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CONTINUED SUPPORT OF THE NATURAL RESOURCES INFORMATION SYSTEM (NRIS) FOR THE STATE OF OKLAHOMA: INCLUSION OF A NATIVE AMERICAN FOCUSED EFFORT

FINAL TECHNICAL REPORT
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Oklahoma Geological Survey (OGS), University of Oklahoma (OU)
Norman, Oklahoma 73019

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ABSTRACT

The objective of this research program was to continue developing, editing, maintaining, utilizing and making publicly available the Oil and Gas Well History file portion of the Natural Resources Information System (NRIS) for the State of Oklahoma, with a special emphasis on the Osage County records through the Osage Tribal Council. The NRIS Well History file contains historical and recent completion records for oil and gas wells reported to the Oklahoma Corporation Commission on Form 1002-A, and for wells in Osage County that have been reported to the Osage Tribal Council. At the start of this grant, the Well History file contained 378,243 records, providing historical coverage for all of Oklahoma except Osage County. During this grant period, the well record count increased by 33,301, to a new total of 411,544 records. Coverage is now completed for all Oklahoma counties.

Through NRIS, the Oklahoma Geological Survey (OGS) and the University of Oklahoma (OU) have developed a system with demonstrated value as a data resource for industry exploration and development, policy considerations, scientific research, conservation and other related issues. Because of the ongoing support of the U.S. Department of Energy, the initial development phase of the NRIS Well History file has been completed. Through the ongoing support of the federal and state governments as well as industry, it is fully expected that NRIS will continue to be a growing resource for Oklahoma and the nation.

EXECUTIVE SUMMARY

The objective of this research program was to continue developing, editing, maintaining, utilizing and making publicly available the Oil and Gas Well History file portion of the Natural Resources Information System (NRIS) for the State of Oklahoma, with a special emphasis on the Osage County records through the Osage Tribal Council. In 1986, the Oklahoma Geological Survey, working with Geo Information Systems at the University of Oklahoma Sarkeys Energy Center, began the construction of this information system in response to the need for publicly-available digital data about the state's resources, particularly oil and gas resources. These data are needed to address critical state and federal policy issues, as well as support the data needs of Oklahoma's petroleum industry. The current grant cycle was designed to complete the initial development phase for the Well History file by adding the remaining Osage County well records to complete the State of Oklahoma.

The NRIS Well History file contains historical and recent completion records for oil and gas wells reported to the Oklahoma Corporation Commission on Form 1002-A, and for wells in Osage County that have been reported to the Osage Tribal Council. Throughout the development of this database, data quality assurance has been a primary objective. To meet this objective, all forms go through processing stages that include photocopying, a pre-data-entry coding process, data entry and verification, and general and special edit procedures. As a step toward assuring ongoing data quality and system integrity, comprehensive documentation has been prepared for the entire NRIS system.

Processing of the oil and gas well completion reports proceeded smoothly throughout this grant period. At the start of the grant, the Well History file contained 378,243 records, providing historical coverage for all of Oklahoma except Osage County. During this grant period, the well record count increased by 33,301, to a new total of 411,544 records. Coverage is now completed for all Oklahoma counties.

Efforts have been made since early 1991 to disseminate NRIS information. As a result, a dramatic response to the release of NRIS data began during the summer of 1991 and has continued. Feedback from the public continues to reflect a great deal of enthusiasm about this resource for the oil and gas industry in Oklahoma. Hundreds of users have accessed millions of data records, by the resale of the data through commercial firms and the Oklahoma City Geological Society Library, and by direct access through the project offices.
The Oklahoma Geological Survey has established a computing facility to further promote user access to the NRIS data by Survey staff and by the public. Additionally, the NRIS data have served as a critical foundation for in-house projects, technology transfer initiatives, OU research projects, theses and dissertations. Data and analyses have been provided that would not have been feasible prior to construction of the NRIS system.

