentional damage to underground facilities during excavation is a significant cause of disruptions in telecommunications, water supply, electric power, and other vital public services, such as hospital and air traffic control operations, and is a leading cause of natural gas and hazardous liquid pipeline accidents;

(2) excavation that is performed without prior notification to an underground facility operator or with inaccurate or untimely marking of such a facility prior to excavation can cause damage that results in fatalities, serious injuries, harm to the environment and disruption of vital services to the public; and

(3) protection of the public and the environment from the consequences of underground facility damage caused by excavations will be enhanced by a coordinated national effort to improve one-call notification programs in each State and the effectiveness and efficiency of one-call notification systems that operate under such programs.

SEC. 7302. ONE-CALL NOTIFICATION PROGRAMS.

(a) In General. -- Subtitle III of title 49, United States Code, is amended by adding at the end thereof the following:

"CHAPTER 61--ONE-CALL NOTIFICATION PROGRAMS

"6104. Compliance with minimum standards.
"6105. Review of one-call system best practices.
"6106. Grants to States.
"6107. Authorization of appropriations.
"6108. Relationship to State laws.

“6101. Purposes

"The purposes of this chapter are–

"(1) to enhance public safety;
"(2) to protect the environment;
"(3) to minimize risks to excavators; and
"(4) to prevent disruption of vital public services,

by reducing the incidence of damage to underground facilities during excavation through the voluntary adoption and efficient implementation by all States of State one-call notification programs that meet the minimum standards set forth under section 6103.

"6102. Definitions

"In this chapter, the following definitions apply:

"(1) ONE-CALL NOTIFICATION SYSTEM. -- The term ’one-call notification system’ means a system operated by an organization that has as 1 of its purposes to receive notification from excavators of intended excavation in a specified area in order to disseminate such notification to underground facility operators that are members of the system so that such operators can locate and mark their facilities in order to prevent damage to underground facilities in the course of such excavation.

"(2) STATE ONE-CALL NOTIFICATION PROGRAM. -- The term ’State one-call notification program’ means the State statutes, regulations, orders, judicial decisions, and other elements of law and policy in effect in a State that establish the requirements for the operation of one-call notification systems in such State.

"(3) STATE. -- The term ’State’ means a State, the District of Columbia, and Puerto Rico.

"(4) SECRETARY. -- The term ’Secretary’ means the Secretary of Transportation.

"6103. Minimum standards for State one-call notification programs

"(a) MINIMUM STANDARDS. -- In order to qualify for a grant under section 6106, a State one-call notification program shall, at a minimum, provide for-

"(1) appropriate participation by all underground facility operators;
"(2) appropriate participation by all excavators; and
"(3) flexible and effective enforcement under State law with respect to participation in, and use of, one-call notification systems.

"(b) APPROPRIATE PARTICIPATION. -- In determining the appropriate extent of participation required for types of underground facilities or excavators under subsection (a), a State shall assess, rank, and take into consideration the risks to the public safety, the environment, excavators, and vital public services associated with--

"(1) damage to types of underground facilities; and
"(2) activities of types of excavators.

"(c) IMPLEMENTATION. -- A State one-call notification program also shall, at a minimum, provide for–

"(1) consideration of the ranking of risks under subsection (b) in the enforcement of its provisions;
"(2) a reasonable relationship between the benefits of one-call notification and the cost of implementing and complying with the requirements of the State one-call notification program; and
"(3) voluntary participation where the State determines that a type of underground facility or an activity of a type of excavator poses a de minimis risk to public safety or the environment.

"(d) PENALTIES. -- To the extent the State determines appropriate and necessary to achieve the purposes of this chapter, a State one-call notification program shall, at a minimum, provide for–

"(1) administrative or civil penalties commensurate with the seriousness of a violation by an excavator or facility owner of a State one-call notification program;
"(2) increased penalties for parties that repeatedly damage underground facilities because they fail to use one-call notification systems or for parties that repeatedly fail to provide timely and accurate marking after the required call has been made to a one-call notification system;
"(3) reduced or waived penalties for a violation of a requirement of a State one-call notification program that results in, or could result in, damage that is promptly reported by the violator;
“(4) equitable relief; and
“(5) citation of violations.

“6104. Compliance with minimum standards

"(a) REQUIREMENT. -- In order to qualify for a grant under section 6106, each State shall submit to the Secretary a grant application under subsection (b). The State shall submit the application not later than 2 years after the date of enactment of this chapter.

"(b) APPLICATION. --

"(1) Upon application by a State, the Secretary shall review that State's one-call notification program, including the provisions for the implementation of the program and the record of compliance and enforcement under the program.

"(2) Based on the review under paragraph (1), the Secretary shall determine whether the State's one-call notification program meets the minimum standards for such a program set forth in section 6103 in order to qualify for a grant under section 6106.

"(3) In order to expedite compliance under this section, the Secretary may consult with the State as to whether an existing State one-call notification program, a specific modification thereof, or a proposed State program would result in a positive determination under paragraph (2).

"(4) The Secretary shall prescribe the form and manner of filing an application under this section that shall provide sufficient information about a State's one-call notification program for the Secretary to evaluate its overall effectiveness. Such information may include the nature and reasons for exceptions from required participation, the types of enforcement available, and such other information as the Secretary deems necessary.

"(5) The application of a State under paragraph (1) and the record of actions of the Secretary under this section shall be available to the public.

"(c) ALTERNATIVE PROGRAM. -- A State is eligible to receive a grant under section 6106 if the State maintains an alternative one-call notification program that provides protection for public safety, excavators, and the environment that is equivalent to, or greater than, protection provided under a program that meets the minimum standards set forth in section 6103.

"(d) REPORT. -- Within 3 years after the date of the enactment of this chapter, the Secretary shall begin to include the following information in reports submitted under section 60124 of this title–

"(1) a description of the extent to which each State has adopted and implemented the minimum Federal standards under section 6103 or maintains an alternative program under subsection (c);

"(2) an analysis by the Secretary of the overall effectiveness of each State's one-call notification program and the one-call notification systems operating under such program in achieving the purposes of this chapter;

"(3) the impact of each State's decisions on the extent of required participation in one-call notification systems on prevention of damage to underground facilities; and

"(4) areas where improvements are needed in one-call notification systems in operation in each State.

The report shall also include any recommendations the Secretary determines appropriate. If the Secretary determines that the purposes of this chapter have been substantially achieved, no further report under this section shall be required.

“6105. Review of one-call system best practices

"(a) STUDY OF EXISTING ONE-CALL SYSTEMS. -- Except as provided in subsection (d), the Secretary, in consultation with other appropriate Federal agencies, State agencies, one-call notification system operators, underground facility operators, excavators, and other interested parties, shall undertake a study of damage prevention practices associated with existing one-call notification systems.

"b) PURPOSE OF STUDY OF DAMAGE PREVENTION PRACTICES. -- The purpose of the study is to gather information in order to determine which existing one-call notification systems practices appear to be the most effective in protecting the public, excavators, and the environment and in preventing disruptions to public services and damage to underground facilities. As part of the study, the Secretary shall consider, at a minimum–

"(1) the methods used by one-call notification systems and others to encourage participation by excavators and owners of underground facilities;

"(2) the methods by which one-call notification systems promote awareness of their programs, including use of public service announcements and educational materials and programs;

"(3) the methods by which one-call notification systems receive and distribute information from excavators and underground facility owners;

"(4) the use of any performance and service standards to verify the effectiveness of a one-call notification system;

"(5) the effectiveness and accuracy of mapping used by one-call notification systems;

"(6) the relationship between one-call notification systems and preventing damage to underground facilities;

"(7) how one-call notification systems address the need for rapid response to situations where the need to excavate is urgent;

“(8) the extent to which accidents occur due to errors in marking of underground facilities, untimely marking or errors in the excavation process after a one-call notification system has been notified of an excavation;

"(9) the extent to which personnel engaged in marking underground facilities may be endangered;

"(10) the characteristics of damage prevention programs the Secretary believes could be relevant to the effectiveness of State one-call notification programs; and

"(11) the effectiveness of penalties and enforcement activities under State one-call notification programs in obtaining compliance with program requirements.

"(c) REPORT. -- Within 1 year after the date of the enactment of this chapter, the Secretary shall publish a report identifying those practices of one-call notification systems that are the most and least successful in--

“(l) preventing damage to underground facilities; and

"(2) providing effective and efficient service to excavators and underground facility operators.

The Secretary shall encourage each State and operator of one-call notification programs to adopt and implement those practices identified in the report that the State determines are the most appropriate.

"(d) SECRETARIAL DISCRETION. -- Prior to undertaking the study described in subsection (a), the Secretary shall determine whether timely information described in subsection (b) is readily available. If the Secretary determines that such information is readily available, the Secretary is not required to carry out the study.

"6106. Grants to States

"(a) IN GENERAL. -- The Secretary may make a grant of financial assistance to a State that qualifies under section 6104(b) to assist in improving--

"(1) the overall quality and effectiveness of one-call notification systems in the State;
"(2) communications systems linking one-call notification systems;
"(3) location capabilities, including training personnel and developing and using location technology;
"(4) record retention and recording capabilities for one-call notification systems;
"(5) public information and education;
"(6) participation in one-call notification systems; or
"(7) compliance and enforcement under the State one-call notification program.

"(b) STATE ACTION TAKEN INTO ACCOUNT. -- In making grants under this section, the Secretary shall take into consideration the commitment of each State to improving its State one-call notification program, including legislative and regulatory actions taken by the State after the date of enactment of this chapter.

"(c) FUNDING FOR ONE-CALL NOTIFICATION SYSTEMS. -- A State may provide funds received under this section directly to any one-call notification system in such State that substantially adopts the best practices identified under section 6105.

"6107. Authorization of appropriations

"(a) FOR GRANTS TO STATES. -- There are authorized to be appropriated to the Secretary to provide grants to States under section 6106 $1,000,000 for fiscal year 2000 and $5,000,000 for fiscal year 2001. Such funds shall remain available until expended.

"(b) FOR ADMINISTRATION. -- There are authorized to be appropriated to the Secretary such sums as may be necessary to carry out sections 6103, 6104, and 6105 for fiscal years 1999, 2000, and 2001.

"(c) GENERAL REVENUE FUNDING. -- Any sums appropriated under this section shall be derived from general revenues and may not be derived from amounts collected under section 60301 of this title.

“6108. Relationship to State laws

"Nothing in this chapter preempts State law or shall impose a new requirement on any State or mandate revisions to a one-call system."

(b) CONFORMING AMENDMENT. -- The table of chapters for subtitle III of such title is amended by adding at the end thereof the following:

"61. ONE-CALL NOTIFICATION PROGRAMS ..... 6101".

CONFERENCE REPORT LANGUAGE

(May 22, 1998 Congressional Record, pp. H 3930-H 3931)

Subtitle C--Comprehensive One-call Notification
House bill

No provision.

Senate amendment

Section 3301 contains several findings that unintentional damage to underground facilities during excavation is a significant cause of disruptions; that excavation performed without prior notification or with inaccurate marking causes damage that can result in fatalities; and, that protection of the public and the environment from the consequences of underground facility damage will be enhanced by a coordinated national effort to improve one-call notification programs.

Section 3302 establishes a new chapter, which would be chapter 61, in Subtitle III of title 49, United States Code. The purposes of chapter 61, as set forth in 6101, are to enhance public safety; protect the environment; minimize risks to excavators; and prevent disruption of vital public services by improving one-call notification programs.

The new section 6102 defines a one-call notification system as a system operated by an organization that has as one of its purposes the receipt of notification from excavators of their intent to excavate in a specified area and the notification of underground facility operators so that they can locate and mark their lines in the area scheduled for excavation. The definition includes statutes, regulations, orders, and other elements of law and policy in effect that establish one-call notification system operation requirements within a State.

The new section 6103 also outlines minimum components that one-call notification programs should cover, including the appropriate participation by all underground facility operators, all excavators, and flexible and effective enforcement mechanisms governing participation in, and use of, one-call notification systems. In making a determination on the appropriate extent of participation required by underground facilities or excavators, the section requires a State to assess, and take into consideration, the risks to public safety, excavators, the environment, and vital services posed by underground facility damage and the actions of excavators.

The new section 6103 would further provide that a state could allow voluntary participation in one-call notification systems when it determines that certain types of underground facilities or excavation activities pose a de minimis risk to public safety or the environment. The section requires one-call notification programs to include administrative or civil penalties commensurate with the seriousness of a violation, increased penalties for parties that repeatedly damage underground facilities because they neglect to use one-call notification systems or fail to provide timely and accurate marking of underground facilities. The section allows states to reduce or waive penalties when underground facility damage is promptly reported.

The new section 6104 establishes a two-year program whereby states could apply for grants upon a showing that the state's one-call notification program meets the minimum standards outlined in the bill. The section further provides that a state providing for greater protection than the minimum standards criteria

established in the legislation would also be eligible to receive grants. The new section 6104 would also require the Secretary to include, three years after the enactment of this legislation, additional information on one-call notification programs in the biennial report on gas and hazardous liquids.

The new section 6105 requires the Secretary of Transportation to initiate a study of the best practices employed by one-call notification systems in operation in the States. If a study is undertaken, the Secretary is required to report on the best practices identified and encourage their adoption in the States. The Secretary is authorized to suspend with the report if the Secretary determines that the information is already readily accessible.

The new section 6106 would authorize the Secretary to make grants to improve one-call notification systems, and should take into account the commitment of each state in improving its program, in awarding grants. The provision also authorizes a state to convey its funds directly to any one-call notification system that adopts the best practices established under 6105. The new section neither opens nor closes the door to having one or more one-call system. Most states have a single one-call system, but several have more than one, this determination will remain a state's choice.

The new section 6107 would authorize up to $1,000,000 and $5,000,000 in fiscal years 2000 and 2001 out of general revenue funds.

Section 3302 also made conforming changes to the table of chapters for subtitle III, and certain conforming changes to the existing one-call notification systems language of 49 United States Code 60114.

Conference substitute

The Conference adopts the Senate provisions with modifications. The Conference stresses that untimely marking of underground facilities, as well as the findings contained in the Senate provision, also cause underground facility damage.

The Conference also clarifies that compliance with the minimum standards outlined in sections 6103 and 6104 would only be required when applying for a grant under the new section 6106. The Conference also modifies the Senate language to require the Secretary to encourage states to adopt the most successful practices of one-call notification systems as determined the most appropriate by each state. The Conference also modifies language in the newly added section 6108 to clarify that nothing in the new chapter 61 preempts any existing state law, or would require a state to modify or revise existing one-call notification systems. The Conference also retains 49 U.S.C. 60114.

APPENDIX C
Glossary of Terms/Definitions

For the purpose of the Common Ground Study, a common set of definitions were utilized. These definitions were arrived at through a consensus process, similar to the methodology used to identify the best practices.

Abandoned Line or Facility: Any underground or submerged line or facility no longer in use.

Alternative Dispute Resolutions (ADR)*:* Any process or procedure other than litigation that is agreed to by the disputing parties as the means for resolving the dispute, and is binding or non-binding pursuant to the agreement by the disputing parties. ADR includes, but is not limited to, advisory boards, arbitration, mini-trials, mediation, partnering and standing neutrals.

Attribute: Characteristic that helps describe the data.

As-built Drawing: A detailed depiction of facilities as installed in the field.

Backfill: To fill the void created by excavating.

Business Day: Any day of the week except Saturday, Sunday and state and federal legal holidays.

