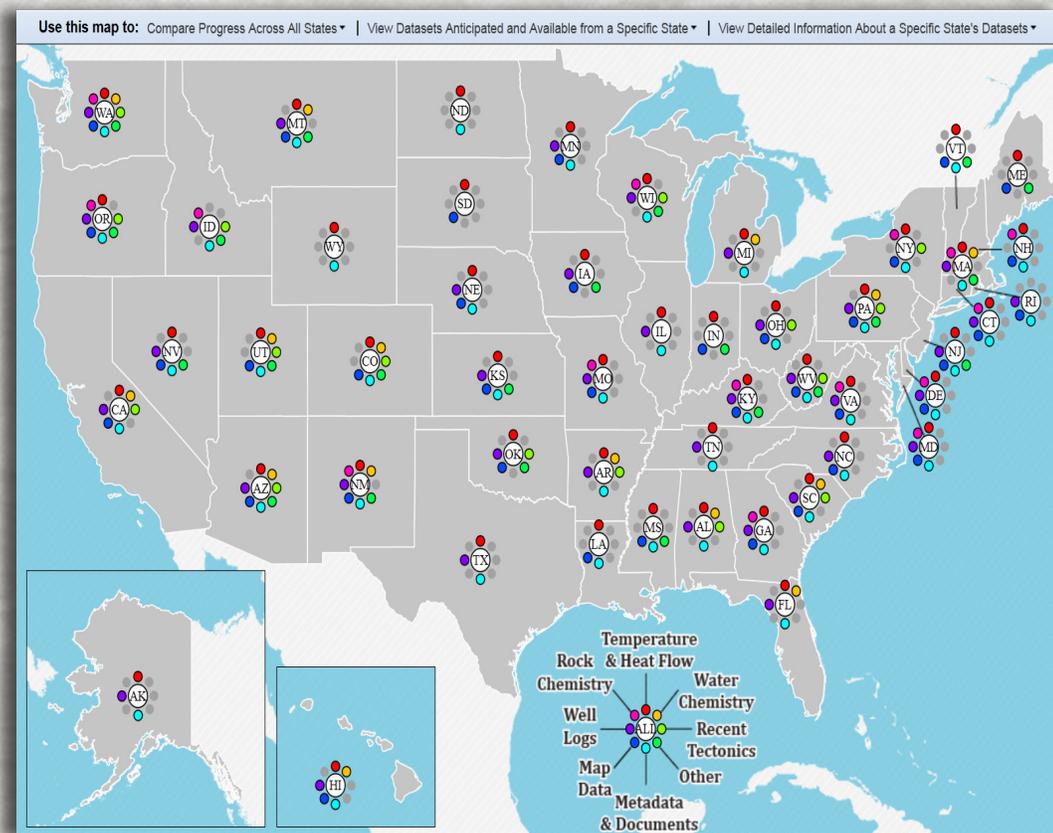


STATE GEOLOGICAL SURVEY CONTRIBUTIONS TO THE NATIONAL GEOTHERMAL DATA SYSTEM

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Interactive data contribution map at www.stategeothermal.org

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State Geological Survey Contributions to the National Geothermal Data System

Accomplishments through September 30, 2011



AASG
GEOHERMAL DATA

Arizona Geological Survey



State Geological Survey Contributions to the National Geothermal Data System

Accomplishments for Federal Fiscal Year 2011
October 1, 2010 to September 30, 2011

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Executive Summary

The project achieved its primary goals and milestones during FY2011, which included data retrieval from 44 subrecipients and providing an online, interoperable network serving geothermal relevant data. Nearly all subrecipients have completed at least one data set and submitted data into the network. The digital catalog for the system is functional and includes over 30,000 entries representing hundreds of thousands of data points, map records, and documents.

Statements of Work for the second project year were received and reviewed by the project Science Advisory Board in a joint meeting taking place at the Utah Geological Survey in Salt Lake City, Utah. Additional external subject matter experts were invited and participated in the review. Board members completed a review of current data input prior to approving the statements of work. The majority of Year 2 Statements of Work have been approved, with the remainder nearing completion.

The Management Advisory Board has communicated frequently, with the project Principal Investigators providing updates, including a presentation at the Association of American State Geologist's Annual Meeting in Dubuque, Iowa.

The Technical Advisory Board has been absorbed by the National Geothermal Data System Development (NGDS) and Population Technical Working Group. This working group is comprised of representation from all NGDS projects including Boise State University, Southern Methodist University, U.S. Geological Survey, and Arizona Geological Survey, and is chaired by U.S. Department of Energy.

Supplemental funding of \$4.1 million for new data acquisition was awarded to 16 state participants. Projects range from simple well logging to complex drill projects. An article for *Arizona Geology* was published to discuss the projects funded.

The AZGS management, financial, and technical team expanded over the past year including a fiscal services specialist, technology transfer specialist, geoinformatics content specialist, web services developer, and geologist.

AZGS revised the project website (www.stategeothermaldata.org) to include a project management side for subrecipients. This allows subrecipients to seamlessly upload invoices, reports, and data contributions for processing by AZGS staff. The project management site also allows for project staff to ensure submissions are processed in a timely fashion. Finally, the site incorporates a progress tracking mechanism to allow the public and subrecipients to follow the data review process from proposal to completion.

In order to more effectively track progress and maintain workflow a series of task management sites were created and are currently in use at AZGS and the AASG hubs.

Four regional information technology and service hubs have successfully deployed and are hosting content from across the nation. The hub sites include the Illinois Geological Survey in Champaign, IL; the Kentucky Geological Survey in Lexington, KY; and the Nevada Bureau of Mines and Geology in Reno, NV. The Arizona Geological Survey is also a hub in the network.

AZGS team members gave numerous talks, briefings, web presentations, and conference exhibits during the fiscal year. In addition AZGS contributed three publications, including two chapters in the book "Geoinformatics" published by Cambridge University Press.

Highlights

As of September 30, 2011 there are over 34,000 entries in the catalog, by the end of the calendar year this number is expected to be over 70,000. The catalog represents hundreds of thousands of data points, map data, and documents.

New data collection projects have been awarded to Arizona, Colorado, Idaho, Indiana, Massachusetts, Maine, New Jersey, New Mexico, Nevada, Oklahoma, Oregon, Pennsylvania, Utah, Vermont, Washington, and West Virginia. Compliance with the National Environmental Policy Act (NEPA) for new data collection has been initiated.

The project received positive evaluations from the 2011 Department of Energy Project Peer Review.

All 50 states are represented in the project and subcontractors been actively participating in data digitization, collection, and distribution.

Initial feedback from the user community at tradeshow has been incredibly positive and provided valuable feedback; a key goal for FY2012 is to receive formal review from industry.

Milestones:

- Finalized outstanding contracts and Statements of Work remaining from YR 1.
- Integrated the Technical Advisory Board into the National Geothermal Data System wide Development and Population Technical Working Group.
- Participated in authoring the National Geothermal Data System (NGDS) Architecture, Design, Testing, and Maintenance continuation plan, which established system wide advisory and coordination groups.
- Science Advisory Board met for two days at the Utah Geological Survey in Salt Lake City, Utah to review Year 2 Statements of Work covering all 50 states from 44 subrecipients and 2 in-kind contributors.
- Supplemental funding projects awarded, including \$2.6 million in new geothermal well drilling across the Great Basin and Northwest U.S.
- Provided the Management Advisory Board with frequent updates on the status of the project, and consulted with members at the Association of American State Geologists (AASG) Annual Meeting.
- Continued to hire for key positions.
- Regional server and IT hubs established; including a workshop for hub managers at AZGS to discuss technical and backup requirements for the system.
- Launched public website (www.stategeothermaldata.org) which includes a project management section for subrecipients.
- Established internal Quality Control and Assurance measures for incoming data.
- Created and launched online data review tracking system that is open to the public.
- Launched functioning online network catalog using ESRI GeoPortal implementing ISO19115 metadata standards.
- Developed content models and deployed services for borehole temperature data, active faults, well headers, volcanic centers, thermal springs, drill stem tests, and geochemical data.
- Partnerships with Microsoft Research and Energistics continued to develop.
- New partnership with the Western Regional Partnership (www.wrpinfo.org), a Department of Defense funded collaboration of 5 Western States and 15 federal agencies, to link land use and land management data into the network was signed.
- Continued to build relationship with ESRI, the manufacturer of the ArcGIS suite of software which is the most commonly used geospatial visualization and analysis software in the U.S.

Technical Accomplishments

The USGIN Metadata Catalog was deployed to discover data resources within the USGIN, NGDS, and therefore, by extension the State Geothermal Data Project. The catalog is deployed using ESRI Geoportal Server Open Source Project (v.10) and consumes metadata using ISO 19139 for metadata management, discovery, and Catalog Services for the Web (CSW) services. A previous incarnation of the catalog using Geonetwork Open Source catalog prototype was harvested by the Geoportal catalog to transfer existing metadata to the new catalog system. A two-day workshop on ESRI's Geoportal was held in early October 2010.

Geoportal can also harvest existing ISO metadata and OGC GetCapabilities documents from Web Map Services and we are working on harvesting OGC WFS GetCapabilities and FGDC xml-encoded metadata into Geoportal. These harvest processes use xslt transformations to convert xml to USGIN ISO-profile conformant metadata.