Through NRIS, the Oklahoma Geological Survey (OGS) and the University of Oklahoma (OU) have developed a system with demonstrated value as a data resource for policy considerations, scientific research, industry exploration and development, conservation and other related issues. Because of the ongoing

support of the U.S. Department of Energy, the initial development phase of the NRIS Well History file has been completed. With the completion of this initial phase, users are identifying their "wish list" for future enhancements and data development needs. More capabilities are needed to address well abandonments and plugging methods; production from marginally-producing wells; and well log, core and sample data for wells. Through the ongoing support of the federal and state governments as well as industry, it is fully expected that NRIS will continue to be a growing resource for Oklahoma and the nation.

INTRODUCTION

The objective of this research program was to continue developing, editing, maintaining, utilizing and making publicly available the Oil and Gas Well History file portion of the Natural Resources Information System (NRIS) for the State of Oklahoma. This grant funds that ongoing development work as a continuation of earlier grant numbers DE-FG19-88BC14233, DE-FG22-89BC14483, and DE-FG22-92BC14853. In 1986, the Oklahoma Geological Survey, working with Geo Information Systems at the University of Oklahoma Sarkeys Energy Center, began the construction of this information system in response to the need for a computerized, centrally located library containing accurate, detailed information on the state's natural resources, with an initial emphasis on oil and gas energy data needs. Since that time, the initial development phase for the NRIS Oil and Gas Production subsystem had been completed, and records had been added to the Well History database for all of the wells in Oklahoma with the exception of Osage County. The current grant cycle was designed to complete the initial development phase for the Well History file by adding the oil and gas data for Osage County, which is under the authority of the Osage Tribal Council.

The Oklahoma Geological Survey has prime responsibility for monitoring the State's non-biological natural resources. The need for publicly-available digital data about these resources is growing. Policy issues needing to be addressed at both the state and national levels are of critical importance to the economic well-being of this state and the country. The small operators and independents that constitute a growing portion of Oklahoma's petroleum industry are increasingly seeing the business necessity of a good data resource. Before the development of NRIS, only limited and fragmentary computerized data on Oklahoma resources were available from any private or public source. The resource being developed as NRIS is suitable for a variety of data needs, but is particularly designed to support the efforts of the oil and gas industry within Oklahoma.

DISCUSSION

SUMMARY OF TECHNICAL PROGRESS

The NRIS Well History file contains historical and recent completion records for oil and gas wells reported to the Oklahoma Corporation Commission on Form 1002-A, and for wells in Osage County that have been reported to the Osage Tribal Council. Data elements on this file include API well number, lease name and well number, location information, elevations, dates of significant activities for the well and formation items (e.g., formation names, completion and test data, depths and perforations). Throughout the development of this database, data quality assurance has been a primary objective. The routine processing steps for the project were designed to meet this objective.

Routine Processing Activities: An early step in the well file processing involves photocopying the completion reports for use in coding prior to data entry. All in-house completion reports had been copied by the end of the grant, representing the entire in-house collection of historical 1002-A forms, all new reports as they were received, and all of the reports obtained from the Osage Tribal Council.

The photocopies of the forms are then used to complete a pre-data-entry coding process. Efforts are made to assure that the data from the highly variable reports are captured in a manner that is as thorough, systematic and consistent as possible. Data entry is verified through 100% redundant keying to further increase the quality of the data. Once a record has been added to the database, it is processed through a general edit program that flags anomalies in the data contents or formats.

Special edit procedures also are regularly conducted on the well data. For example, special procedures are used to research well records with incorrect legal descriptions or county location data, and to identify well records that should be cross referenced. Field codes and Oklahoma Tax Commission lease numbers are assigned to well records through combined machine and manual matching processes between the field, lease and well files. Special projects are undertaken to add supplemental data to the file from well logs, scout tickets, and core and sample documentation.

As a step toward assuring ongoing data quality and system integrity, comprehensive documentation has been prepared for the entire NRIS system. For both the Well History and the Production subsystems, an operations guide (documenting the weekly processing job streams) and a system specifications volume (documenting the computer programs) have been developed, and are regularly used and maintained. In addition, an NRIS Data Manual has been prepared that thoroughly documents the standards and coding procedures for each data element. An updated release of the Data Manual was completed during this grant period. This Data Manual is a valuable tool for the users of the NRIS data as well as for the staff members who are building the database.