Cathodic Protection: The process of arresting corrosion on a buried or submerged structure by electrically reversing the natural chemical reaction. This includes, but is not limited to, installation of a sacrificial anode bed, use of a rectifier based system, or any combination of these or other similar systems. Wiring is installed between the buried or submerged structure and all anodes and rectifiers; wiring is also installed to test stations which are used to measure the effectiveness of the cathodic protection system.

Compliance: Adherence to the statute and its regulations.

Damage: Any impact or exposure that results in the need to repair an underground facility due to a weakening or the partial or complete destruction of the facility, including, but not limited to, the protective coating, lateral support, cathodic protection or the housing for the line, device or facility.

Damage Reporting: The immediate reporting to a one-call center and the facility owner/operator of any damage made or discovered in the course of excavation or demolition work. To alert immediately the occupants of premises as to any emergency that such person may create or discover at or near such premises. Also, contact emergency responders, if necessary, as quickly as practical.

Demolition Work: The partial or complete destruction by any means of a structure served by, or adjacent, to an underground line or facility.

Designer: Any architect, engineer or other person who prepares or issues a drawing or blueprint for a construction or other project that requires excavation or demolition work.

Digital mapping data: Geospatial data that is in a format that the computer can recognize.

Emergency: A sudden or unforeseen occurrence involving a clear and imminent danger to life, health, or property; the interruption of essential utility services; or the blockage of transportation facilities that requires immediate action.

Emergency Notice: A communication to the one-call center to alert the involved underground facility owners/operators of the need to excavate due to a sudden or unforeseen occurrence, or national emergency, involving a clear and imminent danger to life, health, environment, or property (including the interruption of essential utility services or the blockage of transportation facilities) that requires immediate excavation.

Emergency Response: A facility owner/operator's response to an emergency notice.

Excavate or Excavation: Any operation using non-mechanical or mechanical equipment or explosives used in the movement of earth, rock or other material below existing grade. This includes, but is not limited to, augering, blasting, boring, digging, ditching, dredging, drilling, driving-in, grading, plowing-in, pulling-in, ripping, scraping, trenching, and tunneling.

Excavator: Any person proposing to or engaging in excavation or demolition work for himself or for another person.

Facility Owner/Operator: Any person, utility, municipality, authority, political subdivision or other person or entity who owns, operates or controls the operation of an underground line/facility.

Facility: An underground or submerged conductor, pipe or structure used in providing electric or communications service (including, but not limited to, traffic control loops and similar underground or submerged devices), or an underground or submerged pipe used in carrying, providing, or gathering gas, oil or oil product, sewage, storm drainage, water or other liquid service (including, but not limited to, irrigation systems), and appurtenances thereto.

Geospatial data: Data that identifies the geographic location and characteristics of natural or constructed features and boundaries on the earth.

Geographic Information System (GIS): An organized collection of computer hardware, software, and geographic data used to capture, store, update, maintain, analyze, and display all forms of geographically referenced information.

Global Positioning System (GPS): A system consisting of 25 satellites used to provide precise position, velocity and time information to users anywhere on earth. Location information can be received using a GPS receiver. The GPS receiver helps determine locations on the earth's surface by collecting signals from

three or more satellites through a process called triangulation. Simple and inexpensive hand-held receivers provide an accuracy of +/-100 meters of a true position. More sophisticated receivers that use additional technologies or post process the original GPS data can provide sub-meter accuracy.

Grade: The surface of the earth (i.e., ground level) upon which a structure is built or prepared.

Grounding Systems: A system of one or more ground conductors or ground rods providing a low resistance path to earth ground potential through a mechanical connection to structures, conductors and equipment.

Land base: Mapped data that depicts features of the surface of the earth and is tied to real-world geographic coordinates, such as latitude and longitude.

Latitude (Lat): Distance measured north or south of the equator.

Line: See definition for "Facility".

Locate: To indicate the existence of a line or facility by establishing a mark through the use of stakes, paint or some other customary manner, that approximately determines the location of a line or facility.

Locate request: A communication between an excavator and one-call center personnel in which a request for locating underground facilities is processed.

Longitude (Long): Distance measured east or west from a reference meridian (Greenwich).

Marking Standards: The methods by which a facility owner/operator indicates its line or facility in accordance with the APWA guidelines.

Member database: Structured collection of data defined for a particular use, user, system, or program; it may be sequential, network, hierarchical, relational, or semantic

Membership: Persons who participate voluntarily in a one-call notification center because they have an interest in the protection of lines or facilities, or because they have a statutory responsibility to protect lines or facilities.

Minor or Routine Maintenance of Transportation Facilities: The adding of granular material to unpaved roads, road shoulders, airport runways, airport taxiways, and railroad roadbeds; removal and application of patches to the surface of paved roads runways and taxiways; road, airport and canal lock facility crack or joint cleaning and sealing; replacing railroad ties and related appliances excluding road crossings; adjusting ballast on top of railroad roadbed; cleaning of paved drainage inlets and paved ditches or pipes.

Notice: The timely communication by the excavator/designer to the one-call center that alerts the involved underground facility owners/operators of the intent to excavate.

Notification Period: The time beginning when notice is given and ending when the work may begin.

One-Call Notification Center: An entity that administers a system through which a person can notify owners/operators of lines or facilities of proposed excavations.

Orthophoto: An aerial photograph of a site which has been differentially rectified to correct the distortion caused by the terrain and attitude (tip, tilt and yaw) of the camera. A multicolored, distortion-free, photographic image.

Person: Any individual or legal entity, public or private.

Planning: An activity at the beginning of a project where information is gathered and decisions are made regarding the route or location of a proposed excavation based on constraints including the locations of existing facilities, anticipated conflicts and the relative costs of relocating existing facilities or more expensive construction for the proposed facility.

Plat: A map or representation on paper of a piece of land subdivided into lots, with streets, alleys, etc., usually drawn to a scale.

Positive Response: Communication with the excavator, prior to excavation, to ensure that all contacted (typically via the one-call centers) owner/operators have located their underground facilities and have appropriately marked any potential conflicts with the areas of planned excavation.

Pre-Marking or Positive Site Identification: The marking of the proposed excavation site/work area consistent with APWA guidelines.

Subsurface Utility Engineering (SUE): An engineering process for accurately identifying the quality of underground utility information needed for excavation plans and for acquiring and managing that level of information during the development of a project.

Test Holes: Exposure of a facility by safe excavation practices used to ascertain the precise horizontal and vertical position of underground lines or facilities.

Tolerance Zone: The space in which a line or facility is located, and in which special care is to be taken.

APPENDIX D
Acronyms

AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACC	Arizona Corporation Commission
ADI	Arbitron Areas of Dominant Influence
ADR	Alternative Dispute Resolution
AGA	American Gas Association
AGC	Associated General Contractors of America
AMTRAK	National Railroad and Passenger Corporation
ANSI	American National Standards Institute
AOPL	Association of Oil Pipelines
APGA	American Public Gas Association
API	American Petroleum Institute
APWA	American Public Works Administration
AREMA	American Railway Engineering and Maintenance of Way Association
ARTBA	American Road and Transportation Builders Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AUCC	Arizona Utility Coordinating Committee
CATV	Cable Television
DAMQAT	Damage Prevention Quality Action Team
DOT	Department of Transportation
EEI	Edison Electric Institute
EMI	Equipment Manufacturers Institute
FCC	Federal Communication Commission
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
GIS	Geographic Information System
GPR	Ground Penetrating Radar
GPS	Global Positioning System
GRI	Gas Research Institute
HTML	Hypertext Markup Language
INGAA	Interstate Natural Gas Association of America
Lat/long	Latitude/Longitude
LDC	Local Distributing Company
LT	Linking Team
NACE	National Association of Corrosion Engineers

NAPSR	National Association of Pipeline Safety Representatives
NARUC	National Association of Regulatory Utility Commissioners
NCTA	National Cable Television Association
NOPV	Notice of Probable Violation
NOV	Notice of Violation
NRSC- FST	Network Reliability Steering Council - Facility Solutions Team
NRWA	National Rural Water Association
NTDPC	National Telecommunications Damage Prevention Council
NTSB	National Transportation Safety Board
NUCA	National Utility Contractors Association
NULCA	National Underground Locating Contractors Association
OCSI	One Call Systems International, subcommittee of the American Public Works Administration
OCSS	One-Call Safety Study
OPS	Office of Pipeline Safety of the U. S. Department of Transportation's, Research and Special Programs Administration
OSHA	Occupational Safety and Health Administration
PE	Polyethylene Pipe
PSA	Public Service Announcement
PUC	Public Utilities Commission
PUCA	Pennsylvania Utility Contractors Association
RSPA	U. S. Department of Transportation's, Research and Special Programs Administration
SCC	State Corporation Commission, Virginia
ST	Steering Team
TIA/EIA	Telecommunications Industry Association and Electronic Industry Association
TT	Task Team
USGS	U.S. Department of the Interior, Geological Survey
VMS	Video Mapping System

APPENDIX E
References

E.1 INTRODUCTION

The references listed in this Appendix illustrate the various sources that were reviewed during the Task Teams' efforts to identify and document best practices. They include, but are not limited to, various state one-call laws; federal regulations; industry standards; company procedures and operating practices; expert opinion; and other documents. This list is not presented as a standard list of references, nor does it document all source material that was reviewed during this Study. Some specific sources cited by the Task Teams are noted in the following sections.

E.2 PLANNING AND DESIGN TASK TEAM

1. 23 Code of Federal Regulations CFR Part 645.
2. 49 Code of Federal Regulations (CFR) Parts 192 and 195.
3. American Association of State Highway and Transportation Officials (AASHTO) Standards.
4. American Public Works Association. (1999). *Guidelines for Uniform Temporary Marking of Underground Facilities*.
5. American Railway Engineering and Maintenance of Way Association (AREMA) Manual. *Chapter 1, Part 5 - Pipelines*.
6. American Railway Engineering and Maintenance of Way Association (AREMA). *Specifications for Fiber Optic Route Construction on Railroad Right of Way*.
7. American Society of Civil Engineers (ASCE). *Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data.*
8. American Society of Mechanical Engineers (ASME) B31.8.
9. Arizona Utility Coordinating Committee (AUCC). (December 1996). *Public Improvement/Project Guide*.
10. Chicago Region Committee on Underground Corrosion standards.
11. Consolidated Edison, New York, NY. (June 9, 1997). *Construction Management Interference Control Manual*.
12. Florida Department of Transportation. (January 1999). *Florida Department of Transportation Utility Accommodation Manual, Document No.: 710-020-001-d, Section 11.4*.
13. Florida Law (Chapter 337.14 FS.) And Rules of the State of Florida, Department of Transportation, Chapter 14-22.
14. Highway/Utility Guide (FHWA), Publication No. FHWA-SA-93-049; June 1993.
15. Michigan Electrolysis Committee standards.
16. Minnesota Statute 216D.
17. National Electrical Code.

18. National Electrical Safety Code.
19. National Fuel Gas Code.
20. Pennsylvania Act 287 of 1974 as amended by Act 187 of 1996.
21. St Louis County, Minnesota, zoning ordinances.
22. Subsurface Utility Engineering, Federal Highway Administration (FHWA), February 1999, Office of Program Administration (HIPA).
23. Union Pacific Railroad procedures.
24. Wisconsin Administrative Rule Chapter Trans 220 "Utility Facilities Relocations."
25. Wisconsin Corrosion Control Coordinating Committee standards.
26. Wisconsin Sec. 186.0175 Stats.

E.3 ONE-CALL CENTER TASK TEAM

1. 49 CFR Part 192: §192.614, Damage prevention program (For operators of Natural Gas Facilities).
2. 49 CFR Part 198, (Subpart C - Adoption of One-Call Damage Prevention Program): §198.31, Scope; §198.35, Grants conditioned on adoption of one-call damage prevention program; §198.37, State one-call damage prevention program; §198.39, Qualifications for operation of one-call notification system.
3. Final Rule Addressing Negative Call Back, 49 CFR Part 192, Docket No. PS-88; Amendment 192-57; Gas Pipeline Damage Prevention Programs (Eff. 9/30/87).
4. Model One-Call for the 20th and 21st Century: A model One-Call design that has the features and capabilities needed to sustain the industry into the 21st century.

E.4 LOCATING AND MARKING TASK TEAM

1. American Public Works Association. (1999). *Guidelines for Uniform Temporary Marking of Underground Facilities*.
2. National Transportation Safety Board. (1995). *Proceedings of the Excavation Damage Prevention Workshop; 1994 September 8-9; Washington, DC, Report of Proceedings*. (NTSB/RP-95/01, pp.177-178). Washington, DC.
3. National Transportation Safety Board. (1997). *Protecting Public Safety through Excavation Damage Prevention, Safety Study*. (NTSB/SS-97/01, pp. 25-26). Washington, DC.
4. National Utility Locating Contractors Association. (1996). *Locator Training Standards and Practices*. Spooner, WI.
5. National Utility Locating Contractors Association. (1998). *Underground Facility Marking Standards*. Spooner, WI.

E.5 EXCAVATION TASK TEAM

1. American Public Works Association (APWA). *Guidelines for Uniform Temporary Marking of Underground Facilities*.
2. CNA. (August 1998). *Minimum Damage Prevention Guidelines*.
3. National Transportation Safety Board (NTSB). (1997). *Protecting Public Safety Through Excavation Damage Prevention*.
4. Occupational Safety and Health Administration (OSHA) Subpart P - Excavation Standard 29 CFR 1926.651.
5. Telecommunications Industry Association and Electronic Industry Association (TIA/EIA). *Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant*. (ANSI/TIA/EIA-590-A-1996).

E.6 MAPPING TASK TEAM

No references were cited.

E.7 COMPLIANCE TASK TEAM

1 Alternative Dispute Resolution Act of 1998, enacted October 1998.
2 Arizona Corporation Commission policy, "Notice of Violation", § 1(A) and (C).
3 Arizona Corporation Commission policy, "Notice of Violation," section 1-3.
4 Arizona Code, Article 6.3, § 40-360.26(A).
5 Arizona Code, Article 6.3, § 40- 360.27(C).
6 Arizona Code, Article 6.3, § 40-360.28.
7 Arizona Code, Article 6.3, § 40-360.28(C).
8 Arizona Code, Article 6.3, § 40-360.32.
9 Massachusetts Regulation, 220 C.M.R. §99.01(1).
10 Massachusetts Regulation, 220 C.M.R. §99.07(1).
11 Massachusetts Regulation, 220 C.M.R. §99.12(1).
12 Massachusetts Regulation, 220 C.M.R. §99.12(2).
13 Minnesota Code, Chapter 216D.03, Subd. 2(a).
14 Minnesota Code, Chapter 216D.06, Subd. 2(b).
15 Minnesota Code, Chapter Title: District Courts, § 484.76.
16 Minnesota Rules, 7560.04000, Subp.1 - Subp. 2(A).
17 Minnesota Rules, 7560.0800, Subpart 3.
18 Minnesota Rules, 7560.0400, Subp. 1, *Notice of Violation;* 7560.0500 *Response Options;* 7560.0600, *Director Review;*7560.0800 Civil Penalties; Subp. 3, *Assessment considerations.*
19 New Hampshire Code, RSA 374, § 374:55(VIII).
20 New Hampshire Regulation, Chapter Puc 800, § Puc 805.02.
21 New Hampshire Regulation, Chapter Puc 800, § Puc 805.06(b)(1)-(3).