The four regional hubs (AZ, NV, IL, and KY) met in early August to discuss expectations, protocols, and sustainability of the network. Extensive training on network components took place and network backup protocols were discussed. We plan to host another hub workshop in conjunction with the technical project participants' workshop during the summer of 2012.

Geospatial Data Services (Web Map Services, Web Feature Services, and Web Coverage Service) have been deployed on all hub servers. To date, the services are focused on WMS and WFS with WCS in process.

The <http://lab.usgin.org> site is being used to provide information related to service profiles and implementation approaches for the USGIN that are being used for AASG geothermal NGDS services. It assists developers to learn about the standards in use, the objectives of the application profiles being developed, software being used or tested for implementation of services, and details about particular implementations. Forums are available for asking questions about the services, profiles, and implementation issues.

A URI dereferencing application implemented for USGIN, using Django to register and redirect http URI's, is being used to resolve URIs in NGDS web services to produce responses according to the data provider's guidance (<http://lab.usgin.org/implementations/usgin-uri-management>). The site uses a rule based approach to rewrite http URIs to URLs that retrieve useful representations of information resources.

The USGIN Repository was launched (<http://repository.usgin.org>) to upload documents for use by the USGIN community. A metadata record for the document must be created as part of the upload process and this metadata will be harvested into the USGIN Catalog. Anyone wishing to make documents accessible to the network may use this site as a repository to host the document. If a document is already hosted online, and only a metadata record is needed for the catalog, then a Metadata Wizard was created.

The Metadata Wizard (<http://mw.usgin.org>) is a tool to create, manage, and export metadata to the USGIN catalog service. It is designed for information resources that are already accessible with existing URLs.

For metadata production and entry into the catalog for geothermal data system we added functionality to the web-based metadata creation tools at the Metadata Wizard and USGIN repository. Thus, when metadata records are published, the metadata record is saved to a web-accessible directory and harvested by the ESRI Geoportal. This process is intended to keep the metadata catalog in sync with the online tools and repositories.

We have developed a software application that validates metadata in the tabular template format using a collection of user defined rules. This validation framework will be useful for validation of content for geothermal data services as well.

Data delivery templates are being developed as necessary, and are made available at http://stategeothermaldata.org/data_delivery/content_model_templates. The following is a list of available templates:

- Active Fault/Quaternary Fault
- Aqueous Chemistry
- Borehole Temperature Observation Feature
- Direct Use Feature
- Drill Stem Test
- Earthquake Hypocenter
- Fault Feature
- Geologic Contact Feature
- Geologic Unit Feature
- Heat Flow Template
- Lithology Interval Log Feature
- Metadata Template
- Thermal/Hot Spring Feature
- Volcanic Vents
- Well Header
- Well Log Data Compilation

Additional templates are being developed with peer review from data users and content experts.

Starting in August, AASG geothermal data templates have been posted for review and acceptance by the GDSDP Working Group for use by other NGDS projects. Documents and content models are posted when deemed ready for broader review and use.

To bulk load metadata records in the template table we have developed a software application to read the metadata from the table and serialize as xml that can be imported to the catalog.

In House Technical Accomplishments and Project Management

An online tracking notification system was designed for in-house and hub use (<http://tasks.usgin.org>). This allows AZGS staff to easily track incoming data deliverables and assign them to the appropriate staff for QA/QC and deployment. If the data is submitted to a hub, then the hub representative is notified.

State Deliverables Administration

The overhaul of the project website (www.stategeothermaldata.org) includes a new project management system designed to ease state deliverables. Project subrecipients now upload data deliverables for QA/QC. They are also able to upload their project reports (Quarterly and ARRA reports) and invoices to the system. AZGS staff pulls the item from the site and enters it into the tasks.usgin.org site. Progress is then tracked through the public interactive tracking map on the website or through the project-wide report on <http://services.usgin.org/track/report>. (See Figures 1, 2, and 3 for screenshots representing the online tracking capabilities)

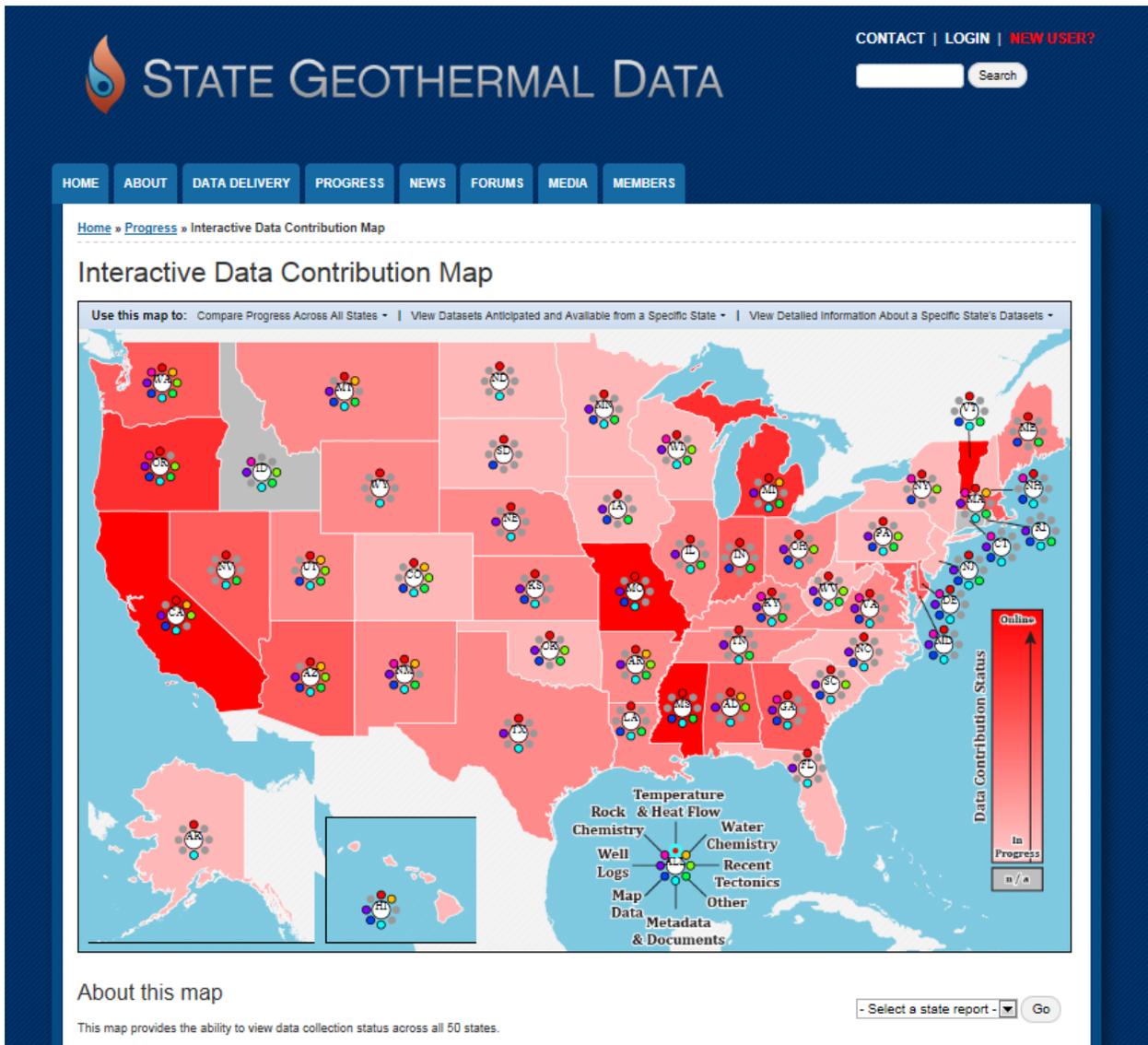


Figure 1: A screenshot of the Interactive Data Contribution Map on www.stategeothermaldata.org which allows project members and the public to track data submissions by data subset or by individual state.



STATE GEOTHERMAL DATA

AASG Geothermal Data System-Wide Report

Content Category	Expected Deliverables	Completed Deliverables	Percent Complete	Records Online	Most Recent Submission
Metadata and Documents	1	0	0%	0	
Totals for Kentucky	13	3	23.08%	3	
State: Louisiana					
Map Data	2	2	100%	4	Jun 29, 2011
Temperature & Heatflow	3	1	33.33%	5201	May 28, 2011
Other	1	0	0%	0	
Metadata and Documents	4	1	25%	8	Jun 16, 2011
Totals for Louisiana	10	4	40%	5213	
State: Maine					
Map Data	1	0	0%	0	
Temperature & Heatflow	4	1	25%	131	Nov 9, 2011
Other	1	0	0%	0	
Totals for Maine	6	1	16.67%	131	
State: Maryland					
Map Data	3	1	33.33%	72	Jun 15, 2011
Temperature & Heatflow	10	5	50%	963	Nov 22, 2011
Well Logs	13	7	53.85%	1319	Nov 22, 2011
Rock Chemistry	1	0	0%	0	
Metadata and Documents	4	1	25%	95	Sep 8, 2011
Totals for Maryland	31	14	45.16%	2449	
State: Massachusetts					
Temperature & Heatflow	6	3	50%	634	Sep 19, 2011
Water Chemistry	1	1	100%	9	Jun 17, 2011
Well Logs	1	1	100%	35	Nov 7, 2011
Rock Chemistry	5	1	20%	202	Aug 22, 2011
Other	1	0	0%	0	
Metadata and Documents	1	0	0%	0	

Figure 2: A view of the fifty state deliverable report on www.stategeothermaldata.org indicating the State, Category, Expected Deliverable, Completed Deliverable, Percent Complete, Records Online, and Most Recent Submission.