Routine Processing Progress: Processing of the oil and gas well completion reports proceeded smoothly throughout this grant period. At the start of the grant, the Well History file contained 378,243 records, providing historical

coverage for all of Oklahoma except Osage County. The map in Figure 1 shows the counties in which the historical coverage had been completed prior to and during this grant. Coverage is now completed for the entire state.

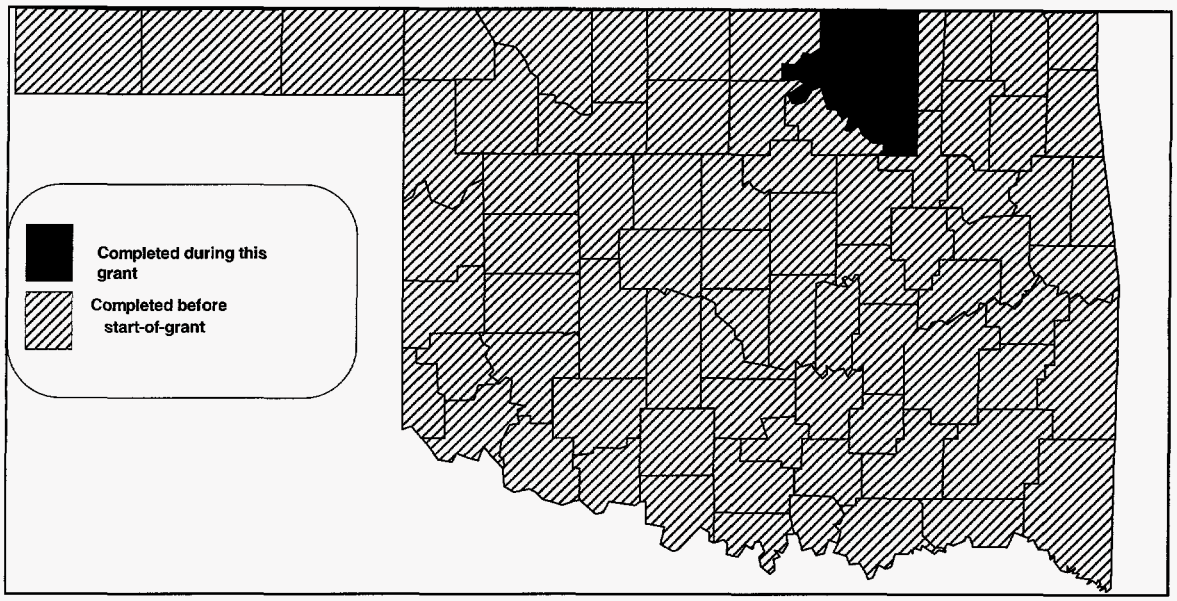


Figure 1: Oklahoma Coverage, by County, in the NRIS Well Database

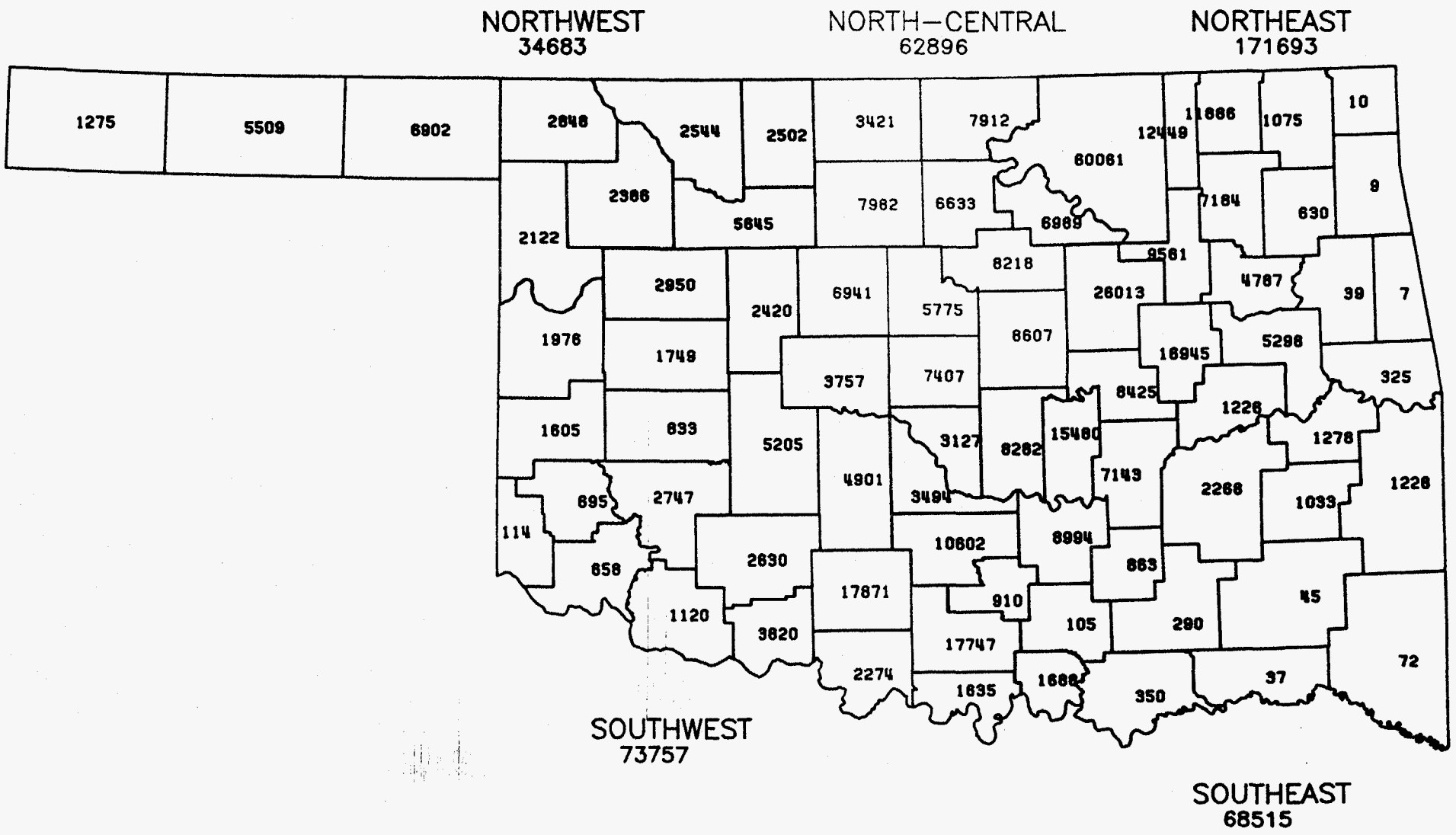
During the slightly over one year of the grant, the well record count increased by 33,301, to a new total of 411,544 records. Table 1 shows this progress by NRIS Regional Division. For those regions that were completed prior to the start of this grant, additional records were from two primary sources: (1) new 1002-A forms provided by the Corporation Commission, and (2) forms that were located during efforts to identify missing wells, as discussed in more detail below.

Area of Coverage	Start of Grant (Sept., 1994)	End of Grant (Nov., 1995)	Net Increase
Southeast Region:	67,883	68,515	632
Southwest Region:	72,955	73,757	802
Northeast Region:	140,766	171,693	30,927
Northwest Region:	34,103	34,683	580
North Central Region:	62,536	62,896	360
Total # Well Records	378,243	411,544	33,301

Table 1: NRIS Well Record Counts by Region

A status map showing the end-of-grant record counts by county is shown on the next page in Figure 2.

STATUS OF WELL HISTORY DATABASE PROJECT



TOTAL WELL RECORDS: 411544

PRODUCED BY GEOLOGICAL INFORMATION SYSTEMS

NOVEMBER 30, 1995

Figure 2: Status of Well History Database Project

Osage County Special Processing: For most of the state, completion reports are filed through the Oklahoma Corporation Commission; however, the Osage Tribal Council is the reporting agency in Osage County. For the NRIS Well History file development, special actions and processing were required to incorporate the Osage records. An arrangement was made through the cooperation and generosity of the Osage Tribal Council to gain access to the paper files of well records; in return, as soon as the Tribal Council has the computer capability to store and use the database, they will receive copies of those records in digital form. The entire historical collection of Osage County forms was received from the Tribal Council under the previous grant. Throughout the course of the current grant, copies of new records for the county regularly were provided by the Council.