22 New Hampshire regulations, Chapter Puc 800, sections Puc 805.01, *"Notice of Probable Violation";* Puc 805.02, *Alternative Responses to Notice of Probable Violation*; Puc 805.03, *Notice of Violation*; Puc 805.04, *Response to Notice of Violation*; Puc 805.05 *Commission Action*; Puc 805.06, Civil Penalties.
23 New Jersey Code, Title 40A, § 40A-11-50.
24 New York Code, 16 NYCRR Part 753, § 753-5.3(b)(1)-(2).
25 New York Code, 16 NYCRR Part 753, § 765(b).
26 New York General Business Law Article 36, § 761.
27 New York Public Service Law, § 119-b(8).
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29 Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 2(8).
30 Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 2(9).
31 Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 3(7).
32 Pennsylvania Code, 73 P.S. § 176 *et. seq.*, Section 7.1(b).
33 Virginia "Rules for Enforcement of the Underground Damage Prevention Act", § 3.
34 Virginia "Rules for Enforcement of the Underground Utility Damage Prevention Act", § 6.
35 Virginia Bylaws of the Advisory Committee, Article II.

E.8 PUBLIC EDUCATION AND AWARENESS TASK TEAM

1. 49 CFR Part 192 .614.
2. 49 CFR Part 195.
3. 49 CFR Part 198.
4. American Petroleum Institute (API) Recommended Practice 1123.
5. DAMQAT Nationwide Survey: “Presentation of Findings: OPS/DAMQAT Underground Facility Damage Prevention Study.”
6. DAMQAT Pilot Campaign Surveys: “Presentation of Findings: DAMQAT Pilot Evaluation Study.”

E.9 REPORTING AND EVALUATION TASK TEAM

1. API/AOPL Voluntary Accident Tracking Initiative. Hazardous Liquid Pipeline Facility. (1998, December 16). *Part TP. Third Party Damage*, Draft #4.
2. Connecticut Call Before You Dig Compliance Committee. *Compliance Supervisor’s Duties and Responsibilities*.
3. Connecticut Department of Public Utility Control. Call Before You Dig, Inc. *Incident Report Form*.
4. Connecticut Department of Public Utility Control. (1995, December 15). *Report to the Connecticut state legislature concerning compliance and enforcement of provisions in Chapter 293, Excavation, Demolition, and Discharge of Explosives.*

5. Consolidated Edison Company of New York, Inc. (1998, August). *Contractor Damage Report*.
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9. Massachusetts Department of Telecommunications and Energy. Pipeline Engineering and Safety Division. (1998, March 20). *Alleged Violation(s) of Dig Safe.*
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14. New Hampshire Public Utilities Commission. (1998) Evaluation reports/graphs of the underground damage prevention program.
15. New Hampshire Public Utilities Commission. *Report of Probable Violation of Underground Utility Regulations and/or Damage to Underground Facilities Form-E26*.
16. PENNSAFE Bureau, Department of Labor and Industry. Underground Utility Line Protection Act. *Contractor Statement*.
17. PENNSAFE Bureau, Department of Labor and Industry. Underground Utility Line Protection Act. *Facility Statement*.
18. PENNSAFE Bureau, Department of Labor and Industry. Underground Utility Line Protection Act. *Incident Report*.
19. PENNSAFE Bureau, Department of Labor and Industry. Underground Utility Line Protection Act. *Investigation Form*.
20. Tennessee One-Call System, Inc. *Underground Facility Damage Report*.
21. Tierdael Construction Company, General Contractors. *Utility Miss Locate or Hit Notification Report*.
22. United States Department of Transportation, Office of Pipeline Safety. *Accident Report - Hazardous Liquid Pipeline Report*, DOT Form 7000.1 (4-85).
23. United States, National Transportation Safety Board. Safety Study. (1997, December) *Protecting Public Safety Through Excavation Damage Prevention*. (NTSB/SS-97-01).
24. Virginia State Corporation Commission, Underground Utility Damage Prevention Act. (1996, December) *Incident Report* DPA-1 Report Form.

APPENDIX F
Common Ground Study Team Member Biographies

STEERING TEAM

James Barron
Mr. Barron is President and Owner of Ronkin Construction, Inc., a Joppa, Maryland based contractor that specializes in the installation of underground utilities in Baltimore and Maryland. Mr. Barron started Ronkin in May of 1978 and has been involved in the underground utility industry for thirty years. He is a Past President of the Associated Utility Contractors of Maryland (AUC) and a Past Publisher of AUC's magazine, "Underneath It All." As Past Region III Vice President of the National Utility Contractors Association (NUCA), he acted as NUCA's liaison to nine NUCA chapters in Delaware, Pennsylvania, Maryland, Virginia and West Virginia. Mr. Barron currently sits on NUCA's Board of Directors and is Chairman of NUCA's Damage Prevention Committee.

Willard S. Carey
Mr. Carey is the Regulatory Leader - Federal for Public Service Electric and Gas Company (PSE&G) of New Jersey. He is responsible for establishing operational and maintenance standards for Gas Distribution. He is also responsible for maintaining relationships with state and federal regulatory authorities in the area of regulatory compliance. Mr. Carey provides technical contributions to internal and external clients in the area of damage prevention, regulatory initiatives, and operating procedures. At the state level he has served as chairman of the Transmission and Distribution Committee of the New Jersey Utilities Association that represents all regulated utilities within the State. At the national level he is a member of industry organizations that address notices of proposed rule-making and operational matters through committees of the American Gas Association and the Gas Piping Technology Committee (ANSI/GPTC Z380). He has also served as an advisor to the Gas Research Institute on research initiatives pertaining to residential and commercial utilization of natural gas. Mr. Carey has testified before the state legislature and Congress on damage prevention matters. He currently serves on the Board of Directors of New Jersey One Call where he is a member of the Operating Committee.

Mr. Carey's professional associations include the American Gas Association, Gas Piping Technology Committee (ANSI/GPTC Z380), Gas Research Institute, and New Jersey Utilities Association.

Charles E. Dettmann
Mr. Dettmann is the Executive Vice President for Operations, Research & Technology for the Association of American Railroads (AAR). He joined Missouri Pacific Railroad in 1964 as an industrial engineer and transferred to railroad operations in 1967. He served as an assistant trainmaster, trainmaster, division superintendent, superintendent, assistant general manager of transportation, general manager and vice president of transportation for the company. In 1986, Mr. Dettmann was elected Vice President of Transportation for the Union Pacific Railroad. Subsequently, he served as Assistant Vice President - Service & Design, Assistant Vice President - Service Reliability Action Team, and Senior Assistant vice

president - quality and service reliability. He retired from Union Pacific in 1992. In January, 1993, he was elected Vice President of Operations and Maintenance for AAR. In September, 1994, he was appointed to his current position.

Mr. Dettmann is a graduate of the Georgia Institute of Technology. He completed the Harvard Program for Management Development in 1975. He served on the Boards of Directors of the Chicago Heights Terminal Transfer Railroad Company, the Chicago and Western Indiana Railroad Company, the Alton & Southern Railroad Company, the Terminal Railroad Association of St. Louis, and the Kansas City Terminal Railway Company. He currently serves on the Boards of Directors for Operation Lifesaver, Inc. and ITS America.

Don Evans

Don Evans is the Operations Manager of Underground Service Alert of Southern California, also known as Dig Alert. His work with converting the Dig Alert operations to predominately telecommuters has been featured in numerous technical publications. Mr. Evans was the 1998-1999 Chair of One Call Systems International (OCSI) and the 1996-1997 Chair of the OCSI Delegates Committee. In addition to his service to Dig Alert, Mr. Evans teaches basic computer skills at University Extension Services of California State University at Long Beach. Prior to coming to the one-call industry, he was an owner/manager at United Parcel Service. He has worked in the private sector for over 27 years as manager over industrial engineering, human resources and operations functions.

Stacey Gerard

Ms. Gerard has been with the U.S. Department of Transportation, Research and Special Programs Administration (RSPA), Office of Pipeline Safety (OPS) for seven years. She is Director of the Office of Policy, Regulations and Training. Ms. Gerard is responsible for program development, regulatory initiatives and budget. Her recent efforts focused on damage prevention, risk management, mapping, data analysis, and environmental programs. Prior to OPS, she served in RSPA's Office of Policy and Program Support and the Office of Hazardous Materials Transportation. She has 20 years of government experience in nuclear, chemical and national disaster emergency planning and 10 years of experience in private industry management consulting.

Allen S. Gray, Sr.

Mr. Gray is Director, Carolinas AGC (CAGC) Utility Division and Coordinator of Divisions Planning. Mr. Gray has an extensive background in government on the local, state and federal levels having worked for the US Congress, Department of Labor, and as a Municipal Administrator. He also has been associated with the construction industry through his family's business, G.E. Moore Construction Co., Inc., which was founded by his Grandfather in 1932. He presently serves on the NC One-Call Center (NCOCC) Board of Directors, NCOCC Legislative Committee, NCOCC Long Range Planning Committee, Joint Engineers Committee of NC, North and South Carolina Utility Coordinating Committees, CAGC North and South Carolina Underground Utility Damage Prevention Task Forces, and he is a member of the American Society of Association Executives.

John Healy
Mr. Healy has over 21 years of experience in the telecommunications industry, with 15 years of experience in telecommunications reliability. He is the Chief Scientist, Network Reliability, for Telcordia Technologies. He has a Ph.D. in mathematical statistics. Mr. Healy led the data collection and analysis efforts for both Network Reliability Councils. The documents *Network Reliability: A Report to the Nation* and *Network Reliability: The Path Forward* contain graphs produced by Mr. Healy and his organization. He directed the development of the analyses methods used by the Network Reliability Steering Committee. He co-wrote the original proposals defining the outage index, which has been adopted by industry as the way to measure outage impact. Mr. Healy directed the development of risk analysis as the way to quantify network risks. He co-chairs the Facilities Solution Team and wrote both major reports. He advised the President's Commission on Critical Infrastructure Protection on network reliability and security. Mr. Healy is currently Vice-Chair of the Reliability and Maintainability Symposium Committee. He wrote the *Reliability Prediction Procedure*, a commercial standard for hardware reliability prediction, which is used by many companies. He co-chaired the last two major studies of network impairments in the U.S. Public Switched Telephone Network.

John Walko
Mr. Walko is on the board of NULCA. He is founder and president of Excavac Corporation, a manufacturer of vacuum excavation equipment and accessories.

LINKING TEAM

Glynn Blanton
Mr. Blanton is Chief of the Gas Pipeline Safety Division at the Tennessee Regulatory Authority (TRA). He holds a Bachelor of Science degree in Engineering from the Tennessee Technological University. He has also attended and completed various courses, related to pipeline engineering, liquefied natural gas facilities, hazardous liquid pipelines, and corrosion control of pipelines, at the Federal Transportation Safety Institute in Oklahoma City, Oklahoma. Prior to joining the TRA, Mr. Blanton was with the Georgia Public Service Commission (PSC), where he served as Section Chief of the Utilities Engineering Division.

Mr. Blanton is a member of the National Pipeline Safety Representatives Association (NAPSR), where he has served in several offices, including National Chairman. He is currently serving as NAPSR Chairman of the Grant Allocation Committee and as Chairman of the Legislative Committee. Mr. Blanton is President of the National Conference of Regulatory Utility Commission Engineers (NCRUCE), a member of the American Gas Association, past chairman of the National Association of Regulatory Utility Commissioners (NARUC) staff sub-committee on pipeline safety, and a member of the American Society of Mechanical Engineers, Gas Piping Technology Committee and National Association of Corrosion Engineers. He was selected in 1997 by the federal Office of Pipeline Safety to participate on the Damage Prevention Quality Action Team (DAMQAT). Mr. Blanton served as Liaison to the Compliance and Public Education Task Teams.

Claudette Campbell

Ms. Campbell has been involved in one-call for the past 19 years as the Executive Director of Utilities Protection Center of Georgia. She represents One Call Systems International (OCSI) in the Common Ground One-Call Systems Study. She is a past chairperson of OCSI and the National Utility Location and Coordination Council of the American Public Works Association, where she has also served as a national director. Most recently she has served as the one-call industry representative on the Damage Prevention Quality Action Team (DAMQAT). Ms. Campbell served six years as a public representative on the TPSSC and participated in the National Research Council study on "Enhancing Public Safety Around Pipelines." Ms. Campbell served as Liaison to the One-Call and Public Education Task Teams.

Larry Davied

Mr. Davied is employed by The Williams Companies in Tulsa, Oklahoma. He is the Director of Operations Control, which includes responsibilities for the centralized operations of William's Refined Products and Natural Gas Liquids Pipelines and Terminals. Mr. Davied is also responsible for Williams One-Call Services, Inc., which provides ticket screening and notification related services to Williams and third party facility operators. Other responsibilities include measurement, energy procurement, pipeline integrity, and GIS sponsorship for Williams Energy Services. Mr. Davied served as the Co-Chair of the Linking Team.

Donna Erat

Ms. Erat manages the Disaster Preparedness Programs for the American Public Works Association, including the One-Call Systems International Committee. Her background includes five years with the Federal Emergency Management Agency, where she developed program policy and guidance for a mitigation grant program as well as served as the Director's Intergovernmental Liaison to Tribal, State and Local Governments, and the White House on disaster issues. Ms. Erat served as the Liaison to the Reporting and Evaluation Task Team.

Larry Galbreath

Mr. Galbreath is now the Director, Fiber Optic Installation, Design & Construction, for CSX Transportation in Jacksonville, FL. He began work with L&N Railroad on November 11, 1961, as a rodman in the Division Engineer's Office, in Nashville, TN, and has held various positions in the engineering departments of subsequent merged companies. He is responsible for coordination of utility and telecommunication occupancy of CSXT right-of-way. He is also responsible for Safety Training and is Chairman of the Safe Job Procedure Committee. Mr. Galbreath was also the Director Engineering, CSX De Mexico, for approximately one year. He attended the University of Tennessee. He has held a Tennessee Surveyors License since November 1970.

Griffin (Griff) Goad

Mr. Goad is the Senior Damage Prevention Manager for BellSouth Telecommunications, Inc. He is Chairman of the National Telecommunications Damage Prevention Council (NTDPC) and a member of the Facility Solutions Team, a sub team of the Network Reliability Steering Council. Both organizations' sole purpose is the prevention of damage to the national telecommunications infrastructure. Mr. Goad has 32 years experience with BellSouth serving in numerous roles of telephone plant construction. The last several years he was responsible for the procedural development of BellSouth's contracted excavating and

locating work. Currently Mr. Goad is responsible for the development and evaluation of BellSouth's underground damage prevention program. Mr. Goad served as the Co-Chair of the Linking Team.

Russ Kopidlansky

Mr. Kopidlansky works for Wisconsin Public Service Corporation and is a Gas Control and Utilization Supervisor. Among his other responsibilities is the process of locating underground facilities. Because of this duty, he has been involved with Diggers Hotline of Wisconsin since 1984 and has served as President of Diggers since 1991. Over the years he has participated in two American Gas Association (AGA) sponsored benchmarking round tables related to locating and has attended numerous symposiums and conferences. Mr. Kopidlansky is a representative for AGA on the Linking Team and a participant on the Mapping Best Practices Team. He is currently President of the Wisconsin Society of Professional Engineers and has been an active member of the National Society of Professional Engineers since 1975. Mr. Kopidlansky served as the Liaison to the Mapping Task Team.