STATE GEOTHERMAL DATA

Summary Report for New Jersey (All Project Years)

Content Category	Expected Deliverables	Completed Deliverables	Percent Complete	Records Online	Most Recent Submission
State: New Jersey					
Map Data	1	0	0%	0	
Temperature & Heatflow	3	0	0%	0	May 18, 2011
Well Logs	1	0	0%	0	Jun 2, 2011
Other	2	0	0%	0	
Metadata and Documents	6	0	0%	0	May 18, 2011
Totals for New Jersey	13	0	0%	0	

New Jersey Data Available Online

Downloads
No downloads available

Services
No services online

Submission Tracking for New Jersey

Title	Submitted On	Status
Document - Metadata (logs) YR1 (Metadata and Documents)		
NJGS Geot Well Records - DWR <i>File Name: NJGS Geothermal Well - Complete Metadata v1.2.0</i> <i>Comments: - Jul 15, 2011: Reviewed NJ metadata for logs. Returned to NJ with comments. Additional logs?</i>	May 18, 2011	Returned as of Jul 15, 2011
Well Records (tiffs) <i>File Name: Numerous tiff files</i> <i>Comments: - Jul 15, 2011: Documents should be sent to Hub for online access or at NJGS. Documents require metadata template records. Returned to NJ with comments.</i>	May 18, 2011	Returned as of Jul 15, 2011
Documents Public School GHPS YR1 (Metadata and Documents)		
NBCP Temperature Depth Resistivity YR1 <i>File Name: NBCP Recovered Data</i> <i>Comments:</i>	May 18, 2011	Returned as of Jul 15, 2011

Year Two Deliverables

Year Three Deliverables

<http://stategeothermaldata.org/>

Map View ([Click here for the nationwide map](#))

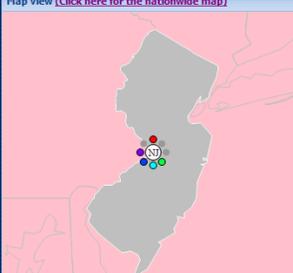


Figure 3: A state specific report on www.stategeothermaldata.org indicating the deliverables status items listed in Figure 2 as well as the Statement of Work, Available Downloads, and Interactive content map as shown in Figure 1.

User Interface and Accessing Data

After discussions with the NGDS Prime Contractor and the shift in scope of the Geothermal Desktop (part of the NGDS Architecture Design award), AZGS has undertaken development of demonstration client applications including a search portal into the system. An Education Outreach and Technology Transfer (EOT) team was formed to assist AZGS developers address user access requirements. This is outside the original scope of work; however, in order to adequately receive feedback on the system and data being contributed to the system, such an access portal is required. As such, we have developed <http://catalog.usgin.org/search/>, a map based catalog search that allows users to view the data set (if WMS is available) prior to downloading the dataset. It is also available via the project website at www.stategeothermaldata.org. The map based services can be downloaded directly into ESRI's ArcMap application. While these data sets are interoperable among a variety of viewers (for example uDig, QuantumGIS, and the USGS National Map Viewer), ESRI's ArcMap is the primary software currently in use for geospatial data analysis. This particular model of the user interface shows that the data is accessible through customizable interfaces. Our intention is that the most functional interfaces will be developed by the end users based on their desired functionality. Just as the web has standardized protocols for displaying information, the data system has similar protocols and this permits interoperability with existing systems or the ability to customize interfaces.

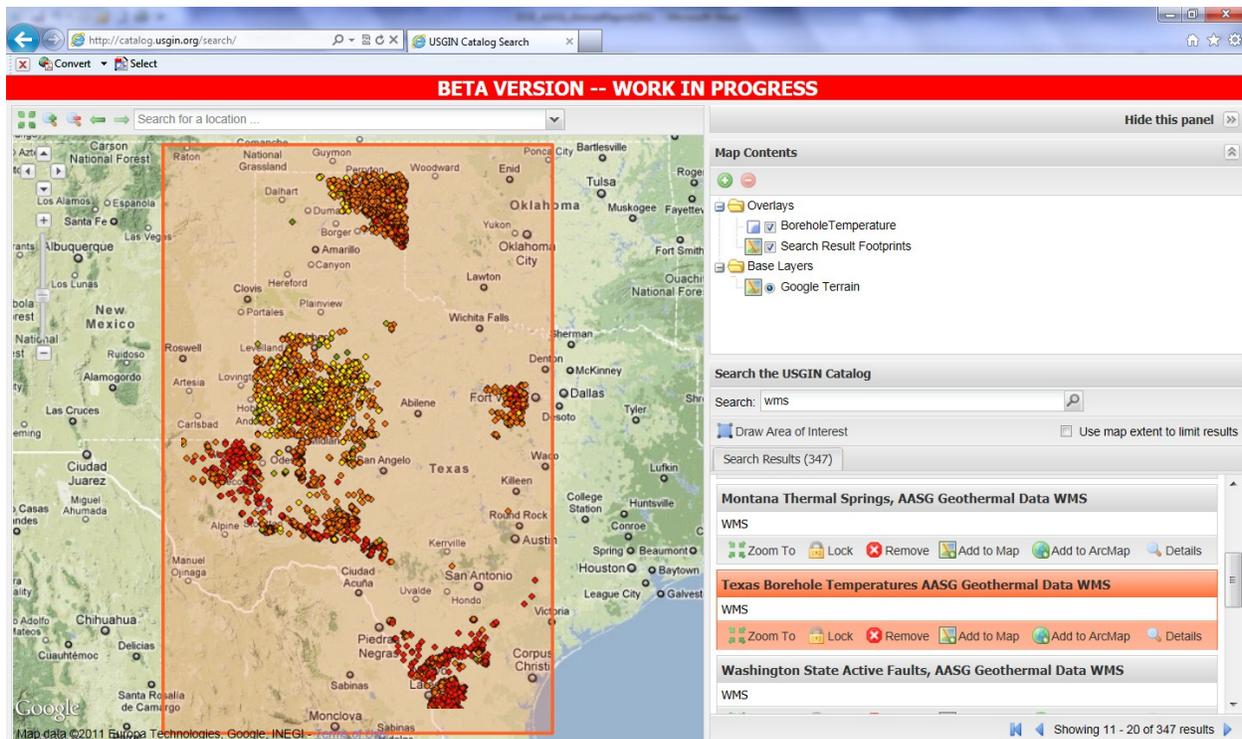


Figure 4: Screenshot of the BETA search interface showing the current borehole temperature service from the Texas Bureau of Mines and Geology.

In addition, we have developed a Catalog Service for the Web (CSW) application for ArcMap, which is easily installed as an extension. It provides an interface to search the NGDS catalog (as well as GEOSS and OneGeology catalogs), locate map services, and add a selected service as a layer in the ArcMap project. The, ArcMap does not have to go to an external site to find data, and they can access map services directly from their project environment.

The USGS National Map Viewer is also implementing CSW search functionality (see 'advanced' tab in the user interface there), allowing a user of the National Map to pull in data sets from various catalogs, including the NGDS. Conventions are being developed for more standardized metadata that will make this functionality progressively more reliable.

Conventions for delivering geologic map data using the recently released GeoSciML Portrayal View schema are under development and during the next year we plan to promote deployment of feature-based geologic map services to support geothermal energy exploration.

With support from Co-PI Steve Richard, the International Union of Geological Sciences (IUGS) CGI Interoperability Workgroup has continued to develop xml schema for flat file (simple feature) gml views of GeoSciML to facilitate use with layer-based GIS clients (like ArcGIS) that will support the project.

Management and Operations Accomplishments

Department of Energy Peer Review 2011

The project participated in the DOE external peer review in early June of 2011 and received marks ranging from “good” to “outstanding.” The following comments reflect the review responses:

“This project has definitely made a significant impact on DOE’s mission and goals. The project has evolved exceptionally well and has addressed many difficulties in attempting to achieve its stated goals.”

“The approach taken by the PI and research team has been exceptional. The technical approach taken by the PI is remarkable, reasonable, and logical.”

“Results are already extensive and impressive.”

“The most visible strength was the outstanding project management.”

Project Annual Meeting

Project members met at the Association of American State Geologist’s (AASG) Annual Conference in Dubuque, Iowa from June 6-12, 2011. A project update was provided to the Management Advisory Board and one-on-one meetings with project participants took place. During FY2012 project leads will be encouraged to attend the AASG conference in Austin, TX and technical leads will be encouraged to attend a workshop at the Earth Science Information Partners (ESIP) Federation and DataOne meeting in Madison, WI. Collaboration with ESIP and DataOne are encouraged to provide a community of practice regarding federated data.

State Participation

All 50 states are represented in the project (Attachment 1). By the end of the 2011 Fiscal Year, all but two states had submitted sample data (NC, NH). New Hampshire was unable to participate in the project until the 2012 state fiscal year due to hiring freezes within the state and North Carolina will be hiring to staff the project during FY 2012. NH has presented a condensed statement of work to complete the project in the shorter time period. NC has done the same due to their late contract start (April of 2011). Project management has been encouraging these states to move forward with the project even with delays.