The forms used by the Osage included numerous data elements that had not been reported on 1002-A forms. Therefore, the NRIS database dictionary had been expanded to include these new data elements. During this grant period, those data elements also were incorporated into new data release formats to facilitate their access by outside users. Between the Osage data elements and the new data elements being collected on the 1992 1002-A format, over one hundred new data elements were added to the data release formats.

Missing Wells Special Processing: The original collection of 1002-A forms that was used to build the NRIS well file does not provide comprehensive coverage for all non-Osage wells drilled in the state. There are a variety of reasons for this: (1) some wells were drilled in the very early days of the industry, before state regulations required the reporting of those wells; (2) not all wells were reported that were drilled after the reporting requirements began; (3) errors could have occurred in the process of getting copies of all submitted forms from the Corporation Commission; and (4) the public-access 1002-A collection has been vulnerable to forms being lost, mis-filed, or taken. It is clear that, with all of these potential sources of problems, there are a significant number of wells that are "missing" from the NRIS database.

Since the start of the grant, efforts have been in place to identify these missing wells and, when possible, locate their 1002-A forms. A variety of methods have been successfully used. For example:

- A match process was used to link wells to their respective producing leases on the NRIS Lease Master File. While this was a labor-intensive effort, it did result in the identification of missing wells that are still producing.
- At a more general level, state-wide matches have been completed in which a comparison of the numbers of wells and leases in each section were used to flag areas that might be missing significant numbers of well records.
- Users of the NRIS data have been helpful in identifying wells that they know should be on the database.
- Some efforts have been devoted to comparing lists of NRIS well records to the hardcopy scout tickets available through the Lawrence Youngblood Energy Library at the University of Oklahoma. Initial efforts concentrated in the northeastern part of the State on a township-by-township basis, and have been completed on a time-available basis.

Lists of wells that were identified as missing from the NRIS database were sent to Sooner Well Log Service, a privately-owned company with a very complete collection of 1002-A forms. Any "missing" 1002-A's available through their collection were obtained and added to the file. Those wells that were also

missing from the Sooner Well Log collection were added to the NRIS file based on the scout ticket information when it was available.

Formations Data Special Processing: Efforts were undertaken to standardize the formation names on the Well History file. A PC-based program was developed that uses a conversion table to standardize spellings, and allows the user to interactively build new entries for the conversion table as new spelling variations are encountered. Over 95% of the reported names have been standardized in this effort. This formations-editing process was further enhanced by the addition of a table to determine the standard "Franklinized" abbreviation for each reported name, following the convention with which industry users are familiar.

Field Data Special Processing: One goal of the NRIS system involves efforts to "assign" leases and wells to oil and gas fields, based on the official field outlines as designated by the Mid-Continent Oil and Gas Association's Oklahoma Nomenclature Committee (ONC). However, some areas exist in which these assignments have been impossible because significant field extension drilling has taken place and the ONC has had insufficient resources to update the field boundaries accordingly. To assist the ONC in updating their field outlines, information packages have been produced from the NRIS system for selected areas; these packages included well data listings and well spot maps. Based on this input, the Committee has been working toward alleviating the problems of unassigned leases and wells. During the course of the NRIS project, through these efforts the unassigned gas production has been reduced from 26% to 6% of the annual average production, and unassigned oil production has been reduced from 26% to 12%.

TECHNOLOGY AND INFORMATION TRANSFER

Efforts have been made since early 1991 to disseminate NRIS information through meetings, workshops, and mailings to numerous individuals, companies and organizations. As a result, a dramatic response to the release of NRIS data began during the summer of 1991 and has continued. Feedback from the public continues to reflect a great deal of enthusiasm about this resource for the oil and gas industry in Oklahoma. Data and analyses have been provided that would not have been feasible prior to construction of the NRIS system.