Rich Maxwell

Mr. Maxwell is a Manager at A & L Underground (Olathe, KS). He serves on numerous committees including the American Public Works Association's P/E/T-Right of Way Committee and the American Society of Civil Engineers' Trenchless Standards Steering Committee. He currently is supporting research to find better facility locating systems and has been a damage prevention activist, publishing numerous articles on damage prevention and horizontal directional drilling. Mr. Maxwell served as the Liaison to the Excavation Task Team.

Michael K. McDonald

Mr. McDonald represents the electric utility industry. He is employed by Arizona Public Service (APS). He is currently an Operations Section Leader with 23 years experience in the design, construction and locating and marking of underground gas and electric facilities. Mr. McDonald is actively involved with the American Public Works Association (APWA) and is a former Executive Committee member for APWA's subcommittee, One Call Systems International (OCSI). He currently sits on the Editorial Advisory Board for Underground Focus, a publication covering one-call and damage prevention issues. He is also the Chairperson for the Operations Committee for Arizona Blue Stake.

Guy "Skip" McIntosh, III

Mr. McIntosh is a Vice President of UtiliQuest (formally Byers Locate Services), an underground utility locating company. Mr. McIntosh was formerly employed by Kelly Cable Corporation and has been involved in the locating and excavation business for fifteen years. In November of 1999, Kelly Cable Corporation sold their locate division to Byers Locate Services. Mr. McIntosh accepted a Vice President position with UtiliQuest and is currently running the Western Division. Mr. McIntosh has served on the Board of Directors for the National Utility Locating Contractors Association (NULCA) since its inception in 1995. Mr. McIntosh was the President of NULCA from 1997 to 1999 and is currently serving as Past President. Mr. McIntosh served as the Liaison for the Locating and Marking Task Team.

Ken Naquin
Mr. Naquin is the Executive Director Occupational Divisions Louisiana AGC. He was the office engineer for two years with Austin Power Construction Co. in Dallas, Texas. He was hired by the Louisiana AGC in 1980 to serve as Highway and Utility Division Manager, Manager of Louisiana Chapter ARTBA, NUCA, and Highway Users Foundation. Mr. Naquin serves as trustee to Laborers/AGC Training Program. He is a Visiting Lecturer at Louisiana State University, Northeast Louisiana University, Louisiana Tech and Grambling University Schools of Construction. Mr. Naquin served as the Liaison to the Emerging Technologies Task Team.

Andy Scott
Mr. Scott started his career in the cable television industry in 1978. Since then he has gone on to hold a variety of positions such as Headend Technician, Senior Electronic Technician, Telecommunications Services Engineer, and Technical Operations Manager. His experiences in these positions have given Mr. Scott an extensive background in the engineering and deployment of advanced communications services to residential, business and governmental users. Currently Mr. Scott is the Director of Engineering for the National Cable Television Association where he focuses daily on a wide variety of technical policy issues affecting the cable television industry.

Paul Scott
Mr. Scott is the Headquarters Utilities Coordinator for the Federal Highway Administration (FHWA). He is responsible for all matters involving the relocation, adjustment, and accommodation of utilities on highway rights-of-way. He began his career with the FHWA in 1969 and has worked on many federal-aid issues in a number of headquarters and field offices. He has been in his present position since 1990. Mr. Scott is a registered Professional Engineer. Mr. Scott served as the Liaison to the Planning and Design Task Team.

Jim Stutler
Mr. Stutler is the President of Tierdael Construction Company, Denver, Colorado. He currently serves as a Regional Vice President of the National Utility Contractors Association. Mr. Stutler also served as Chairman of the Underground Committee of the Colorado Contractors Association for five years. He has over 22 years experience in Heavy Highway and Utility Construction.

Massoud Tahamtani
Mr. Tahamtani has worked with the Virginia State Corporation Commission since 1980. In his current position, as an Assistant Director with the Commission’s Division of Energy Regulation, he manages the Commission's Gas and Hazardous Liquid Pipeline Safety Program**.** He also administers the Commission's enforcement of the Virginia Underground Utilities Damage Prevention Act. He previously served as the Division’s Utilities Manager where he managed the Commission's Gas Pipeline Safety Program. Mr. Tahamtani has completed training programs in pipeline safety at the U. S. Department of Transportation’s (DOT) Transportation Safety Institute and in the design and operation of both fossil and nuclear power plants at the Virginia Power Company. He holds various technical certificates related to electrical power production, distribution, and utility management.

Mr. Tahamtani is a past National Chairman of the National Association of Pipeline Safety Representatives (NAPSR) and a member of the NAPSR Grant Allocation and Legislative Committees. He is also a

member of the National Association of Regulatory Utility Commissioners (NARUC) Subcommittee on Gas Pipeline Safety, and a past member of the Southeastern Reliability Council. In 1997, the Secretary of Transportation appointed Mr. Tahamtani to the Hazardous Liquid Pipeline Safety Standards Committee. He served on the Linking Team for this Study.

Eben M. Wyman
Mr. Wyman is a Transportation Specialist with the U.S. Department of Transportation (DOT)'s Pipeline Safety Program, working in program and regulatory development. He is also a liaison to the National Transportation Safety Board. He joined the DOT's Research and Special Programs Administration in 1993, serving in various Congressional and media affairs functions. Mr. Wyman recently coordinated a successful negotiated rulemaking on pipeline operator qualification and serves on the Risk Assessment Feasibility Team for local distribution companies. Prior to his service at DOT, Mr. Wyman served as a Legislative Assistant to Williams & Jensen, a Washington, D.C. government relations corporation.

PLANNING AND DESIGN TASK TEAM

Robert C. Arnold
Mr. Arnold is the Manager of Pipeline Operations for Duke Energy. He is responsible for overseeing the maintenance and operations of the Texas Eastern pipelines and the Algonquin pipelines. The pipelines carry natural gas from the Gulf of Mexico to Massachusetts and Maine. Mr. Arnold has worked with local one-call agencies to support Duke Energy in its efforts to minimize third party damage to its own pipelines and others. During his career, he has worked in the different phases and sides of the one-call process from marking and locating Duke Energy facilities for third parties to identifying underground facilities inside project excavation areas for Duke Energy. Mr. Arnold has been with Duke Energy for 11 years and has served as a field engineer, pipeline Supervising Engineer, Project Supervising Engineer to his current title.

Matt Bacon
Mr. Bacon is a District Supervisor for Sprint Long Distance in Anaheim, CA. He is responsible for ten field locators/technicians, one outside plant engineer, 42 remote sites and 934 miles of fiber optic cable. Mr. Bacon serves on the Board of Directors for Underground Service Alert of Southern California where he is currently Vice-Chair of the Board, Chair of the Communications and Advertising sub-committees and a member of the Rate Structure, Ticket Format and Executive committees. He regularly speaks at Contractor Awareness meetings for the One-Call Center representing the long distance telephone industry. Within Sprint, Mr. Bacon serves as the field representative for the Western States for Sprint's internal One-Call ticketing system. Prior to becoming a supervisor eight years ago, he was a field locator/technician for three years and an equipment installer for two years, both within Sprint.

Johnny Becker, P.E.
Mr. Becker is the Vice President of Pipelayers Inc., an underground utility construction firm. He is a member of AGC and NUCA, among other associations. He is the Local Municipal utility Vice Chairman for AGC. He has been a utility contractor for 15 years. Prior to that Mr. Becker was a civil engineer specializing in municipal engineering.

Rocco DePrimo

Mr. DePrimo is the Production Support Manager for the Florida Department of Transportation. His responsibilities encompass Utility Coordination/Negotiations, Value Engineering, and the Local Agency Program projects. He began his career in 1967 with the Florida Department of Transportation in construction. In 1977 he moved to Dade County and when he left for private industry in 1986 he was Director of Design for the Miami Dade Transit Authority. He served 6 years as a private consultant before returning to Florida Department of Transportation (FDOT) in 1991. Mr. DePrimo has a B.S. degree in Construction Management and has completed graduate work in Public Administration. He holds the designation as a Certified Public Manager (CPM).

James E. Farrell

Mr. Farrell is the Director - Fiber Optics & Asset Utilization for Union Pacific Railroad Company. He administers Union Pacific's fiber optic and asset utilization programs, which began in 1984. He is responsible for the longitudinal fiber optic systems of various telecommunication companies installed along Union Pacific rights-of-way, from the negotiation of agreements through the planning, engineering and installation of these systems, and the activities associated with their subsequent maintenance. Mr. Farrell joined Union Pacific in 1976 as Senior Manager - Market Development and served as Director - Strategic Planning and Director - Special Projects prior to assuming his current position.

Donald H. Gordon

Don Gordon is an independent consultant in Greendale, WS, specializing in underground facility damage prevention and roadside safety. He is currently assisting the University of Wisconsin Transportation Information Center with work zone safety training. Mr. Gordon retired after 41 years of service to Wisconsin Electric Power Company. He began his career as an electrical engineering technician in distribution and progressed through several positions to Utility Coordinator. His responsibilities included right-of-way coordination, joint-use administration and excavation damage prevention. He served as president of Diggers Hotline and for several years on the Board. Mr Gordon has been a long time member of the American Public Works (APWA) Utility Location Coordination Council (ULCC - now the Utility and Public Right-of-Way Committee - UPROW) and, as chair of the ULCC Standards Committee, he refined and enhanced the APWA Uniform Color Code for the temporary marking of underground facilities. He is current chair of the APWA/One Call Systems International Color Code Task Force and a member of the FHWA Roadside Safety Committee. Mr. Gordon served as the Co-Chair of the Planning and Design Task Team.

Anne-Marie Joseph

Ms. Joseph serves as the Office of Pipeline Safety (OPS)'s Liaison to national associations with interests in pipeline safety, including the National Association of Pipeline Safety Representatives and the National Association of Regulatory Utility Commissions. In this role, she works closely with all state agencies participating in the OPS pipeline safety program to promote federal and state efforts to enhance pipeline safety, including one-call state grant programs. Ms. Joseph is also a member of the OPS Damage Prevention Quality Action Team (DAMQAT), which has developed a national damage prevention campaign.

Ms. Joseph has been a registered Professional Engineer with the state of Virginia since 1991. She has previously worked as a civil and structural engineer for Bechtel, Inc., and the Naval Research Laboratory in the Washington, DC area.

Gary U. Mentjes
Mr. Mentjes is the Manager, Public Works for Canadian Pacific Railway (CPR), Soo District. During his 34 year railroad career, Mr. Mentjes has held a variety of positions, supervising all areas of construction and maintenance on railroad right-of-way. He represents CPR's interests in all contracts with highway authorities in a seven state midwestern territory, and also is responsible for evaluating, approving and permitting construction of pipelines, wirelines and cables on Railroad property.

Patrick J. Murphy
Mr. Murphy is a Chief Construction Inspector for Consolidated Edison of New York. His responsibilities include overseeing utility construction in conjunction with government sponsored construction projects as well as a municipal liaison between Con Edison and the various municipalities in the Westchester County area of New York state. Mr. Murphy is also a Director with the Underground Facilities Protective Organization of New York, the oldest one-call center in the world. He began his career as a gas mechanic in outside plant construction and worked his way to his present position.

Paul Norgren
Mr. Norgren is Senior Legal Counsel and Project Specialist for Lakehead Pipe Line Company and Enbridge (U.S.) Inc., which is a crude oil transmission pipeline in the Midwest. In addition to coordinating regulatory, right-of-way and permitting issues for the Company's projects, he serves on committee's of the pipeline industry's Association of Oil Pipelines and is a member of the Minnesota Pipeline Safety Advisory Committee. Prevention of damage to underground facilities is a key concern for pipeline operators and through industry and government committee work, Mr. Norgren has had an opportunity to participate in many activities relating to damage prevention initiatives.

John L. Robertson, P.E.
Mr. Robertson is President and Co-founder of The Spectra Group, Inc., an 18 year old Engineering and Surveying firm that specializes in Subsurface Utility Engineering. With over 30 years experience in Highway and Utility Design, Mr. Robertson is recognized as an expert in the field of Underground Facilities Location and Mapping. Mr. Robertson is a Registered Engineer in five states. He is a member of NSPE, VSPE, ITE, ASCE, NULCA, and AME. Mr. Robertson served as the Co-Chair of the Planning and Design Task Team.

ONE-CALL CENTER TASK TEAM

Mike Ames
Mr. Ames is a senior project engineer in the Pipeline Safety Division of Enron Corp. in Houston, TX. He has been involved with one-call systems in several states over the last 15 years. Mr. Ames served on the Board of Directors for Kansas One Call for six years, including four years as treasurer. He served for several years on the Operating Committee for Kansas One Call and Texas Excavation Safety System (TESS). He was elected to the Board of Directors for TESS last year. His experience with Enron Corp. includes pipeline operations, operation audits, control systems, gas quality analysis, and corrosion control.

Danny Barrett
Mr. Barrett is currently the AT&T National Damage Prevention Supervisor. He has been employed with AT&T for 29 years. Twenty-two of those years have been spent in the Outside Plant Department. His responsibilities have included engineering and design, relocation and maintenance of AT&T's underground transcontinental cable facilities. He was the original AT&T Contractor Contact Representative in North and West Florida, providing damage prevention educational presentations for the excavating community. He was also involved with the writing of Florida's One-Call Legislation.

Zach Barrett
Mr. Barrett is a State Liaison for the U. S. Department of Transportation, Office of Pipeline Safety (OPS). He is responsible for developing, supporting, and evaluating pipeline safety programs for the 11 OPS Western Region States. Mr. Barrett has supported state legislative efforts toward improving damage prevention laws and has served on damage prevention discussion panels for the OPS. In addition to State Liaison, throughout his 13 year career with OPS Mr. Barrett has held the positions of Senior Engineer and Compliance Officer. Prior to OPS, he spent four years in the oil and gas exploration, production, and service industries with Haliburton Services and Cathey Production.

Kirby (Tim) Brubaker
Mr. Brubaker is the One Call Liaison for AT&T. He represents AT&T's interests to some 68 one-call agencies in the United States. He also maintains close contact with one-call system vendors and peers from other one-call member companies. Tim has been active in one-call liaison work since January 1998. He began his career with AT&T in 1974 in outside plant construction, moved to cable and microwave radio maintenance in 1980, then moved to national fiber restoration coordination in 1990.

John Collins
Mr. Collins is the Headquarters Utility & Permit Engineer for the Louisiana Department of Transportation & Development (LADOTD). He is responsible for managing LADOTD's utility relocation, right-of-way permit, and joint use programs. Mr. Collins is a licensed Professional Engineer.

Roger Fleming
Mr. Fleming is Manager of Field Operations for Explorer Pipeline Company. Explorer owns and operates a 24" and 28" diameter 1400 mile products pipeline system transporting primarily gasoline, fuel oil, and jet fuel from Gulf Coast refineries and import facilities in Texas and Louisiana into the mid-western United States. Mr. Fleming has field operations, maintenance, and product measurement responsibility for the

pipeline system. His career in the pipeline industry began when he went to work for Gulf Refining Company in Houston, TX, as a pipeline engineer. He joined Explorer in 1973 and has held various engineering and management positions leading to his current position in the company's Tulsa, OK, headquarters office. Mr. Fleming's area of responsibilities includes protecting the large diameter pipeline from excavation damage. Explorer was a charter member of the Oklahoma One-Call System, where Mr. Fleming has been a member of the operating committee and on the Board of Directors.