The North Dakota Geological Survey (NDGS) had to withdraw from their contract with AZGS due to limitations from the state legislature during the fall of 2011. A negotiation with the University of North Dakota (UND) located in Grand Forks has commenced. Dr. Will Gosnold (UND), who is working on data collection from Nebraska and Minnesota, will work with the NDGS to collect and digitize the geothermal relevant data in North Dakota. Contract execution for this phase is expected winter of 2011/2012.

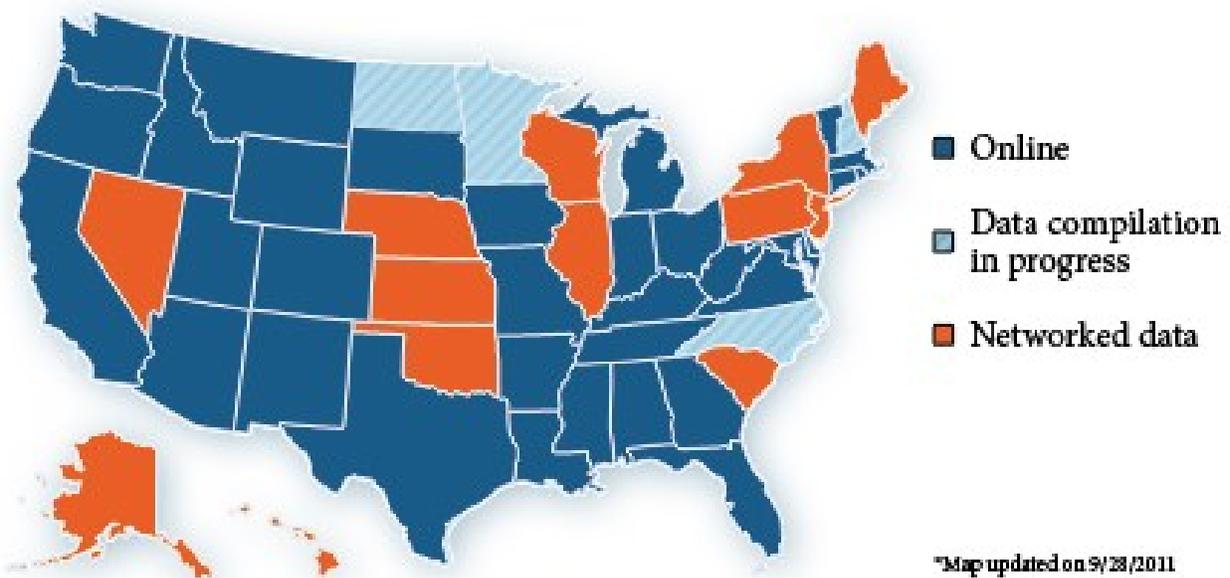


Figure 5: Graphical representation of states with data a) online and registered in the catalog, b) states that have only submitted sample data (networked data), and c) states with compilation still in progress as of September 28, 2011.

Management Advisory Board

The MAB met June 12-16, 2011 in Dubuque, Iowa during the AASG Annual Meeting. The MAB was briefed on state deliverables and overall progress of the project. In addition, the MAB met September 18-21, 2011 in Washington, DC during the AASG Liaison meeting. During the liaison meeting AASG members met with DOE Geothermal Technologies Program staff.

Membership:

- AASG Past-President, Jim Cobb, Kentucky
- AASG President, Vicki McConnell, Oregon
- AASG Vice President, Bob Swenson, Alaska
- NGDS Principal Investigator, Walter Snyder, Boise State University, Idaho
- DOE-GTP, Ava Coy, Colorado

Science Advisory Board

The SAB was called upon twice during the year, first to review supplemental funding proposals and then to review the Year 2 statements of work. The first review was done by web communications including webinars and email. The second review was done in person.

The board met in Salt Lake City, Utah June 2 & 3, to review Year 2 statements of work. Additional reviews were conducted via email. For the primary review in June, invitations to John Ziagos, DOE GTP Contractor, and Colin Williams, USGS, were extended. Both participated in the event as geothermal experts.

Each statement of work was reviewed using the following criteria:

1. The relevance and significance of the proposed deliverables for development of geothermal resources
2. The appropriateness and utility of the proposed delivery mechanism
3. Whether the quantity of delivered data is consistent with the funding level and reasonable estimation of the effort required to produce the proposed deliverable.

In addition, SAB members provided recommendations on quality assurance plans, duplication of efforts, and other factors as they Board saw fit. The SAB is guided by the "Science Advisory Board Plan" dated July 6, 2010 and included in last year's annual report.

Membership:

Chair- Rick Allis, Utah Geological Survey
John Costain, Virginia Tech University
Dave Norman, Washington Geological Survey
Arlene Anderson, Department of Energy
Lisa Shevenell, Nevada Bureau of Mines and Geology
Ed Deal, Montana Bureau of Mines and Geology
Chacko John, Louisiana Geological Survey

Technical Advisory Board

The project specific technical advisory board was absorbed by the NGDS wide coordination group NGDS Development & Population Technical Working Group (GDSDAPTWG) per the NGDS Architecture Design, Testing, and Maintenance continuation plan accepted by DOE and Boise State University May 3, 2011.

Membership of the GDSDAPTWG includes representation from each of the national NGDS data acquisition projects (BSU, AZGS, SMU, and USGS) as well as the US Department of Energy. Currently the group's membership is comprised of:

- Arlene Anderson, Department of Energy
- Dave Cuyler, Department of Energy
- Christian Loepp, Boise State University
- Steve Richard, Arizona Geological Survey
- Fabian Moerchen, Siemens, Southern Methodist University
- Jacob DeAngelo, US Geological Survey

The GDSDAPTWG serves as the initial point of review for products, technical standards, procedures, protocols, and web services developed by AZGS for the NGDS Architecture Design, Testing, and Maintenance project housed at BSU. The group provides recommendations to AZGS which adopts or responds to those recommendations and are then communicated to the BSU Project Steering Committee in the form of written reports and other documents.

While the group does not "approve" proposals or products, it does play a critical role in ensuring the integration of the NGDS Architecture Design, Testing, and Maintenance project with DOE initiatives utilizing the US Geoscience Information Network (USGIN).

Collaboration

- A community of practice (GeoNet) was formed between data networks in order to collaborate and share best practices in standards and protocols. Participants in GeoNet include National Geoinformatics Community, DataONE, Ocean Observing Initiative, OneGeology, OneGeology Europe, Earth Science Information Partnership (ESIP) Federation, CUAHSI, AuScope, and USGIN. Additional funding is being sought through the National Science Foundation. Plans are to include NEON and ECHO in the community of practice during FY2012
- AZGS, under the auspices of USGIN, signed a working agreement with the Western Regional Partnership, a collaboration led by the Department of Defense consisting of five state governments and fifteen federal agencies for land use and planning in regards to public lands in the west. WRP will be implementing USGIN protocols to enable certain GIS data layers to be included in the NGDS. WRP is compiling over 10,000 GIS data layers.
- Project CoPI Richard was elected Chair of the Geoinformatics Division of the Geological Society of America.

- Project PI Allison was reappointed to the Executive Committee of the Earth and Space Science Informatics section of the American Geophysical Union, and reappointed to the Editorial Advisory Board for AGU's *Eos* newspaper for the field of informatics.
- Project PI's Allison and Richard were appointed to the GIS Advisory Board for the iPlant Collaborative (\$50 million NSF cyberinfrastructure initiative) to bring USGIN/NGDS expertise to the plant science community.
- Project members participated in the DataONE User Group meeting and Earth Science Information Partners meeting in Santa Fe, NM. We are working with DataONE to integrate networks and plan to incorporate some of the DataONE educational materials with the USGIN/AASG educational materials.
- AZGS joined the Open Geospatial Consortium (OGC) to have better access to standards materials and input on development of new standards.
- State of Arizona approved the US Geoscience Information Network (USGIN) as a data integration framework for state agencies, which will lead to additional Arizona data sets being made available to NGDS users.
- Discussions took place with the Consortium of Universities for the Advancement of Hydrologic Sciences, Inc (CUAHSI) about linking their Hydrologic Information System to NGDS using GIN. This led to CUAHSI joining the USGIN-led GeoNet coalition.
- Discussions were held with the Earth & Environment division of Microsoft Research about developing capabilities of their flagship visualization software Layerscape (within World Wide Telescope). While Microsoft is concentrating on their OpenData protocols for initial implementation, open source standards and protocols (and thus, GIN/NGDS) will also be compatible.
- Rather than join in an MOU, the Texas Bureau of Economic Geology (BEG) and Southern Methodist University (SMU) joined in a conference call to delineate the division of data contributions to the AZGS and SMU projects BEG resubmitted their SOW following the conference call to conform to the changes discussed.
- AZGS is adopting Lamont-Doherty Earth Observatory's International GeoSample Number (IGSN). The IGSN preserves the unique identify of a sample regardless of its current location (repository) which allows researchers to track the history and provenance of a sample. The IGSN is generated by the System for Earth Sample Registration (SESAR). The intention is that samples related to the NGDS will be registered with an IGSN and searchable through the catalog.
- Energistics (a project partner) released the Metadata Energy Industry Profile (EIP) v1.0 for ISO 19115 for public comment. CoPI Richard is a member of the Energistics Metadata Work Group and is a co-author of this release. The primary objective for the Group is to develop a metadata profile specification for discovery, evaluation, and retrieval of information and physical resources of interest to the energy industry.