Several commercial data venders subscribe to the NRIS data for redistribution purposes. The number of data requests that have been processed for small companies and independents has tripled in the past year, and users are beginning to directly access the database through a computing facility (described below). NRIS well data have been made available through the Oklahoma City Geological Society Library with very positive results. Just during this last year of this grant, several hundred users have acquired NRIS data for their applications, in addition to an unknown number of users through the commercial data redistributors.

The Oklahoma Geological Survey has established a computing facility to promote user access to the NRIS data by Survey staff and by the public. This facility was opened to industry on June 1, 1995. Visual Basic user interfaces, along with a PC-level relational database management system (Oracle), are

being used to allow menu-driven retrieval systems customized to NRIS data. A Novell network system has been installed in order to allow multi-user access to the databases. A large digitizer, large plotter and desk-top scanning equipment enhance the capabilities available through computer mapping software, such as ARC/INFO and GeoGraphix. Users in the computing facility can benefit from multi-user access to contour mapping, and production and log analyses programs that are widely used in industry today. Additionally, Platte River Associates has donated their digital landgrid, which includes all of the sections and townships for Oklahoma

NRIS data have provided a foundation for several other projects in which technology transfer is a key goal. For example, the lab described in the previous paragraph is the central location for NRIS data access and distribution in the Survey's role as Regional Lead Organization for the Southern Mid-Continent under the Petroleum Technology Transfer Council (PTTC) program. Another project funded by DOE involves the study of Oklahoma's fluvial-dominated deltaic (FDD) oil reservoirs, and also includes technology transfer as an underlying goal. A series of workshops and publications are being produced regarding FDD plays. NRIS data have provided a key resource for this effort. In addition to these major projects, NRIS data have been used in numerous OU research projects, theses and dissertations.

CONCLUSIONS AND RECOMMENDATIONS

Through NRIS, the Oklahoma Geological Survey (OGS) and the University of Oklahoma (OU) have developed a system with demonstrated value as a data resource for policy considerations, scientific research, industry exploration and development, conservation and other related issues. National energy policy can best serve the needs of the public sector by encouraging the production of the remaining domestic hydrocarbon resources. Because the largest component of the remaining crude oil resource base in the onshore areas of the lower 48 states is in known fields, steps must be taken to maximize the recovery from those known fields, and a reliable and available data source is a critical tool for that process. The NRIS system is providing that tool for the Oklahoma petroleum industry.

The need for accurate, complete data on oil fields within Oklahoma is made critical by the large amount of drilling that has taken place. The remaining resource base lies primarily in unswept mobile and nonmobile oil; thus, "new" oil will be found primarily from extensions to existing fields, in-field drilling, and revisions of recoverable reserve estimates derived from enhanced oil recovery procedures. Because much of Oklahoma's current crude oil production is by small companies and independents, further exploration and development will be of interest primarily to those operators, and to the Indian tribes. Success requires cost-effective exploration and development, backed by the knowledge of recovery methods ascertained by the scientific research community, and the support of national and state governmental policies. These activities are being greatly enhanced by the availability of accurate, detailed information from the NRIS system.

As state organizations, OGS and OU work with other agencies and groups to avoid needless duplication of effort in generating needed information. Currently, OGS and OU are working with both the Oklahoma Tax Commission and the Oklahoma Corporation Commission in oil and gas data collection and development, and with the Mid-Continent Oil and Gas Association's Oklahoma Nomenclature Committee to redefine the State's official oil and gas field boundaries. The availability of the NRIS system permits responses to the Legislature and other state agencies in a manner consistent with their needs. Recent economic and energy developments make the need for a responsive information system more imperative than ever before.

Because of the ongoing support of the U.S. Department of Energy, the initial development phase of the NRIS Well History file has been completed. The tremendous value of this development is evident through the increasing use of the NRIS data for industry, scientific, and policy research applications. With the completion of this initial phase, users are identifying their "wish list" for future enhancements and data development needs. More capabilities are needed to address well abandonments and plugging methods; production from marginally-producing wells; and well log, core and sample data for wells. Through the ongoing support of the federal and state governments as well as industry, it is fully expected that NRIS will continue to be a growing resource for Oklahoma and the nation.