David Frey

Mr. Frey is the Vice President and Director of Marketing for Louisiana One Call. He is responsible for the marketing, legislative, membership, and administrative efforts of Louisiana One Call. Mr. Frey has a history of actively working with individuals, associations, and legislative and regulatory agencies to advance the concept of one-call. Prior to his work with Louisiana One Call, Mr. Frey was employed as Executive Vice President of the Louisiana Building Material Dealers Association and Governmental Affairs Director of the Baton Rouge Chamber of Commerce.

George Glenn

Mr. Glenn is the Executive Director of the North Carolina One-Call Center and in that capacity he is involved in Damage Prevention Programs on a state and national level. He is retired from BellSouth where he held numerous positions that were related to underground damage prevention. Mr. Glenn served as the Co-Chair of the One-Call Center Task Team.

Jim Holzer

Mr. Holzer is the Director of Operations, One Call Concepts, Inc., a provider of one-call management, software and support solutions. He started his career in underground safety as a call center operator at the Diggers Hotline Center in Milwaukee, Wisconsin in 1981. Since that time, he has served in a direct management capacity at one-call centers for Delaware, Maryland, Oregon, Virginia, Washington, Wisconsin, the District of Columbia and the Province of Ontario. He has provided support for call center operations serving Idaho, Kansas, Louisiana, Minnesota and Texas. Mr. Holzer has had extensive involvement in legislative efforts in Oregon and Virginia. He is currently the secretary for the Virginia State Corporation Commission's Damage Prevention Advisory Committee, which is charged with hearing all cases regarding violations of the State's damage prevention laws.

Glenn Johnston

Mr. Johnston is president and founder of Glenn Johnston, Inc., a construction firm located in Pittsburgh, PA, that installs approximately 60 miles of underground utilities a year. Mr. Johnston represents NUCA and AGC, both of which are national contractor organizations involved in the excavation industry. His firm has been a member of NUCA for eight years and he serves on the Board of Directors. Mr. Johnston is active in the Pennsylvania Utility Contractors Association (PUCA), where he was president in 1995 and 1996 and still serves as Vice President on the Board of Directors. His firm also belongs to AGC and their chapter the WVCA. Mr. Johnston is also in his fourth year serving as the contractor member of the Board of Directors of the Pennsylvania One Call System.

Steven W. Kindschy
Mr. Kindschy is employed by Consumers Energy Company, Michigan's largest utility. He is Manager of Contractor Partnering, Damage Prevention and Claims for the Company's Natural Gas Business Unit. In his 27 year career, he has held a variety of engineering, operating and management positions in both the Company's natural gas and electric divisions. He is a member of the Michigan Damage Prevention Committee and is President of the Board of Directors of MISS DIG System, Inc., Michigan's One-Call Center. He is a licensed Professional Engineer in the state of Michigan. Mr. Kindschy served as the Co-Chair of the One-Call Center Task Team.

Patti Lama
Ms. Lama, Director of Joint Utility Programs at Enron Portland General Electric, has 21 years of diversified electrical utility experience including: Nuclear Engineering and Construction; Controller's Office; Generation Engineering and Construction; Public Affairs; Public Relations and Distribution Operations. In her current position, Ms. Lama is responsible for identifying critical joint utility issues and developing effective responses and solutions to those issues in conjunction with other utilities, cities, counties and state agencies. Ms. Lama has been involved in the one-call center arena for 8 years and was an active participant in the legislative committee that rewrote the dig law in the state of Oregon. Ms. Lama is also on the Oregon Utility Notification Center Board, representing regulated power, and was elected Board Chair in 1998 and 1999.

Lee Marrs
Mr. Marrs is the President of Texas Excavation Safety System, Inc. (TESS), a non-profit corporation that operates the DIG TESS one-call notification center, located in Dallas. The TESS system covers the state of Texas and has 397 members. The Center processed over 860,000 incoming location requests from excavators and transmitted over 2.7 million outgoing tickets to members in 1998. Mr. Marrs has been in the one-call industry for nearly 20 years. While with Southwestern Bell Telephone Company, he helped to organize the Oklahoma One Call System. He has also been involved with the establishment and operation of one-call centers in Kansas, Mississippi, and Tennessee.

Michael T. McNamara
Mr. McNamara is President and Chief Executive Officer of One Call Systems, Inc. (OCS). He has over 28 years of experience in managing technical centers. This includes: VP of Eastern Operations for United Information Services (now Sprint); Director of the Chicago Data Center for United Computing Systems; Center Manager for Itel Utility Data Services; and 15 years as One Call Systems' executive management. Under his leadership, OCS currently operates one-call centers in Dallas, TX, Piscataway, NJ, Jefferson City, MO, and Pittsburgh, PA. Mr. McNamara is also on the Board of Directors of two Pittsburgh High-Technology firms.

Gregory A. Obsincs
Mr. Obsincs is currently the Executive Director of the Ohio Utilities Protection Service, the one-call in the state of Ohio. He has served as the Executive Director for over seven years. Over the years, he served as a member of the OCSI executive board and delegate counsel. In addition, he held a position on the Board of Directors of Buckeye State Locating, a contract locating company in Ohio. Before coming to Ohio Utilities Protection Services, Mr. Obsincs worked for AT&T for 27 years, holding various positions,

many of which involved managing groups responsible for the installation and protection of underground facilities. He was responsible for a center in Drannesville Va., which received and processed excavation reports from various one-calls on the East Coast. Mr. Obsincs also sat on several state one-call boards while working for AT&T. In addition, while with AT&T, Mr. Obsincs held positions in operator services which involved the managing of call centers.

Ron Olitsky

Mr. Olitsky has been president of Underground Service Alert of Southern California (USA/SC) for the past twelve years. He previously served as the manager of USA/SC from September of 1980 to December of 1986. His background includes six years in retail management and ten years in broadcast journalism. He has been involved with Underground Service Alert from the time it was an Association with 25 members getting 150 calls a day. Today USA/SC is a non-profit mutual benefit corporation with over 800 members, receiving more than 2000 calls a day.

Mark F. Palma

Mr. Palma is an attorney with the national law firm of Hinshaw & Culbertson. Mr. Palma has served as general counsel since 1987 of Gopher State One Call, the Minnesota "Call Before You Dig" center. He is also the incorporator and general counsel to the National Utility Locating Contractors Association (NULCA), the national association responsible for standards and practices of the nation's contract locators. Mr. Palma also represents a series of for-profit and non-profit businesses in his practice as a partner in Hinshaw & Culbertson and serves as heads of its business organization and entrepreneur practice for this 400 member, 26 city law firm. Mr. Palma, in addition to holding a magna cum laude degree in law, also has the distinction of having his Masters Business Administration and being a licensed Certified Public Accountant.

LOCATING AND MARKING TASK TEAM

L. Bradford Barringer

Mr. Barringer is President of B.R.S., Inc., Richfield, NC. He served on the Carolinas AGC (CAGC) Board of Directors from 1988 to 1993, serving as President in 1993. He is presently serving as a subject matter expert to the National Center on Construction Education and Research on a pipe layer craft worker training program. Mr. Barringer's interests include helping to develop the fiber optics standard and updating blasting regulations.

Ronald J. Boes

Mr. Boes is the Manager of Public Safety for Indiana Gas. He has spent 35 years working within a medium sized Local Distributing Company (LDC). He has designed and supervised natural gas distribution systems, ranging from services to big inch piping. He worked several years developing procedures and standards for compliance with federal and state legislation. He is currently implementing a public safety program ,while serving on the Board of the Indiana One-Call Center for ten years (President for three years), and actively serving as a member of OCSI.

Dan Bradley
Mr. Bradley is a Vice President and the General Manager of STS, Inc., an underground utility locating company. Mr. Bradley has been involved in the locating industry for over 20 years. He has been a Board member of the National Utility Locating Contractors Association since its inception, and is currently serving as its President. Mr. Bradley served as the Co-Chair of the Locating and Marking Task Team.

Randy Burke
Mr. Burke has worked in the pipeline industry for 25 years in a variety of maintenance and operations positions. His current position is DOT Specialist for Chevron Pipe Line Company, The Woodlands, Texas. He has served on various committees of the American Petroleum Institute, past and present. Mr. Burke was a co-chair of the Common Ground Locating and Marking Task Team.

Rod Elms
Mr. Elms has been in the underground cable locating industry for the past 13 years. He has managed UTI's operations in Arizona for the past six years, working closely with many utility companies, railroads, the Arizona Corporation Commission, and the Department of Transportation. For the last three years, he has been a consultant to the Blue Stake One-Call Center in Arizona and served on their Executive Committee.

Aydren D. Flowers
Mr. Flowers has been the State Utility Agent for the NC Department of Transportation since May, 1992. He is responsible for coordinating utility relocations and installations on highway construction projects.

Bobby Haney
Mr. Haney has been a registered engineer in the state of Texas since 1980. He has worked in several phases of gas distribution for ENTEX, including engineer in the South Texas division, senior engineer with cathodic protection and field engineering responsibilities in Houston, division operations manager in Mississippi, chief engineer of Houston, and director of engineering for ENTEX. He has had responsibility for line locating and one-call operation for ENTEX since 1988.

Kelly Hardy
Mr. Hardy is currently employed by the Utilities Protection Center, Inc. of Georgia, serving as Liaison Manager and Chairman of the UPC Advisory Board. He has diverse experience in the subsurface facility/utility locating industry, including the areas of field locate technician (locating gas, electric, communications, and water/sewer), many levels of supervision, and Manager of Georgia Operations for a contract locate/engineering firm, directing multiple office, multiple contract/utility locating operations. Mr. Hardy's professional associations include membership in NULCA; APWA; OCSI; GUCC (Georgia Utility Coordinating Council) - Safety and Awards/Recognition Committees and multiple local chapters; GUCA (Georgia Utility Contractors Association) - Legislative, Safety, Apprenticeship, and Educational and Scholarship Committees; Georgia's Chapter of AGC - Young Leadership Program; and GMA (Georgia Municipal Association) Gas Section - Operator Qualification Instructor for Continuing Education Program sponsored by the University of Georgia Center for Continuing Education.

Tom Jackson
Mr. Jackson has been employed by Georgia Power since 1971. He is supervisor of Joint Use/DOT. He has been a member of the Georgia Utility Protection Center Board since 1986. Presently, he is chairman of the Georgia Conflict Resolution Board, chairman of the GUCC Legislative Committee, and member of APWA, PET, and R/W Utility.

Orlando Jerez
Mr. Jerez is the Chief Utility Engineer for the Utah Department of Transportation.

Dan Knight
Mr. Knight is a Damage Prevention Manager with U S WEST Communications. He has worked for U S WEST (Northwestern Bell) for 27 years. His experience includes installation, maintenance, construction, contract administration, engineering and damage prevention. He is a member of the APWA.

Keith Leewis
Dr. Leewis was recruited by GRI to lead their risk management program and improve the safety performance of the gas transmission pipeline industry. He brought more than twenty years materials and engineering experience in iron and steel making; fracture mechanics; pipeline inspection, welding and fabrication, and adult education. He is a key resource and was a member of four industry/regulator Risk Assessment Quality Action Teams (RAQTs), helping to write the Gas Risk Assessment Quality Action Team (GasRAQT) Report, the Joint Gas/Liquid RAQT Report, the Risk Management Demonstration Standard, and the Guidelines for Performance Measures. As manager of the Pipeline Integrity Management and Systems Operations in the GRI Transmission Business Unit, Dr Leewis meets three times a year with senior managers from the major pipelines. In addition he is the liaison with the Interstate Natural Gas Association of America (INGAA) Pipeline Safety Committee, and a member of the Corrosion, Offshore and Design, and Welding Supervisory Committees for the Pipeline Research Council International (PRCI). Dr. Leewis has published over 40 articles, proceedings, and peer reviewed papers.

Joseph W. Maresca, Jr.
Dr. Joseph W. Maresca, Jr., is the Vice President of Vista Research, Inc., a technology development company specializing in the development and evaluation of detection and monitoring systems for environmental protection. For the past 15 years at Vista Research, Dr. Maresca has developed a wide range of leak detection systems for underground and aboveground storage tanks and their associated piping, and for mapping and locating underground utility pipe and conduit using acoustic and radar measurement systems. Previously, he was a Program Manager at SRI International (formerly Stanford Research Institute) for nine years doing contract research for DOD on a variety of radar, lidar, and acoustic remote measurement systems. Dr. Maresca has a Ph. D. and a M. S. degree in Physical Oceanography from the University of Michigan, a M. S. degree from Stanford University in Civil Engineering, and a B. S. from Lehigh University In Civil Engineering. He has published over one hundred technical papers and reports and is the inventor on over 15 patents.

Gary L. McKay
Mr. McKay has 30 years of experience with an electric utility (Detroit Edison). He is presently responsible for contract administration for underground lines construction and facility locating. A previous

position also included supervising an in-house group responsible for locating underground lines and all types of underground construction in the Detroit area. He is currently a member of the Southeastern Damage Prevention Association, the Michigan Damage Prevention Association and member of the Board of Directors and Secretary for the Michigan One Call System (Miss Dig).

Charles E. Moore
Mr. Moore has worked in the natural gas distribution and pipeline industry for 42 years. During this time he has worked for several Fortune 500 companies in the management area. He is presently the Manager of Line Location for the Operations Group of Reliant Energy. Mr. Moore is a past chairman of the Texas Gas Association and is a member of ASME and ASM. He is a registered Professional Engineer in seven states.

Bob Nighswonger
Mr. Nighswonger is employed by Utility Technical Services.

Jerry Palmer
Mr. Palmer is national sales manager of Radiodetection Corporation. He has been with Radiodetection for eight years. Previously, he was Vice President and owner of Airsco, Inc., and U.S. West Communications.

James Pfeiffer
Mr. Pfeiffer is General Manager of Subsite Electronics, a Division of The Charles Works, Inc., with responsibility for engineering, manufacturing, manufacturing engineering, markets, sales and technical support for the divisions. He is a member of The Charles Machine Works, Inc. Senior Management team. He is a member of the America Production Inventory Control Society (APICS) and is the EMI Committee Chairman of the Underground Electronics Council. He is certified in Production and Inventory Management and Integrated Resource Management by APICS.

LeRoy Schoon
Mr. Schoon owns and operates Schoon Construction, Inc., Cherokee, IA. His is a general contracting firm specializing in fiber optics and general excavation for municipalities and communication companies.

Gregory T. Strudwick
Mr. Strudwick is the President/CEO of Line One, Inc. of Lewisville, TX. Mr. Strudwick attended the University of Texas at Arlington. He has been a certified OSHA instructor since 1991 and he is actively involved in the Underground Utility Contracting Industry since 1970. He is a member of the National Utility Contractors Association since 1985, and is currently serving as a regional Vice President. Safety and continued improvement in field conditions for installation crews is the primary motivation for taking part in the One-Call Study.

Steven T. Theis
Mr. Theis is a Certified Safety Professional and Certified Hazardous Materials Manager. He has been employed by Henkels and McCoy, Inc., since 1984, and is presently the Corporate Director of Safety, Health, and the Environment. He actively participates in several standards' writing organizations and safety-related committees, including the American National Standards Institute, A10 Committee for Construction;

American Society of Testing and Materials, F-18 Committee, Electrical Protective Equipment for Workers, and E-34 Committee, Occupational Health and Safety; the National Electrical Safety Code, Subcommittee 8; the Network of Employers for Traffic Safety; and the National Safety Council Utilities Division. He is a member of the American Society of Safety Engineers, American Industrial Hygiene Association, the National Safety Management Society, and the American Red Cross.