Supplemental Funding

DOE-GTP approved supplemental funding of \$4,058,277, principally to enhance Task 2.4 of the SOPO on new data collection. During first quarter of Federal Fiscal Year 2011, 19 states submitted Supplemental Statements of Work and proposed budgets in a competitive bid for additional funding. The proposals were reviewed in November and rated by the Science Advisory Board based on direct utility, targeting key data acquisition, financial advantage, and viability to complete the project within the contract timeframe. AZGS provided comments pertaining to concerns regarding the SAB review rating method and consistency. The AZGS comments were forwarded to DOE project advisor for third party review and opinion. Awards for supplemental funding were awarded to 16 states, totaling \$3,678,449. The remaining funds (9%) were committed to the Arizona Governor's Office of Economic Recovery for mandatory ARRA administration, additional funding for the SAB review, and indirect costs.

The states receiving supplemental funding include:

Drilling Projects	Funding Received (\$)
Idaho*	457,662.80
Nevada*	504,201.80
Oregon*	526,803.80
Utah*	516,294.80
Washington	648,878.80

*Denotes members of the Great Basin Consortium, awarded \$1,000,000 for drilling services split equally between members. Additional funds were awarded to support sampling and drilling overrun.

Non-Drilling Projects	Funding Received (\$)
Arizona	179,976
Colorado	174,763
Indiana	69,975
Maine	49,912
Massachusetts	74,839
New Jersey	49,989
New Mexico	200,000
Oklahoma	20,000
Pennsylvania	83,425
Vermont	78,870
West Virginia	42,858

Since each state proposed some form of field work, National Environmental Policy Act (NEPA) clearance is required for each of the projects. States have submitted their EF-1s to AZGS and AZGS has submitted these to DOE. Projects are currently under NEPA review.

Staffing

AZGS continued to build the management and technical team necessary to complete the project. The following are updates on project staffing during the year.

- Pam Barry-Santos was hired as Web master.
- Kim Patten replaced Catherine Martinez-Wells as Project Coordinator.
- Celia Coleman was hired as a Geoinformatics Content Specialist to work with data submissions and web services.
- Esty Pape and Leah Musil were promoted from part time scanners and digitizers to full time Information Technology Specialists I to review and process data submissions.
- Jordan Matti was hired as Technology Transfer Specialist to assist with subrecipient education and training.
- Leif Gustad was hired as a Fiscal Services Specialist II to support the project.

- Janel Day was hired as GIS Manager to oversee AZGS's GIS and Mapping projects, permitting Ryan Clark to spend additional time on programming and data integration for the project. Combined, they also implemented a visualization schema for tracking data.
- Genhan Chen was hired as Web Service Developer to work on data integration.
- The IT Manager was dismissed from the AZGS, a search for a new IT manager has commenced.

Communications, Outreach, Technology Transfer

Website Development

The project website, www.stategeothermaldata.org, received substantial revisions to improve user access to information and data. We re-engineered the site moving from Concrete5 to Drupal 7.0 content management system. This transition helped simplify our maintenance process and improve the functionality of the site, incorporating user recognition and project management. As part of the project management component, each subrecipient was provided with a site login. They can use that login to upload reports (ARRA, quarterly, and SOW updates) as well as financial documents (invoices and reports) and data review submissions. The backend of the site allows AZGS to effectively process submissions in a timely fashion. With integration with the internal Tasks site and the Deliverables tracking site, we have been able to streamline and more easily track data submissions.

Drupal has also allowed us to more seamlessly integrate functionality such as surveys. AZGS is currently seeking input on additional applications and use portals to the catalog; feedback from industry is requested. A user survey has been initiated on the www.stategeothermaldata.org site. Plans to increase visibility to industry include collaboration with the Geothermal Resources Council and Geothermal Energy Association.

We have also implemented a new communications scheme with “newsletters” (email blasts) going to targeted project participants including the financial personnel, principal investigators, and the general public. This allows us to better target communication and reminders to the subrecipients and keep the public up-to-date on the project.

Tutorials

In the past year a number of tutorials have been released to help users understand the protocols and standards in development for USGIN and by extension the NGDS. The tutorials are housed on the revised <http://usgin.org> site. While the tutorials are centered on USGIN, all are applicable – and in many cases written specifically for – the State Geothermal Data (SGD) project. The following is a list of tutorials available:

- About USGIN
- SGD Catalog Search Client for ArcMap
- SGD Content Model
- USGIN Metadata
- USGIN Metadata Wizard
- USGIN Specifications
- USGIN URI
- USGIN Web Services
- Who Uses USGIN?
- XML

All tutorials are laid out in a step-by-step manner and some include interactive components such as the metadata quiz.

A new demonstration of the project has been designed for release at the Geological Society of America annual meeting in Minneapolis, MN scheduled for early October 2011. The demonstration takes advantage of the three screen display inaugurated last year. On one screen a demonstration of the services in various visualization and analytical tools is displayed (primarily in ESRI's ArcMap), in the second screen an overview of the map based data sets is presented, and in the third screen live search

demonstrations will take place. This format will be adjusted as necessary for the Geothermal Energy Association Expo and American Geophysical Union Meeting and Convention during the Fall of 2011.

A short course on USGIN and State Geological Survey Contributions to the NGDS was scheduled for the Geological Society of America but was canceled due to low registration numbers. However, a geothermal energy technical session co-hosted with J. Michael Rhodes of the University of Massachusetts Amherst and the Massachusetts Geological Survey was highly successful with a full session of 15 minute talks and posters. We will continue to propose similar events at future meetings while promoting informatics and the NGDS through oral presentations, invited talks, posters, and exhibits. A list of related publications and presentations follows.

Publications

Allison, M. Lee and Stephen M. Richard, 2011, *State Geothermal Contributions to the National Geothermal Data System: Annual Report 2010*, AZGS Open-file Report 11-01, 46p.

Allison, M. Lee, Linda C. Gundersen, Stephen M. Richard, 2011, "Geoinformatics in the Public Service: Building a Cyberinfrastructure Across the Geological Surveys," in *Geoinformatics*, R. Keller & C. Baru, eds, Cambridge University Press, pp. 342-349.

Richard, Stephen M., Ryan Clark, and Wolfgang Grunberg, 2011, "Application of the U.S. Geoscience Information Network to deploying a National Geothermal Data System," in *Geoinformatics*, R. Keller & C. Baru, eds, Cambridge University Press, pp.350-370.

Walker, J. D., Linda C. Gundersen, and M. Lee Allison (conveners), submitted, *Workshop on Working towards a National Geoinformatics Community (NGC)*, USGS Denver Federal Center, Denver, Colorado, September 23-24, 2010, 39p.

Presentations

Allison, M. Lee, "Perspectives from the U.S. on Data Interoperability," OneGeology-Europe final workshop, Paris, France, October 27, 2010

Allison, M. Lee, and Stephen M. Richard, invited, "State Geological Survey Deployment of the National Geothermal Data System," Geological Society of America Annual Meeting, Denver, CO, November 2, 2010, http://gsa.confex.com/gsa/2010AM/finalprogram/abstract_178582.htm

Allison, M. Lee, Stephen Richard, Linda Gundersen, & Ian Jackson, submitted, "U.S. Geoscience Information Network (GIN) and Convergence towards Global Data Integration in the Geosciences," Geological Society of America Annual Meeting, Denver, CO, October 30 - November 3, 2010, http://gsa.confex.com/gsa/2010AM/finalprogram/abstract_178715.htm

Allison, M. Lee, "GIN as a data integration framework for the Southern Arizona Template," Western Regional Partnership, Southern Arizona Template Working Group, Phoenix, AZ, November 8, 2010

Allison, M. Lee, "A Digital Revolution in Resource Exploration," SME Tucson Chapter dinner meeting, Tucson, AZ, November 10, 2010

Allison, M. Lee, "Global Data Integration in the Geosciences," Council of State Regulatory Officials, Interstate Oil & Gas Compact Commission, Annual Meeting, Tucson, AZ, November 17, 2010

Allison, M. Lee, Stephen M Richard, Ryan J. Clark, Wolfgang Grunberg, 2010, "Application of the U.S. Geoscience Information Network to deploying a National Geothermal Data System," American Geophysical Union Fall Meeting, San Francisco, CA, Dec. 17, 2010

Gundersen, L., Whitmeyer, S.J., Walker, D., Allison, L., Babaie, H., Cervato, C., Fils, D., Richard, S.M., Arrowsmith, R., 2010, "New Initiatives in the Development of a National Geoinformatics Community," American Geophysical Union Fall Meeting, San Francisco, CA, Dec. 15, 2010

Richard, Stephen M., U. S. Geological Survey Community for Data Integration, ScienceBase planning meeting, "US Geoscience Information Network", web meeting, Jan. 24, 2011

Allison, M. Lee, American Institute of Professional Geologists, Mid-year Board Meeting, "AASG Strategic Directions," Tucson, AZ, February 11, 2011

Allison, M. Lee, American Institute of Professional Geologists, Arizona Section, "Arizona Geological Survey," Tucson, AZ, February 12, 2011

Richard, Stephen M., System for Earth Science Sample Registration Workgroup Meeting, "Metadata for Geoscience Resources", San Diego, CA, Feb. 22, 2011

Allison, M. Lee, U.S. Geoscience Information Network (GIN) and Convergence Towards Global Data Integration in the Geosciences, iPlant GIS Advisory Committee, Univ. of Arizona, Tucson AZ, February 25, 2011

Allison, M. Lee, "Meeting the challenges of the 21st century with data integration," Geo-Data Informatics: Exploring the Life Cycle, Citation and Integration of Geo-Data, National Science Foundation Workshop ("GeoData2011"), Broomfield, CO, March 3, 2011

Clark, Ryan, Western Regional Partnership GIS Committee Meeting, "Brief overview of US Geoscience Information Network", Reno, NV, Mar. 8, 2011

Allison, M. Lee, "Online Data for Mining and Mineral Resources – Arizona Leads the Way," ARPA Critical Issues Conference, AZ Rock Products Association, Phoenix Airport Marriott, Phoenix, AZ, April 1, 2011

Allison, M. Lee, "Everything Digital, Online, and Interoperable," keynote address, Utah Geographic Information Council, 20th annual meeting, Riverwoods Conference Center, Logan, Utah, <http://gis.utah.gov/ugic-conference/general-information>, April 6, 2011

Allison, M. Lee, Stephen M. Richard, Arlene Anderson, and David Cuyler, "National Geothermal Data System and Global Geosciences Data Integration," ESRI Petroleum User Group (PUG) Conference, Data Management & GIS Technology - Data & Standards session, George R. Brown Convention Center, Houston, TX, April 19, 2011

Allison, M. Lee, "Everything Digital, Online, and Interoperable," Americas Petroleum Survey Group, 25th Annual Conference, Houston, TX, May 6, 2011

Allison, M. Lee, June 15, 2011, "Geothermal Data Project Annual Meeting Review," Association of American State Geologists Annual Meeting, Breakout Session, Dubuque, Iowa

Allison, M. Lee, June 13, 2011, "Web Accessibility," Association of American State Geologists Annual Meeting, Breakout Session, Dubuque, Iowa

Allison, M. Lee, June 30, 2011, "US GIN and Related Activities," OneGeology Operational Management Group Annual Meeting, Edinburgh UK

Richard, Stephen M. "USGIN and NGDS status report". IUGS CGI Interoperability Workgroup Meeting, Edinburgh, Scotland, July 4, 2011

Allison, M. Lee, and Stephen M. Richard, ESIP Federation Summer Meeting, July 12, 2011, "Geoscience Information Network (GIN) Town Hall," Santa Fe, NM, http://wiki.esipfed.org/index.php/July_12,_2011

Richard, Stephen, M. Lee Allison, and Ryan Clark, "Distributed web services for geospatial geologic information," ESRI User Conference, San Diego, CA, July 13, 2011

Richard, Stephen M, and Vivian Hutchinson, "Sustaining Community Efforts in the Geosciences: The Future of the US Geoscience Information Network," USGS Community on Data Integration workshop, Denver CO, August 17-18, 2011

Allison, M. Lee, Western Regional Partnership 4th Principals Meeting, Salt Lake City, UT: update on NGDS, GIN and progress on working agreement for data integration with WRP, September 16, 2011

Patten, Kimberly, and Lee Allison, "State Geological Survey Contributions to the National Geothermal Data System," State of Arizona, Governor's Office of Energy Policy, Geothermal Heat Pumps in Arizona Policy Workshop, September 22, 2011

Conference Exhibits

Geothermal Resources Council annual meeting and expo in Sacramento, CA, Oct.24-Oct.27, 2010.

Geological Society of America Annual Meeting in Denver, CO, Oct.30-Nov.3, 2010.

Geothermal Energy Association, Geothermal Energy Technology and International Development Forum, May 4, 2011, Wash. DC [AZGS State Geothermal Data exhibit booth]

Geothermal Energy Association National Geothermal Summit, Reno, NV August 16-17, 2011

Web Presentations

AZGS Webcast: "Thermal Profiling of wells for thermal conductivities and heat fluxes in active sedimentary aquifers," Dr. Franklin Horowitz, Research Professor, at University of Western Australia, School of Earth & Environment, and the Western Australia Geothermal Center of Excellence, January 28, 2011

AZGS Webcast: "Geothermal air conditioning opportunities in hot sedimentary Aquifers," Dr. Franklin Horowitz, Research Professor, at University of Western Australia, School of Earth & Environment, and the Western Australia Geothermal Center of Excellence, January 28, 2011

AZGS Webinar: "Metadata tools and workflows for AASG Geothermal Data", February 15, 2011

AZGS Webinar: "Metadata tools and workflows for AASG Geothermal Data", February 16, 2011

AZGS Webinar: "Web Services for Bottom-Hole Data," March 16, 2011

AZGS Webinar: "AZGS HUBS – Data and Serving Data," April 12, 2011

AZGS Webinar: "AZGS HUBS – Data and Serving Data," April 26, 2011

AZGS Webinar: "Reviewing Data for Online Delivery." May 17, 2011

Richard, Stephen M. "USGIN and WRP" (linking WRP's catalog to the GIN network), AZGS Webinar, September 12, 2011

Workshops

AASG State Geological Survey's Contributions to the National Geothermal Data System Hub Training Workshop. Tucson, AZ August 2-3, 2011

News media interviews and coverage

PI M. Lee Allison with Daryl Bjoraas, "Geothermal Energy in Arizona," Arizona Capitol Television (ACTV), Phoenix, AZ, January 27, 2011

Kim Patten contribution to *Arizona Geology*, "New Geothermal Data Collection Funded in Fifteen States" Tucson, AZ Spring 2011, [correction: 16 funded projects]

http://azgeology.azgs.az.gov/archived_issues/www.azgs.az.gov/arizona_geology/spring11/article_geothermal.html

M. Lee Allison, live hour-long interview on Geothermal Energy with host Brian Hageman and former Congressman Barry Goldwater Jr, Deluge Energy Report Radio Show, KFAX -1100AM, Tucson AZ (and webcast), June 21, 2011

PI M. Lee Allison with Dylan Tussel, Columbus [Ohio] Dispatch: re geothermal energy, State Geothermal Data, and NGDS, August 18, 2011

Scheduled Events (post- Sept. 30, 2011)

Geothermal Resources Council 35th Annual Meeting and GEA Trade Show, San Diego, CA, October 23-26, 2011 [AZGS State Geothermal Data exhibit booth]

Geological Society of America Annual Meeting, Minneapolis, MN, October 9-12, 2011 [AZGS State Geothermal Data exhibit booth]

American Geophysical Union Fall Meeting, San Francisco, CA, December 5-12, 2011 [AZGS State Geothermal Data exhibit booth]

Anderson, Arlene F., Cuyler, David, Snyder, Walter S., Allison, M. Lee, Blackwell, David D., and Williams, Colin F., 2011, National Geothermal Data System: Geological Society of America Abstracts with Programs, v. 43, n. 5, abstract 9-10 (Sunday, October 9, 2011, 10:50 AM)

Allison, M. Lee and Gallagher, Kevin T., 2011, U.S. Geoscience Information Network: A Critical Path for Data Integration in the U.S. Earth Sciences: Geological Society of America Abstracts with Programs, v. 43, n. 5, abstract 170-10 (POSTER, Tuesday, October 11, 2011, 9:00 AM – 6:00 PM)

Jackson, Ian, Broome, John, and Allison, M. Lee, 2011, Delivering Geoscience Knowledge in Federal Systems: Geological Society of America Abstracts with Programs, v. 43, n. 5, abstract 223-10 (Wednesday, October 12, 2011, 11:00 AM)

Love, Diane S., Coleman, Celia, Pape, Esty, Clark, Ryan C., Richard, Stephen M., and Allison, M. Lee, 2011, State Geothermal Survey Contributions to the National Geothermal Data System: Geological Society of America Abstracts with Programs, v. 43, n. 5, abstract 9-10 (Sunday, October 9, 2011, 11:05 AM)

Patten, Kimberly, Allison, M. Lee, and Richard, Stephen M., 2011 U.S. Geoscience Information Network: Distributed Deployment Across 50 States: Geological Society of America Abstracts with Programs , Vol. 43, No. 5, abstract 170-11 (POSTER, Tuesday, October 11, 2011, 9:00 AM – 6:00 PM)

Allison, M. Lee, October 27, 2011, "Renewable Energy, Geologic Hazards, and Risk," Arizona Land Subsidence Group and Association of Environmental & Engineering Geologists (AEG) Conference on "Opportunities for Alternative Energy Development in Arizona and the Southwest– Geologic/Hydrologic Considerations," 2011 Shlemon Specialty Conference, Tempe, AZ

Wunsch, David, and M. Lee Allison, "Web-based Information Services Available from State Geological Surveys to Assist Your Well Contracting Business," National Ground Water Association Annual Meeting and Expo, November 30, 2011

Andersen, Arlene F., David Cuyler, Walter S. Snyder, M.L. Allison, David D. Blackwell, Colin F. Williams, "National Geothermal Data System," American Geophysical Union Annual Conference, San Francisco, CA, December 7, 2011