Buddy Waugh
Mr. Waugh is the Manager of Access Construction Support for GTE Network Design. He has been with GTE for 20 years in a variety of positions He graduated from the University of Kentucky in 1974, B.B.A., Business Administration. Mr. Waugh served in the military active duty and the reserves for 27 years. He is currently a Lt. Colonel in the U.S. Army Reserve.

Lynn Whitford
Ms. Whitford is the Manager of the Utilities Branch of the Right-of-Way Division for the Oklahoma Department of Transportation. She has worked for the State of Oklahoma Department of Transportation for 21 years in construction and rights-of-way, and is responsible for coordinating the relocation of conflicting utilities in advance of roadway construction on individual projects statewide. Ms. Whitford also served on the Compliance Practices Task Team.

Henry Wyche
Mr. Wyche has been employed for 27 years by Norfolk Southern Railway Company and Southern Railway Company. He has served in various positions involving engineering, mechanical facilities, safety, and environmental matters. He is currently Norfolk Southern's Director of Engineering in the Engineering Department. He is a registered Professional Engineer in eight states. He is member of the American Society of Civil Engineers, the National Society of Professional Engineers, and the American Railway Engineering and Maintenance Association. He has served on various Transportation Research Board and Association of American Railroads committees.

EXCAVATION TASK TEAM

Fred Boley
Mr. Boley is a Construction Supervisor for Southern Natural Gas Company. He is responsible for Safety, Environmental, Inspection coordination and technical support for the Project Managers. Mr. Boley has over 20 years in the Oil and Gas Industry, in all phases of construction, including electrical, mechanical and pipeline.

Jack Connolly
Mr. Connolly began his career at Cox Cable in San Diego in 1968. Before being promoted to Systems Technical Manager, he supervised bench repair, head-end, and microwave maintenance. In 1980, he relocated to Cox Cable Corporate in Atlanta to assist with the fledgling franchises. While serving as Assistant Director of Engineering for the Development Division, he was a primary participant in the activation of the first 400 MHz (54-channel) system in the United States. After working in Atlanta, Mr. Connolly served as Regional Manager for the Southeast where he assumed the duties of Project Manager.

After rebuilding and upgrading 1,200 miles of plant, he became the Plant Operations Manager. Mr. Connolly also served as the Project Manager for the upgrade of over 3,200 miles of plant in San Diego; he staffed the Upgrade Project and selected the field contractors. The project was successfully completed in 1998. Presently, Jack Connolly is the Cox Cable Project Manager for the Upgrade in Hampton Roads, Virginia, which has over 6,200 miles of plant. He has been President and Chairman of the Board for the Society of Cable Television Engineers in San Diego; he also served as Treasurer and President for the Chatahoochee Chapter in Atlanta, Georgia.

Roy Dahl

Mr. Dahl has held the position of Network Development Engineer for the past 15 years. He is responsible for all the fiber optics agreements and the placement of the fiber cable on Burlington Northern and Santa Fe Railway Company's (BNSF) 33,000 miles of right of way. In addition to the position of Network Development Engineer, throughout his 31 year career with BNSF Railway Company, Roy has held the positions of Telecommunications Supervisor, Radio Engineer and Microwave Engineer.

Walter Gainer

Mr. Gainer joined W.F. Wilson & Sons, Inc., a Maryland Underground Utility Contractor, in 1969, after graduating from Rio Grande University. He has been the President of the company since 1988. He has served as the past President of the Maryland Utility Contractors Association and the past President of the National Utility Contractors Association. He helped write and get the Maryland State Legislature to pass the State's One-Call Bill. Mr. Gainer served as the Co-Chair of the Excavation Task Team.

Corky Hanson

Mr. Hanson works for the Arizona Corporation Commission (ACC). He has been responsible for the inspection of regulated pipeline facilities within the state of Arizona for the past seven years. He is the Program Manager for the enforcement of the Arizona Underground Facility Law and schedules Comprehensive Audits and Construction Inspections of master meter operators for all of the ACC's Consultants.

Prior to working at the ACC, he was a field supervisor, responsible for operation and maintenance for a natural gas distribution company in Arizona for 13 years. Before that, he had been a heavy equipment operator for an excavation company in Arizona for 5 years, a trade he learned while serving in the United States Army.

Jim Harrison

Mr. Harrison is the Safety Director of Pauley Construction. He has been in safety for 15 years and employed by Pauley Construction for the past 5 years. Mr. Harrison is the chairperson for the Utility Liaison Committee and active in the Utility and Transportation Contractors Association (UTCA) of Arizona and a member of the National Utility Contractors Association (NUCA). He is currently the Treasurer of UTCA. He is active in the safety community and serves on various safety committees. Mr. Harrison handles all insurance for his company and reviews and approves all payments for utility damages.

George S. Kennedy
Mr. Kennedy is Director of Safety for the National Utility Contractors Association. Mr. Kennedy is a Board Certified Safety Professional and holds a civil engineering degree from Rensselaer Polytechnic Institute (RPI). During his tenor with NUCA, he has developed the competent person training program, confined space entry program, trench rescue program, safety manual, and other safety products available through NUCA. Over the years, he has instructed hundreds of safety seminars and training programs. During his 20 year career, he has assisted many companies in the development and implementation of their safety programs.

An outspoken participant on OSHA issues on behalf of NUCA in Washington, DC, he closely monitors the development of OSHA standards and activities. He also writes the safety management column for NUCA's trade magazine, the *Utility Contractor*, and the *NUCA Safety News.*

Terry Pollak
Ms. Pollak has 24 years of service with Ameritech. She has held various positions including Repair Service Manager, Facility Assignment Manager, Installation Control Manager, and Installation/Repair Field Manager. She supports the cable locate job function within Ameritech. Her responsibilities include cable locate process improvements to minimize damage to Ameritech facilities.

Melanie Powers
Ms. Powers, Operations Office supervisor, is a regional support supervisor for the twenty area offices in the Southern region of Columbia Gas of Ohio (COH). She is responsible for overseeing the administrative functions associated with the operational activities of construction and maintenance contracts, outsourced line locating, one-call system activities, reimbursable projects, processing of damage claims, processing of capital job orders, posting recent construction to operations maps, and compliance with state and federal rules and regulations. Ms.Powers serves as trustee on the Board of the Ohio Utilities Protection Service (OUPS) and is the president of the Central Ohio Damage Prevention Council. In her 25 year career with COH, she has held the positions of Applications Support Specialists, Technical Training Specialist, Engineering Technician, and Operations Coordinator.

Gary Schulman
Mr. Schulman is an Area Manager for BellSouth Utilities, a division of BellSouth Telecommunication. His current responsibilities are Buried Service Wire and Main Line Cable Placing Operations in South Carolina. Mr. Schulman was responsible for the establishment of this in-house contract cable group, which is currently the only operation of its kind in BellSouth. During his twenty-year career at BellSouth, he has held numerous line and staff positions including assignments in engineering, budgeting, construction, cable repair, and digital loop carrier maintenance/installation. In his three-year construction assignment, Mr. Schulman was responsible for contract administration for master and individual contractors, as well as insuring expectations were being met. He has participated on previous cable damage and avoidance task teams and is a past officer for the Greenville County Utilities Coordination Committee.

Charlie Scott
Mr. Scott is Director of Sales and Marketing for Subsite Electronics, a Division of The Charles Machine Works, Inc. located in Perry, Oklahoma. Subsite designs and manufactures electronics for the underground construction industry to include line locating equipment and directional drill tracking equipment. It also develops and markets software designed to plan, document and survey directional drilling projects.

Tom Shimon
Mr. Shimon has worked for the past year and a half as Executive Director of Kansas One Call, handling all of the public relations and operations of the corporation. Before joining Kansas One Call, Mr. Shimon spent fifteen years with MCI Telecommunications constructing and maintaining MCI's microwave and fiber optic transmissions systems throughout the United States. Mr. Shimon's entire background has been involved in construction since leaving the family farm in Iowa. Mr. Shimon's primary job now is protecting the underground utility infrastructure that serves the business's and public in the State of Kansas.

Mr. Shimon serves on the One-Call Systems International committee, an arm of the American Public Works Association. He is a member of the Mid-America One Call User's Group promoting excavation safety in the Midwest.

David C. Spangenberg
Mr. Spangenberg has been the Engineer of the Utilities Coordination & Permits Section for the Michigan Department of Transportation for 12 years. He supervises the statewide utility coordination procedures for relocating the utilities for Department projects. He also develops guidelines and permitting procedures for utility companies' use of the Department's right of way. Mr. Spangenberg is responsible for developing specifications for new technology proposed by the utilities, such as the recent development of the directional bore specifications for the Department. In addition, he is involved with state legislative issues relative to utility and department issues. Prior to his current position, he spent 25 years in the Department's Design Division, supervising road and bridge design projects. He managed several major projects such as the total reconstruction of the Lodge Freeway in the City of Detroit.

Loren Sweatt
Ms. Sweatt is the Director, Congressional Relations, Procurement and Environment, for Associated General Contractors of America. Ms. Sweatt's responsibilities include following one-call legislation at the national level. She has been active in this area, following the One-Call Systems Study from the legislative forum through to the best practice stage.

Jeff Vaughter
Mr. Vaughter is the Treasurer/Controller for Craft Construction Co., Inc. of Starr in South Carolina. In his current position, he is responsible for all training regarding safety and competent person. For the past 12 years, Mr. Vaughter has been a Controller in the utility contractors or home builders construction business. He has worked in the utility business from the ground up. He has installed utility lines for telecommunications, water and sewer. Currently Mr. Vaughter is the Vice-Chairman of the Utility Division of Carolinas AGC Chapter. Mr. Vaughter has also testified on behalf of Carolinas' contractors before various Committees and Sub-Committees of the House of Representatives of the State of South Carolina

regarding damage prevention of existing utilities. He has been actively involved with damage prevention in his home state for approximately the last four years.

MAPPING TASK TEAM

Carolyn Carter
Ms. Carter is the Manager of The North Carolina One-Call Center, Inc. She has managed the Center since its inception in 1978 and has been instrumental in guiding the Center to its position as one of the largest One-Call Centers in the nation by ticket volume. Ms. Carter has been active in the American Public Works Association, One-Call Systems International (OCSI) for over 17 years, serving on the OCSI Executive Committee for eleven years and chairing a number of committees during that time. Ms. Carter is currently serving on the OCSI Delegates Committee, and is a member of Southeastern One-Call Center Systems.

Don Carter
Mr. Carter has been employed with Atlanta Gas Light Company continuously since June 1984, in various engineering capacities including Engineer, Division Operations Engineer, and Manager - Planning and Design. His current position is Chief Engineer, which he has held since January 1995. He is a member of the American Public Works Association (APWA) and the National Society of Professional Engineers (NSPE) as well as a Registered Professional Engineer in the State of Georgia. In addition to his duties at Atlanta Gas Light Company, Mr. Carter has served on the Board of Directors for the Utilities Protection Center of Georgia, Inc. since 1992 and is currently President and Chairman of the Board.

Gary Craig
Mr. Craig, Director of Southwest Operations for One-Call Systems, Inc., serves as Liaison Manager for South Dakota One Call and Texas One-Call Systems. He is responsible for sales and support for Texas One-Call Systems and South Dakota One Call, as well as sales of one-call systems, software and one-call related mapping systems for One-Call Systems, Inc. nationwide. Mr. Craig has been active in one-call since 1982 as a utility representative to the one-call operation, and as liaison and customer support for one-call members and has served as call center manager. He worked in management positions for Southwestern Bell Telephone Co. for over 25 years prior to entering the one-call field exclusively. He also serves the public as the President of a Municipal Water and Wastewater Utility, holding this elected position for over 15 years.

Terry Leppla
Mr. Leppla is a Senior Right-of-Way Agent for ARCO Pipe Line Company in Houston, Texas. He has over 19 years in the right-of-way profession and 14 years with ARCO Pipe Line Company. Mr. Leppla has been involved with Texas Excavation Safety System since its inception and recently held the position of Chairman of the Board.

Michael McGrath
Mr. McGrath is the Damage Prevention Coordinator with the Minnesota Office of Pipeline Safety (MnOPS). He has been with the MnOPS for over ten years. Mr. McGrath is responsible for heading up

the states' Damage Prevention Program, which includes education and enforcement of the one-call law, as well as coordinating rules or legislation concerning One-Call and damage prevention. In addition to his damage prevention responsibilities, he is also responsible for conducting inspections of gas and liquid pipeline operators and investigating pipeline accidents. Prior to MnOPS, Mr. McGrath spent four years with a large natural gas distribution company inspecting construction projects.

Bill Pauley

Mr. Pauley is the Western Region Vice President of the Fishel Company, a utility contractor providing turnkey solutions for the design, construction, and maintenance of energy and information systems. Mr. Pauley has 23 years of service with the Fishel Co. He is a member and past president of the Utility and Transportation Contractors Association of Arizona, a NUCA chapter. Mr. Pauley has served on the Arizona Bluestake Committee, the Bluestake Coalition and served as chair of the Utility Liaison Committee. Mr. Pauley served as the Co-Chair of the Mapping Task Team.

Christina Sames

Ms. Sames is a Senior Petroleum Engineer for the U. S. Department of Transportation, Office of Pipeline Safety (OPS). She is leading the joint government/industry initiative to create a National Pipeline Mapping System and the multi-government and industry initiative to define, identify, and locate unusually sensitive areas. Ms. Sames has been active in damage prevention and has published pipeline safety regulations on excavation damage prevention and mandatory one-call participation. Ms. Sames served as the Co-Chair of the Mapping Task Team.

Perly Schoville

Mr. Schoville is an Associate Systems Engineer for Union Pacific Railroad. He is responsible for developing and managing the Precision Measurement Vehicle (PMV) and various Fiber records. Mr. Schoville is responsible for approving as-built drawings, providing easements, and collecting mapping data for use in train operations, Geographical Information Systems and Union Pacific's internal one-call system. Mr. Schoville is a member of AREMA (American Railroad Engineering and Maintenance Association) and began his railroad career in the map department in 1974.

Craig Sewell

Mr. Sewell has been the Director of Locating Services for One Call Concepts Locating Services, Inc. for the past nine years. In that time, he has overseen contract locating operations in the mid-Atlantic states and in Canada. Mr. Sewell was also instrumental in the founding of the National Utility Locating Contractors Association (NULCA) and served as its president for the first two years. He has published several articles concerning locating and training, and is a well know speaker on the subjects. Of late, he has been spending much of his time devising methods to accurately map the underground utility infrastructure using GIS, the GPS and orthographic photography.

James Glyn Smith

Mr. Smith is the Executive Director for Palmetto Utility Protection Service, Inc. (South Carolina's One-Call System). He was appointed to this position in April 1996. Prior to accepting this position, Mr. Smith retired as an officer of the United States Army with twenty-four years service. His military background was in financial and human resource management, along with other career enhancing assignments.

Terry Zachman
Mr. Zachman is the Damage Prevention Coordinator for Sprint Long Distance in all the states East of the Mississippi River. His responsibilities are to represent Sprint at 28 One Calls, One Call Systems International, and the National Telecommunications Damage Prevention Council. He currently sits on three one-call boards. They are Florida, Georgia and Tennessee. Terry assisted in establishing a Damage Prevention practice for Sprint in April of 1993. He started with Sprint in 1984 as a contract Engineer.