Allison, M.L., Stephen M. Richard, Ryan Clark, Celia Coleman, Diane Love, Esty Pape, Leah Musil, "Online, interactive assessment of geothermal energy potential in the U.S." American Geophysical Union Annual Conference, San Francisco, CA, December 7, 2011

Gallagher, Kevin T., M.L. Allison, "A Critical Path for Data Integration in the U.S. Earth Sciences," Poster Session, American Geophysical Union Annual Conference, San Francisco, CA, December 9, 2011

Jackson, Ian, Henry John Broome, and M.L. Allison, "Delivering Geoscience Knowledge in Federal Systems: What Can the Old and New Worlds Learn from Each Other?" Poster Session, American Geophysical Union Annual Conference, San Francisco, CA, December 9, 2011

Allison, M. Lee, Stephen M. Richard, Ryan C. Clark, Kim Patten, Diane S. Love, Celia Coleman, Genhan Chen, Jordan Matti, Janel Day, Esty Pape, and Leah Musil, 2012, "Online, Interactive Assessment of Geothermal Energy Potential in the U.S.," Stanford Geothermal Workshop, Palo Alto, CA, January 30

Allison, M. Lee, "Geothermal Exploration: Everything Digital, Online, and Interoperable," luncheon address, Energy Minerals Division annual meeting, American Association of Petroleum Geologists Annual Conference, Long Beach, CA, April 25, 2012

Schedule, Milestones, and Status

Management, Administration, and Reporting Plans for FY 2012

The primary plan for FY2012 is to continue with full production mode networking data from all fifty states. This is achieved by providing support to subrecipient data collection including finalizing additional content models, tutorials, and QA/QC of incoming data sets.

In February 2012 a preliminary user interface (currently in Beta test mode) will become v1.0 allowing for search capabilities within the NGDS. In addition, client side applications will be available and tutorials on accessing data will be completed.

In May of 2012 the project will participate in the annual peer review organized by the Geothermal Technologies Program. We intend to meet or exceed our previous review scores.

In June of 2012 the MAB and SAB will meet in Austin, TX at the AASG Annual Meeting to plan for the final year of the project and review/approve the Year 3 Statements of Work by the subrecipients.

In July of 2012 AZGS will host a technical workshop for project subrecipients in conjunction with the ESIP and DataOne User Group meeting in Madison, WI. The goal of this workshop is to resolve any remaining issues with data collection (for example content models that may have been minimally used up until the final year) and provide a framework for sustainability of the system.

AZGS will maintain ongoing staff meetings and project planning reviews as well as provide quarterly and annual reporting to DOE.

Technical Plans for FY 2012

The following are highlights and milestones for FY 2012:

- October – Release new exhibition hall demonstration of the network’s capabilities and current data sets
- December – Coordinate with the IGSN on recording and cataloging geoscience samples
- January – Finish metadata scrub of current AASG catalog (enhancing initial metadata records and permitting updates by the content provider to existing metadata records); geologic map (contact, faults, geologic units) content model
- February – Release AASG access portal into the NGDS v1.0 (currently in BETA), demonstrate catalog harvesting capabilities
- March – Spring hub workshop in preparation for YR 3 data and system backup
- April – Coordinate industry review of datasets and system
- May – Collect statements of work for YR 3
- June – SAB meeting in Austin, TX to review YR 2 Deliverables and YR 3 SOWs
- July – Project technical lead workshop at ESIP/DataOne meeting on network sustainability
- August – Draft written sustainability plan
- September – Tutorials on developing user interfaces and client side applications will be released.

Ongoing – Review of incoming datasets, maintenance of current services, and development of additional content models as necessary.

Cost Status

As of September 30, 2011 the project has expended \$4,640,435. This is behind schedule. The setback is primarily due to delayed contract starts during Year 1. In addition, hiring freezes by mostly state agencies has further delayed the start of the project in those states (this is reflected in the ARRA Jobs Reporting demonstrated in the next section). Currently, all but two of the subrecipients are fully operational and mitigation measures with the two nonconforming recipients are in place.

To date a total of \$89,519.58 in cost share has been reported.

ARRA Jobs Reporting

As reported by the subrecipients, the jobs created or saved have steadily increased over the year. The following table reflects reported jobs.

Reporting Quarter with Period	Jobs Created or Saved
Q1 (Oct – Dec 2010)	28.31
Q2 (Jan – March 2011)	40.8
Q3 (April – June 2011)	48.3
Q4 (July – Sept 2011)	52.1

Positions created or saved under this award include professional positions in the sciences and computer programming as well as administrative. In addition a number of workforce development positions have been created to educate and train the next generation of scientists.

The following contains a representative sample of the positions reported as created or saved during FFY 2011:

- Analyst
- Assistant Scientist
- Computer Software Engineer
- Data Specialist
- Database Administrator
- Departmental Assistant
- Digitizer
- Environmental Administrator
- Environmental Scientist
- Environmental Technician
- Executive Officer
- Geoinformatics Specialist
- Geologic Program Manager
- Geological Technicians
- Geologist I, II, III, IV, V
- Geologist in Training
- GIMS Database Administrator
- GIS Analyst
- GIS Specialist
- GIS Technician
- Graduate Research Assistant
- Hydrogeologist
- Information Manager/Specialist
- Intern
- Lab Technician
- Librarian
- Petroleum Geologist
- Post-Doctoral Associate
- Principal Geophysicist
- Program Manager
- Programmer
- Research Associate
- Senior Cartographer
- Senior Geologist
- Senior Scientist
- Senior Systems Administrator
- State Geologist
- Supervising Environmental Engineer
- Technical Assistant
- Technology Transfer Specialist
- Web Administrator
- Web Applications Developer

Actual or Anticipated Problems or Delays

Delays during the reporting period are mostly related to late contract starts as explained in the “Cost Status” section of this report. The intended mitigation measure is to request a no-cost extension through Calendar Year 2013 to cover three full calendar years for all but two of the negotiated contracts. Delayed contracts were required to submit statements of work and budget forms indicating a shorter performance period.

For FFY2012 one of the primary anticipated delays is compliance with the National Environmental Policy Act (NEPA) for the supplemental funding awards. Since the initial award was primarily digitizing existing data a paperwork exclusion was provided for the project. The new data collection awards funding for fieldwork and drilling. As such, compliance and approval from the funding agency is required. A majority of the EF-1s for the new data collection projects were submitted in 2011 by the subrecipients. Review is expected to take several months. Again, a no cost extension to allow for this delay would be beneficial for the success of the project.

An unanticipated, but actual delay, has occurred in staffing for this project. Due to the unique nature of the project, which features the emerging field of geoinformatics (merging of computer sciences and geosciences), recruiting qualified employees, has been difficult. Most staff have an educational background in a specified field with a personal interest in the other. Since this is a new field very few universities embrace such a coordinated degree. In addition, limitations on salary for state employees minimizes the pool of interested candidates. We have, however, found success in hiring recent university graduates who have shown an interest in the complementary field and training them on specific requirements.

Statement of Project Objectives Status of Tasks and Milestones

PHASE 1 – DATA RETRIEVAL, COLLECTION, DEVELOPMENT, AND QUALITY ANALYSIS

Task 1. RDC and QA vision

Purpose: Specify how this project will advance and dovetail with ongoing NGDS design, testing, and management

Approach: Meet with NGDS Boise State project team to plan coordination between the data acquisition activities of this project and NGDS system development.

Milestone: Meeting of project managers and developers from Boise State NGDS project and AASG NGDS project to plan project coordination.

Outcome: Pledges of a coordinated approach and vision for NGDS development.

STATUS: Milestone completed. As a result of the NGDS Architecture Design, Testing, and Maintenance continuation plan as accepted by DOE and Boise State University on May 3, 2011 a Programmatic Working Group has been identified to advise on the coordinated approach and vision of the NGDS among all NGDS projects. The Programmatic Working Group consists of the lead investigators (or their designee) from each of the five subrecipients and an ex officio non-voting member from DOE. In addition Colin Williams of the USGS will participate. The group meets once per quarter.

Task 2. Data Retrieval, Collection, and Development

Purpose: Consistently identify, add, collect, and document data from participants to the NGDS

Approach: The Project's Science Advisory Board (SAB) will serve as a peer review panel to approve the data types, amounts, and priorities on an annual basis for each Project participants.

Milestone: The SAB will review and approve or recommend changes to each participant's Scope of Work for each year of the project. Each subcontractor will be expected to deliver at least one data product for each Phase One cycle in which they receive funding. Bring IT specialists aboard at beginning of Phase I to manage the servers and provide support to participants.

Outcome: Appropriate prioritization of each participant's contributions to NGDS.

STATUS: Annual milestone complete. The SAB has held two formal onsite meetings to review the subrecipients statements of work (SOWs) for Years 1 and 2. In addition, several webinars and email communications have occurred for supplemental funding SOWs and SOWs with outstanding issues.

Subtask 2.1 Determining amounts and types of data that will be made available

Purpose: To identify the types of data most relevant to the geothermal resources in each state, prioritize that to be added to NGDS, and establish annual deliverables and milestones for subcontractors.

Approach: Each state will identify the types of data most in demand or most critical to identifying and characterizing its geothermal resources by cataloguing its data resources, and submitting a statement of work to the Science Advisory Board for review and approval at regular intervals. This Scope of Work will explicitly identify deliverables and milestone for the subsequent work period.