John Ziakas
Mr. Ziakas is the AM/FM (Automated Mapping/Facilities Management) Coordinator for Questar Regulated Services. He is responsible for the supervision and coordination of the AM/FM system including application development, computer system support and hardware/software evaluation and purchase. Mr. Ziakas has been active in the automated mapping industry since 1983. He began his career with Questar Regulated Services (formerly Mountain Fuel Supply Company) in 1977 and has held the positions of Drafter, Engineer Technician and Training Specialist.

COMPLIANCE TASK TEAM

Karen A. Bane
Ms. Bane has worked for Plantation Pipe Line Company for 13 years. Plantation is based in Atlanta, Georgia, and is a liquid petroleum pipe line that transports refined petroleum products across eight states in the Southeast. Ms. Bane has held several positions during her employment with Plantation, most recently as Area Manager based in Northern Virginia. Ms. Bane's perspective, recommendations and suggestions for improvement stem from a utility owner/operator's point of view of the one-call process that begins with the first contact and continues through the project completion. Ms. Bane is affiliated with American Petroleum Institute and the Association of Oil Pipe Lines, which represent major petroleum pipeline companies.

Terri J. Binns
Ms. Binns has worked for the U.S. Department of Transportation, Office of Pipeline Safety (OPS) for 15 years. Currently based in Houston, Texas, Ms. Binns serves as the State Liaison Representative for the Southwest Region, which includes the states of Arizona, Louisiana, New Mexico, Oklahoma and Texas. Previously, Ms. Binns was an inspector/engineer in the Western Region based in Denver, Colorado, and in the Eastern Region and Headquarters in Washington, DC. In that capacity, she was responsible for inspecting the integrity and the safe operation of pipeline systems.

William P. (Bill) Boswell
Mr. Boswell is Vice President and General Counsel of The Peoples Natural Gas in Pittsburgh, Pennsylvania, and General Counsel of Hope Gas, Inc., in Clarksburg, West Virginia. He is also Deputy General Counsel (State Regulation) of their holding company, Consolidated Natural Gas Company (CNG), in Pittsburgh. Mr. Boswell also has been Legal Advisor to One-Call Systems International since 1980, and served as Legal Advisor to the Pennsylvania One-Call System for 14 years beginning in 1978. In 1992, he was elected Legal Advisor Emeritus to the Pennsylvania One-Call System.

Louis (Lou) Cerny

Mr. Cerny, who is representing the Association of American Railroads, is a Professional Engineer in private consulting practice. He was employed in the railroad industry from 1965 to 1997, during which time his focus was railroad rights-of-way and their construction and maintenance. This involved handling matters concerning the utilities on these rights-of-way, including involvement in the study group and research that resulted in the recommended practice of the American Railway Engineering Association (now AREMA) for crossings of pipelines under railroad tracks without casings. From 1979 to 1994, Mr. Cerny served as the Executive Director of the American Railway Engineering Association.

Paul J. Cloran

Mr. Cloran is a Senior Specialist in the Technology/Standards organization for Bell Atlantic. Based in Boston, Massachusetts, Mr. Cloran has been with Bell Atlantic for 36 years. Mr. Cloran has worked in all areas of outside plant (construction, maintenance, engineering and staff assignments). For the past one and one-half years, Mr. Cloran has been responsible for the standardization and approval of underground products and underground-related new technology throughout Bell Atlantic. He previously held the positions of Vice Chairman and Chairman for the National Telecommunication Damage Prevention Council, and he currently represents Bell Atlantic on the Facilities Solution Committee, which works to achieve damage reduction. Mr. Cloran serves as Secretary of the Executive Board for the New England One-Call Center (Dig Safe), and is the Bell Atlantic liaison for all one-call centers within the Bell Atlantic Region.

Alex Dankanich

Mr. Dankanich is Assistant Chief Engineer for the Maryland Public Service Commission (PSC), where he has worked for the past 12 years. He is one of the Maryland PSC representatives on the Maryland and District of Columbia Damage Prevention committee, which meets monthly and is comprised of underground facility owners/operators, excavators, the one-call center representatives and anyone else interested in damage prevention. Prior to joining the Maryland PSC, Mr. Dankanich worked for the Maryland Transportation Authority and for Bechtel Power Corporation.

Robert E. (Bob) Foster

Mr. Foster has served, since July 1996, as Executive Director of Underground Facilities Protective Organization (UFPO), the New York one-call center. Foster also brought to the Compliance Practices Task Team 27 years of experience with AT&T, during 15 of which he served as a Cable Maintenance Supervisor. In performing this job, Mr. Foster served on the one-call center Board of Directors from 1979 to 1989, and as president of the UFPO from 1984 to 1987. In 1995, Mr. Foster participated on the legislative committee during the last rewrite of the New York law. On the Best Practices Study, Mr. Foster represents One-Call Systems International, an organization for which he served as Chairman from 1988-1990.

Kathleen A. Fournier

Ms. Fournier brought 25-years experience with Michigan's MISS DIG one-call center to the Compliance Practices Task Team. Ms. Fournier has been a member of One-Call Systems International since 1991, and served as OCSI's Chairperson for two years. Ms. Fournier recently received a second three year term appointment to the U.S. Department of Transportation Technical Pipeline Safety Standards Committee on which she represents all one-call centers. Ms. Fournier was instrumental in developing the

"musts of every one-call," which was based on established call center operations and which served as the starting point for the One-Call Center Task Team on this Best Practices Study.

Janice Gambill
Ms. Gambill brought over 30 years of experience in the telecommunications industry to the Compliance Task Team. She began her career in operator services, then spent 12 years in outside plant, which included eight years in construction. From outside plant, Ms. Gambill moved into management, overseeing installation and translation control centers as well as facilities. During this time, she attended law school at night, and was admitted to the Indiana Bar in 1995, and the Illinois Bar in 1996. Ms. Gambill served as Regional Operations manager in Risk Management in 1997 and 1998, and most recently as Regional Operations Manager, Network Reliability. She is a member of the Public Utilities Law Sections of the Indiana and Illinois State Bar Associations.

Amy Griffith
Ms. Griffith is Government Relations Counsel for the National Utility Contractors Association (NUCA). Prior to joining NUCA, Ms. Griffith was appointed to a two-year clerkship on the United States District Court for the District of Columbia, and she served as a congressional aide to former Congressman George (Buddy) Darden (7th/Ga). She is admitted to the New York State Bar. Ms. Griffith served as the Co-Chair of the Compliance Task Team.

Brian Holmes
Mr. Holmes is the Executive Secretary of the Connecticut Road Builders Association and Director of Regulatory Affairs for the Connecticut Construction Industries Association (CCIA). CCIA is made up of seven divisions, including the Utility Contractors Association of Connecticut (a NUCA chapter) and the Associated General Contractors of Connecticut. Mr. Holmes is an inactive member of the California Bar.

Lew Hurlbutt
Mr. Hurlbutt brought 29 years experience with the Southern California Gas Company, Sempra Energy to the Compliance Practices Task Team. Currently a Technical Consultant, his assignments involve standards and methods development and outside agency liaison. Previously, Mr. Hurlbutt served as a laborer, equipment operator, welder, crew foreman, underground construction and welding inspector, planning and design supervisor, and an installation and pipeline welding instructor. Mr. Hurlbutt is the current Chairman of Underground Service Alert of Southern California and a Board Member of the Underground Service Alert of Northern California (one-call centers). He has served on the Board of each for seven years. Other memberships include One-Call Systems International, the American Public Works Association and the Los Angeles Substructure Committee.

William G. (Bill) Kiger
Mr. Kiger is the Chief Operating Officer of Pennsylvania One-Call, where he has been involved as a Board member and General Manager since 1974. A Field Engineer, Conduit Construction Inspector and Mapping and Records Supervisor for Bell of Pennsylvania from 1971-1978, Mr. Kiger founded One-Call Systems International (OCSI) in 1975. He served as OCSI's Chair from 1975-1976, and then again in 1981, and he served as the Legislative Committee Chair from 1978-1996. He has attended all 24 of the One-Call

Symposiums. Mr. Kiger has been a member of the American Public Works Association (APWA) since 1975, and served two terms (1980-1984, 1992-1996) on the APWA Utility Location & Coordination Council (ULCC). During his first term, Mr. Kiger served on the ULCC's Temporary Marking Color Code Committee, whose work was approved as an ANSI Standard. Mr. Kiger also served as APWA/ULCC Vice President in 1995, and President in 1996.

Richard G. (Rick) Marini

Mr. Marini is a registered Professional Engineer who brought to the Compliance Practices Task Team 20 years of service with the New Hampshire Public Utilities Commission. Mr. Marini, as the Administrator, Safety Division, New Hampshire Public Utilities Commission, administers and enforces the New Hampshire damage prevention and the state/federal gas safety programs. He previously served as a Pipeline Safety Specialist on that National Transportation Safety Board for three years, and as the Chief Engineer of a gas distribution company for six years. Mr. Marini is co-chair of the State/Industry Regulatory Review Committee, which was established by the U.S. Department of Transportation, Office of Pipeline Safety, and a past chair of the National Association of Regulatory Utility Commissioners subcommittee on pipeline safety, and past chair of the National Association of Pipeline Safety Representatives. Mr. Marini served as the Co-Chair of the Compliance Task Team.

Truman Murray

Mr. Murray brought over 30 years experience with municipal multi-utilities to the Compliance Practices Task Team. Most of that time has been spent managing water distribution and wastewater collection systems. Mr. Murray also served as manager of the engineering section for municipal electric, gas, water and wastewater. Each of the systems now serves between 22,000 to 28,000 customers in both a rural and urban settings, including a very strong industrial base. Mr. Murray is a registered Professional Engineer (P.E.) in Tennessee. He was worked with the Tennessee one-call system since its beginning in 1983.

Harry Short

Mr. Short has been affiliated with the municipal water/sewer industry for over 20 years, serving as both a Class IV Wastewater Operator and Class IV Water Operator. Currently, Mr. Short is the Utilities Director for Van Buren, Arkansas. He also is an Adjunct Professor of the Arkansas Environmental Academy. Mr. Short has served on the Board of the Arkansas Rural Water Association, since 1989, and served as Chairman from 1992-1993. Mr. Short also has been serving on the Arkansas One-Call Board of Directors since 1996. On the Compliance Practices Task Team, Mr. Short represents National Rural Water Association, which is comprised of over 18,000 water systems nationwide.

Robert F. (Bob) Smallcomb

Mr. Smallcomb has been employed in the technical, business and regulatory spheres of the natural gas industry for over 30 years. Mr. Smallcomb was a chemist in laboratories operated by Boston Gas Company and El Paso Algeria Corporation. He also served as a studies analyst in the Production Control Department of El Paso Natural Gas Company. For the past 13 years, Mr. Smallcomb has been with the Massachusetts Department of Telecommunications and Energy and, as Director of the Pipeline Engineering and Safety Division, he is responsible for enforcement of the Dig Safe program and the pipeline safety program in Massachusetts. His participation in the Compliance Practices Team stems from Massachusetts

being one of the first states to aggressively pursue one-call violators, which has resulted in a noticeable decline in utility damage.

John Sterrett
Mr. Sterrett, Engineering Consultant in the Tennessee Gas Pipeline Company Compliance Services Division, brought 32 years of engineering experience in the energy industry to the Compliance Practices Task Team. He has worked in research and development, design, and construction of natural gas pipelines and provided start up, environmental and safety support to pipelines operations. Mr. Sterrett has been providing support within the El Paso Energy companies for compliance with the natural gas pipeline safety federal regulations (49 CFR Part 192) since 1991. Mr. Sterrett is a registered Professional Engineer in the State of Texas.

George Trujillo
Mr. Trujillo is the Owner of Trujillo Construction, Inc. He brought 20 years of experience as a trenchless technology, gas distribution, and sewer/water main construction contractor to the Compliance Practices Task Team. Mr. Trujillo actively participated in the legislation and implementation of the State of Florida's One-Call System, and he continues to work with the One-Call Center on promotions, public awareness and contractor awareness. Mr. Trujillo is on the Board of the National Utility Contractors Association (NUCA) and represents the nearly 2000 member utility contractors. He is a member of the NUCA Damage Prevention Task Force and Vice Chair of the NUCA Political Action Committee, and he is the immediate Past President of the Underground Utility Contractors of Florida.

Lynn Whitford
Ms. Whitford is the Manager of the Utilities Branch of the Right-of-Way Division for the Oklahoma Department of Transportation. She has worked for the State of Oklahoma Department of Transportation for 21 years in construction and rights-of-way, and is responsible for coordinating the relocation of conflicting utilities in advance of roadway construction on individual projects statewide. Ms. Whitford also served on the Locating and Marking Practices Task Team.

PUBLIC EDUCATION TASK TEAM

Bill Bertges
Mr. Bertges works with the U.S. Department of Transportation (DOT), Research and Special Programs Administration (RSPA), Office of Pipeline Safety (OPS) in its Southwest Region, Louisiana District Office, in Denham Springs, LA. His experience includes 6 years in private industry (chemical plant and gas drilling) and 24 years with the DOT. Mr. Bertges has investigated numerous major, third-party damage, pipeline accidents over the years, including participation in several interagency (USCG/MMS/NTSB) joint accident investigations. During the past several years, Mr. Bertges has worked closely with the oil and gas industry and other government agencies toward a collaborative approach to reducing outside force damage to offshore pipelines.

Bob Cave

Mr. Cave is the Executive Director of the American Public Gas Association in Fairfax, VA. . He has held this position since November, 1986. Under Mr. Cave's direction, membership in APGA has more than doubled and he has started many new APGA programs. Before coming to APGA, Mr. Cave accumulated 24 years of experience working in the gas industry. His experience includes all phases of engineering, construction, administration, rates, gas supply, marketing, and general management. From 1979 to 1986, he was Senior Vice President of Berkshire Gas Company in Pittsfield, Massachusetts. Prior to that, he was assistant to the President of Connecticut Natural Gas Company for 16 years.

Mary-Jo Cooney

Ms. Cooney is a Senior Policy Analyst with the U.S. Department of Transportation (DOT), Headquarters, Research and Special Programs Administration (RSPA), Office of Pipeline Safety (OPS) in Washington, DC. Ms. Cooney has worked for the DOT for 13 years. Her current responsibilities with OPS include damage prevention, public education, one-call legislation, and management of the two technical advisory committees for hazardous liquid and natural gas. Prior to her current position, she was an attorney on the Oil Pollution Act Staff of the U.S. Coast Guard.

Prior to her work with the DOT, Ms. Cooney was a trial attorney for the Federal Railroad Administration, working mainly in enforcement and settlement of civil penalty violations and safety-related rulemakings. Ms. Cooney organized the first Negotiated Rulemaking undertaken by OPS and drafted the charter establishing the ground rules by which this group will operate. She helped organize and co-chairs the joint government/industry Damage Prevention Quality Action Team. She is a member of the National Reliability Steering Committee Facilities Solution Team and its legislative subcommittee. Ms. Cooney served as the Co-Chair of the Public Education and Awareness Task Team.

Morris Dock

Mr. Dock is the President and Owner of Mo Do Co., Inc., in Springfield, MO. He formed Mo Do Co. in 1977. Located in Springfield, Missouri, Mr. Dock's company consults with owners in the pre-construction phase of projects and provides recommendations regarding project feasibility, preliminary cost estimates, and design options. Prior to forming Mo Do Co., Inc., Mr. Dock was National Sales Manager with Positronics, Inc. in Springfield, MO. In that position he coordinated sales, manufacturing and distribution of electronic connectors and worked with the engineering departments of Xerox, IBM, Texas Instruments, and Gates Industries in the design of EQP interfacing.

Ronald G. (Ron) Embry

Mr. Embry is the Public Affairs Advisor for Exxon Pipeline Company in Houston, TX. He has 34 years experience with Exxon in a variety of assignments including design engineering, operations management, technical/design management, marketing, long range planning, and public affairs. Now assigned to Exxon Pipeline Company in Houston, he has worked for Exxon in its Baytown, Texas refining complex, in its U.S. Headquarters in Houston, and in the former corporate headquarters in New York. He is active in the American Petroleum Institute and serves in the Pipeline Division on the Public Education and Emergency Preparedness Committee. He also serves on the State Affairs Committee in the Association of Oil Pipelines.

Mark Frost

Mr. Frost is the Public Relations Manager for JULIE, Inc., the Illinois One-Call System. Mr. Frost has been a staff member with the Illinois State Senate and has also served as Marketing Coordinator and Assistant to the Village Manager for the Village of Romeoville, Illinois. Since joining JULIE in October 1991, Mr. Frost has contributed to the growth of JULIE, in terms of implementing new education programs, increasing utility membership, and increasing call volume. He is also very involved in One-Call Systems International (OCSI), the organization that serves his industry. Mr. Frost has served on the numerous OCSI symposium program planning committees; he was the program chairperson for the 1995 Pittsburgh and the 1996 Anchorage Symposiums. He has also served as the chairperson of the Marketing Committee for OCSI and has represented the five-state, OCSI midwest region on its Board of Directors.

Pat Kirchberg

Ms. Kirchberg has 32 years of telecommunication experience. This includes work assignments in cable maintenance, installation and repair, construction, customer service, training, air pressure, cable damage prevention and cable locate operations. She is currently a Staff Manager supporting proactive plant maintenance, cable locate processes, air pressure and damage prevention activities in the fourteen-state U S WEST territory. This includes identification of new initiatives, development of methods and procedures, technical development, and field deployment, training and support.

Craig M. Linn

Mr. Linn is the Director of Operations Support for Williams Gas Pipeline - Transco. He has been employed with WGP-Transco for 19 years, where he has held various management positions in Houston and field operations. He has been actively involved in INGAA's Pipeline Safety Committee. His experience with WGP-Transco includes engineering design, pipeline and plant construction, field operations and operations support with responsibility for pipeline integrity including damage prevention, regulatory compliance and developing company policies and procedures.

Stu Megaw

Mr. Megaw has been Director of the Municipal-Utilities Contractors Division of the Associated General Contractors of America (AGC), in Washington, D.C., for four years. AGC represents over 33,000 members consisting of over 8000 of the nation's largest general contractors and over 25,000 associate members. Prior to joining AGC, Mr. Megaw was Director of Government Affairs for Hiram Walker & Sons and Waste Management, Inc. His work on Capitol Hill included serving on the professional staff of the House Public Works and Transportation Committee as well as Legislative Director for an Illinois Congressman. He is also a former professional broadcaster.

N. Allen Robertson

Mr. Robertson is President and Chief Executive Officer of Byers Locate Services, LLC, a provider of underground utility locating services. The company has offices in 15 states with total staff of 1600. The firm was formed in 1998 through a spin off of an operating unit of Byers Engineering Company. He was a founding employee of Byers Engineering Company having begun work with the firm in January 1971 and held various management positions with the firm, most recently President – Engineering Division with responsibility for all engineering and technical services.

Larry Shamp
Mr. Shamp works for Equilon Pipeline Company as a representative in the Legislative & Regulatory Services group. His responsibilities include coordinating emerging issues on damage prevention, Equilon's public education programs, Equilon's one-call activities, emergency response liaison activities, and U.S. Coast Guard activities.

Mr. Shamp currently serves as Co-Chair of the Damage Prevention Quality Action Team and as Chairperson of the American Petroleum Institute's (API's) Committee on Damage Prevention. He also served as a Co-Chair of the Public Education and Awareness Task group of the One-Call Best Practice Study. Mr. Shamp is a member of One Call Systems International (OCSI) and is a member of OCSI's Legislative/Regulatory Committee. He represented OCSI and the liquid pipeline industry in the successful effort to pass federal one-call legislation.

Mr. Shamp has served as president and as a member of the board of directors for the Texas Excavation Safety System, as President and a member of the board of directors for the Indiana Underground Plant Protection Service, and as a member of the board of directors for the Ohio Utilities Protection Service.

Mr. Shamp is a graduate of California State University at Fresno and the University of California's Hastings College of Law.

Dan Simpson
Mr. Simpson is a Cable Awareness Coordinator with WorldCom Network Services, in Tulsa, Oklahoma. He has been in this position since 1994, and is involved in all aspects of damage prevention awareness for WorldCom. This includes developing damage prevention programs, conducting damage prevention seminars, working with state and federal legislatures on damage prevention issues, and developing and implementing damage prevention training programs. From 1985 through 1993, Mr. Simpson was with Conoco, Inc. in Houston, Texas. He was a production foreman with Conoco and was seconded to the Dubai Petroleum Company. In this position, he supervised the various aspects of international offshore oil and gas production platforms. In previous jobs, he has served in a variety of related industry positions.

Pamela Wagner
Ms. Wagner is a government relations representative for the National Utility Contractors Association (NUCA). NUCA is a non-profit trade association representing contractors of water, sewer, gas, and other underground utility systems. In her capacity as lobbyist for the association, Ms. Wagner has advocated the interests of the underground utility construction industry before Congress and the federal agencies. Her work at NUCA also includes public education and grassroots advocacy of federal legislative and regulatory issues. Before joining NUCA in 1991, Ms. Wagner worked on Capitol Hill for four years as Legislative Assistant and Legislative Director to U.S. Representative D. French Slaughter, Jr. (R-VA).

REPORTING AND EVALUATION TASK TEAM

Dave Barnes
Mr. Barnes is the Compliance Coordinator in the Environment, Health and Safety Department of the BP Amoco Pipeline Business Unit. He is a registered Professional Engineer with the State of Illinois. Dave's background includes five years of pipeline project engineering, two years as a field technical maintenance foreman, and five years in his current position as Compliance Coordinator. He is active in a number of industry initiatives to enhance pipeline safety.

Raul Bernal
Mr. Bernal is the Damage Prevention Regional Manager for the Risk Management Service Department of Pacific Bell. Raul has been employed by Pacific Bell for 23 years, and for the past ten years, Raul has been with the Risk Management Department which focuses on underground facility damages. Currently, Raul is responsible for the development, implementation, direction, and assessment of the Underground Facility Damage Prevention Program and all associated activities for Pacific Bell. He is currently a member of the National Telecommunications Damage Prevention Council, the Facilities Solutions Team (Sub-Team of Network Reliability Council), the Board of Directors of the Underground Service Alert of Northern California, the Board of Directors of the Underground Service Alert of Southern California, the American Public Works Association, and One Call Systems International.

James Book
Mr. Book is the Chief Utility Liaison Officer with the Right of Way Division for the Mississippi Department of Transportation. His background includes 29 years with the Department, including the past six years as Chief Utility Liaison Officer. Mr. Book also attained the rank of E7 Platoon Sergeant during 22 years of service with the Mississippi Army National Guard.

Amy Brox
Ms. Brox is a Gas Safety Engineer for the Missouri Public Service Commission. She is responsible for conducting comprehensive gas safety inspections of Missouri natural gas operators, including natural gas incident investigations. She is currently working in conjunction with the Missouri One Call System, Inc. and the Missouri construction industry, including the Associated General Contractors of St. Louis, to improve the Missouri Chapter 319, damage prevention state statute. Ms. Brox coordinated the establishment of guidelines developed by the Missouri Association of Natural Gas Operators for trenchless excavations of polyethylene pipe near sewer lines. Ms. Brox served as the Co-Chair of the Reporting and Evaluation Task Team.

Ted Eynon
Mr. Eynon is the General Manager of the Services Business Unit for Heath Consultants, Inc. Mr. Eynon has been with Heath for 15 years, and he currently oversees all of the service related operations, as well as marketing. Services provided by Heath include gas leak detection, water accountability, and utility damage prevention. Mr. Eynon has extensive field experience, training, and management in each of these respective areas. He has also been involved in bringing a number of new technologies to the utility industry in the disciplines of gas leak detection and underground locating. Mr. Eynon is a member of the American

Gas Association, serving on the Customer Service and Utilization Committee of the operating section. He is also a member of the National Utility Locating Contractors Association, the American Water Works Association, DCA, and many regional gas associations.

Ronny Jones
Mr. Jones is the President of Ronny D. Jones Enterprises, Inc. He is the third generation of the family-owned construction business that was founded in 1943 and is primarily focused in the grading and underground utility business. Mr. Jones is a member of the Georgia Utility Contractors Association, Inc. and was the past President of the organization. Mr. Jones is currently the Director of the National Utility Contractors Association.

William B. Turner
Mr. Turner is the Executive Director of the Tennessee One Call System, Inc. located in Nashville, Tennessee. He is responsible for managing and overseeing the organization promoting and educating customers, lobbying legislation, and advancing the efforts of the Tennessee One Call System. Mr. Turner has several years of experience in the one-call industry and currently serves on One Call Systems International of the American Public Works Association. Mr. Turner was instrumental in establishing the performance guidelines and damage reporting efforts in Tennessee. Mr. Turner served as the Co-Chair of the Reporting and Evaluation Task Team.

John Zizolfo
Mr. Zizolfo has 33 years of service with the public utility, Consolidated Edison Company of New York, Inc. With experience in customer service, construction, and project management, he is currently the Damage Prevention Coordinator in Construction Management Operations. He monitors all electric, gas, and steam facility damages. Mr. Zizolfo recommends methods to reduce damages and oversees compliance with New York State Law Code 753 (Protection of Underground Facilities). Mr. Zizolfo serves on the board of the New York City and Long Island One-Call Users' Council.

EMERGING TECHNOLOGIES TASK TEAM

Jack Arseneau
Mr. Arsenau is a civil engineer who had 23 years of construction experience as a Wisconsin Department of Transportation (WisDOT) project engineer, experiencing many utility situations on a first-hand basis. He has been the Deputy Executive Director for the Wisconsin Transportation Builders for the last 13 years. In that capacity, he has worked as a liaison between the industry and the DOT, utilities, and other agencies. Part of those duties included settling disputes, drafting specifications, and serving on various task force committees with those agencies.

Rick Canaday
Mr. Canaday works for AT&T Labs as a Senior Technical Staff Member in the area of Network Reliability Standards. In this capacity he serves in a number of industry forums and committees addressing network outage analysis and prevention, such as the Network Reliability Steering Committee and Standards

Committee T1. He has 19 years of telecommunications industry experience, including network operations and maintenance and process quality management and improvement. Mr. Canaday served as the Emerging Technologies Liaison to the Compliance Task Team.

Catherine Carver

Ms. Carver is the Associate Director of Technology Transfer for the Center for Construction Technology and Integration (CT&I) at NC State University. She has been working at the university since 1993 where she has successfully organized CT&I, organized and manages the Consortium to Further Advance the Buried Utility Detection System (BUDS), and organized and directs the Locator Technician Training certification program for Continuing Education credits through NC State University. Ms. Carver is the spokesperson for the center and attends conferences and meetings across the nation, has published many industry-related articles and is most at home addressing the industry concerning the issue of damage prevention. Ms. Carver served as the Co-Chair of the Emerging Technologies Task team.

Charles Cohen

Mr. Cohen worked as a heavy equipment mechanic from 1964-1970 and became a salesman for heavy equipment from 1970 until 1981. In 1981, Mr. Cohen became the founder and owner of Tires N' Tracks, Inc., an underground construction company, which specializes in directional drilling and fiber optics. Tires N' Tracks is a proud member of the Underground Contractors Association (UCA), of which Mr. Cohen is a member of the Board. The company serves on the safety committee for the UCA and Mr. Cohen, through the UCA, works closely with the Illinois One-Call, JULIE. Tires N' Tracks is an active member of the Village of Lombard's Transportation and Safety AD-HOC Committee, representing the industrial area where client facilities are located. Mr. Cohen also serves on the National Utility Contractors Association (NUCA) Board and as laborers' trustee for the Laborers' Union Health, Pension and Welfare Funds. Mr. Cohen served as the Emerging Technologies Liaison to the Excavation Task Team

Sandra Daziani

Ms. Daziani is the Executive Director of Arizona Blue Stake, Inc., the one-call center serving the state of Arizona. She began serving the damage prevention industry in 1981 as a call center agent and, since then, has served Arizona Blue Stake in many diverse management capacities. Her most recent position, before becoming the Executive Director in April 1998, was the Director of Systems. As Director of Systems she successfully developed requirements and implemented their Information Distribution & Exchange Administration System (IDEAS), which has been operational since February 1998. She participated in this Best Practices Study as a proud member of the American Public Works Association's One Call Systems International (APWA/OCSI). She is also a member of the National Utility Contractors Association (NUCA) through the Utility and Transportation Contractors Association of Arizona (UTCA) and the Associated General Contractors of America (AGC). Ms. Daziani served as the Co-Chair of the Emerging Technologies Task Team.

Ziyad Doany

Mr. Doany currently leads the locating products lab design team for 3M Telecom Systems Division in Austin, Texas. He has been designing cable and marker locating equipment since 1988, along with monitoring and developing new technologies for improving the efficiency and accuracy of buried utility

detection equipment. His involvement in the Best Practices Emerging Technology Task Team represents his willingness to share his knowledge on locating technologies for the cause of damage prevention.

Ben Heise

Mr. Heise is currently serving as the Vice-Chairman of the National Telecommunications Damage Prevention Council. He is a manager for AT&T and is responsible for fiber optic outside plant maintenance standards and procedures. Mr. Heise has been involved with the AT&T national fiber optic network since 1993. His experience prior to this assignment included network operations, management and international service improvement. He began his career with AT&T in 1969 in international service provisioning, moved to coaxial transmission and microwave radio maintenance in 1981, then moved to business communications maintenance in 1983 and network operations in 1989. Mr. Heise served as the Emerging Technologies Liaison to the Mapping Task Team.

George Ragula

Mr. Ragula is the Distribution Technology Manager for Public Service Electric & Gas Company and is responsible for evaluating new technology that significantly impacts the safety, efficiency and effectiveness of field operations. His responsibilities include planning, coordinating, managing and implementing procedural and equipment technology transfer with particular emphasis on increased use of various trenchless technologies. He is a member of the American Gas Association, American Society of Mechanical Engineers, North American Society of Trenchless Technology, and the New Jersey Society of Asphalt Technologies. He serves as Director on the Northeast Gas Distribution Council and as a Project Advisor for the Gas Research Institute Distribution Project Advisory Group.

Angela Wallace

Ms. Wallace is the Director of Technology for the Utilities Protection Center, Inc. of Georgia, where she has been employed for the past five years. She is also the Executive Director of the National Joint Utilities Notification System (NJUNS). As a member of the American Public Works Association (APWA) and One Call Systems International (OCSI), Ms. Wallace is serving this year as co-chairperson of the OCSI Symposium Program Committee. She holds a Bachelor of Industrial Engineering Technology from Southern Polytechnic College in Marietta, GA, where she was active in the Cooperative Education program. She was employed through the Cooperative Education program by BellSouth in Outside Plant Engineering. Ms. Wallace served as the Emerging Technologies Liaison to the Reporting and Evaluation Task Team.

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