Milestone: Submission of Scope of Work listing the amounts and types of data proposed for digitization and inclusion. At regular intervals, submission of deliverable products is a prerequisite for submission of a Scope of Work for the work period.

Outcome: State-by-state determination of data priorities to support local situations, milestones and deliverables as metrics for subcontractor performance.

STATUS: Annual Milestone Complete.

Subtask 2.2 Collection, digitization, and indexing of “legacy” data

Purpose: Digitize existing priority data to add to state-based data bases.

Approach: Each state will digitize data, beginning with their highest priorities developing metadata as they do so and populate state-based data bases. AZGS will coordinate data structures to promote compatibility between data from different states.

Milestone: Data will be added incrementally and continually. Specific product delivery schedules will be based on SAB-established priorities and the size and complexity of targeted data.

Outcome: Populating of state data bases with the most at risk or important data.

STATUS: Ongoing. All states are required to submit data as developed and report on results an annual basis.

Subtask 2.3 Documenting and adding digital data bases to the NGDS

Purpose: Add existing digital data to the NGDS with appropriate metadata

Approach: Expose existing digital data bases to the NGDS or convert obsolete digital databases to data schema and formats suitable for incorporation in to NGDS, based on priorities established by the Science Advisory Board.

Milestone: Digital databases will be converted and/or documented incrementally and continually. Specific product delivery schedules will be based on SAB-established priorities and the size and complexity of targeted data.

Outcome: Preservation and addition of digital data to the NGDS and conversion of at-risk digital data for inclusion in NGDS.

STATUS: Ongoing. Based on databases housed at the subrecipients and recommendations from the SAB existing databases are being converted into interoperable formats with metadata that is searchable within the catalog. Examples of these databases include numerous oil and gas borehole databases, water well databases, and earthquake databases. Coordination with related organizations (such as CUAHSI, OneGeology, etc.) is also underway with the integration of the OneGeology catalog expected in early 2012.

Subtask 2.4 Collection of new data

Purpose: Make new measurements calculations, and interpretations, and collect samples.

Approach: Each state will assess the extent, usefulness, and nature of data to determine what gaps are most critical to fill.

Milestone: Data will be collected incrementally and continually. Specific product delivery schedules will be based on SAB established priorities and the size and complexity of targeted data.

Outcome: New data will lead to derived geothermal gradients, heat flow, thermal conductivity, radioactive heat production numbers, and other geothermal relevant data as necessary in areas where such data are inadequate or lacking.

This subtask will include new data contributions from the following:

- *Subtask 2.4 (A) Wisconsin:* See general Subtask 2.4 description above.
- *Subtask 2.4 (B) New Mexico:* See general Subtask 2.4 description above.

- *Subtask 2.4 (C) Washington: See general Subtask 2.4 description above.*
- *Subtask 2.4 (D) Indiana: See general Subtask 2.4 description above.*
- *Subtask 2.4 (E) West Virginia: See general Subtask 2.4 description above.*
- *Subtask 2.4 (F) Oklahoma: See general Subtask 2.4 description above.*
- *Subtask 2.4 (G) Massachusetts: See general Subtask 2.4 description above.*
- *Subtask 2.4 (H) Connecticut: See general Subtask 2.4 description above.*
- *Subtask 2.4 (I) Vermont: See general Subtask 2.4 description above.*
- *Subtask 2.4 (J) Colorado: See general Subtask 2.4 description above.*
- *Subtask 2.4 (K) Idaho: See general Subtask 2.4 description above.*
- *Subtask 2.4 (L) Utah: See general Subtask 2.4 description above.*
- *Subtask 2.4 (M) Oregon: See general Subtask 2.4 description above.*
- *Subtask 2.4 (N) Nevada: See general Subtask 2.4 description above.*
- *Subtask 2.4 (O) Maine: See general Subtask 2.4 description above.*
- *Subtask 2.4 (P) Arizona: See general Subtask 2.4 description above.*
- *Subtask 2.4 (Q) New Jersey: See general Subtask 2.4 description above.*
- *Subtask 2.4 (R) Pennsylvania: See general Subtask 2.4 description above.*

STATUS: Ongoing. Contract modifications, statements of work, and workplans for each of the above listed new data collection tasks are complete. Most of the EF-1s for NEPA clearance were submitted; some of the more complicated drill site NEPA requests remain including Oregon, Idaho, and Nevada. This is primarily due to the necessity for state review prior to submission for federal review.

Subtask 2.5 Creation of metadata catalogs

Purpose: Provide for easy user discovery of and access to data in the NGDS

Approach: Set standards and requirements for metadata content and procedures for entry and preservation of metadata for all information resources exposed to the NGDS. Metadata will be made available through the standard Open Geospatial Consortium Catalog Services for the Web (CSW) interface. AZGS will work with each data provider to determine the most efficient procedure to create metadata and enter it into the NGDS catalog.

Milestones: Profiles for metadata content and catalog service implementation are being developed currently, under the primary NGDS project. Implementation of the catalog system will be demonstrated during Phase I of that project. Metadata production and entry into the catalog will be an integral part of data acquisition, so milestones for this task will be synchronized with milestones for Subtask 2.2, 2.3, and 2.4.

Outcome: Accessible and searchable online metadata describing the type, nature, amount, and location of data available through NGDS will be available for NGDS users and for external applications in open source environments.

STATUS: Complete. The Geoportal catalog service was launched during this fiscal year and currently houses over 30,000 records. Catalog is operational, and maintenance, quality monitoring, and harvest of other relevant metadata will be ongoing.

Task 3. Quality and integrity analysis of the data

Purpose: To ensure the quality and integrity of the data provided to NGDS meets the system standards.

Approach: AZGS will follow the guidelines of the EPA "Guidance for Quality Assurance Plans". AZGS will also use guidelines in place and under development for the NNGDPP National Digital Catalog that are being used by all the SGSs currently, and guidelines developed for the US

Geosciences Information Network. In addition, AZGS will employ standard measures of quality using statistical tools expected to be provided by the NGDS to assess variability, bias, systematic error, imprecision, accuracy, precision, reproducibility, etc.

The project will disseminate preliminary guidelines for data content, format, and quality to all participants at the start of the project and require that each participant address them in the Scopes of Work to be reviewed for the first cycle of Phase 1 by the SAB. Final policies and procedures for metadata and data submission, validation and acceptance will be developed by the technical team, in collaboration with the NGDS prime development team during Phase 1, and submitted to the Management Board for review and approval, and subsequent Scopes of Work will be required to conform to these policies.

Milestone: Regular reviews of each data provider's Scope of Work and regular reviews of accomplishments, to ensure compliance with NGDS procedures and goals.

Outcome: Establishment, documentation, and maintenance of data quality in the NGDS.

STATUS: Ongoing.

Task 4. Establish regional technical resource centers

Purpose: To provide training, guidance, and assistance to Surveys in developing and implementing data quality and integrity guidelines, developing metadata, implementing data services, and configuring their servers to link seamlessly with the NGDS.

Approach: The project will establish multiple regional technical resource centers with a programmer/developer in each one, to serve that region. These centers will utilize existing facilities at the host agency.

Milestone: Hiring of the regional programmers will occur during the beginning of Phase I.

Outcome: Technical resources will be working with participants to meet project goals and standards.

STATUS: Complete. Workshops to discuss sustainability and back-up systems for the hub network are ongoing.

PHASE 2 – TRANSFER AND VALIDATION OF INFORMATION TO DATA SYSTEM

Task 5.0 Data integration into NGDS

Purpose: Enable catalogs and databases to be exposed to the network for discovery, access, and retrieval

Approach: Develop, document, implement, and deploy web services to enable open access to information resources of the NGDS

Milestone: Service specifications are being developed as part of the NDGS Prime project and will be ready for deployment early in Phase I. Data exchange procedures are ready to be implemented now, but they will be made more user-friendly throughout the project. Service implementation and deployment will be prioritized to make data that the SGS collaborators are producing during each cycle accessible.

Outcome: The NGDS is an effective system to enable discovery and access to data provided by the state geological surveys using standard interfaces.

STATUS: Ongoing. Initial data exchange procedures are in place

(http://stategeothermaldata.org/data_delivery/data_dev_tech).

Subtask 5.1 Registration of resources.

Purpose: Enable data providers to register their resources by publishing metadata in the NGDS catalog. Verify that metadata meets requirements, and that registered resource exists and can be accessed using information in metadata.

Approach: Acceptance and publication of metadata in the NGDS catalog will be the formal mechanism for making a resource part of the NGDS. The publication process requires a validation process to determine that metadata and the described resource are conformant with system requirements. This is a technical validation, not a scientific review. Project technical staff will work with data and application providers to efficiently produce metadata meeting system requirements and publish it using the NGDS core, and to develop automated processes for data and metadata validation. Policies for this validation process developed by Project technical staff and the NGDS core team, reviewed for approval by the Technical Advisory Board, and once approved, will be made publically available.

Technical approaches for metadata publication include provider exposing conformant metadata through their own catalog service, use of web crawling software to harvest metadata from other online information provided by data provider, submission of metadata in a structured file for import to the metadata catalog, or production of metadata directly into the catalog using online forms. Once metadata is available from at least one catalog server in the system it can be harvested to archive in the NGDS Core catalog.

Milestone: Data delivered by project participants as Task 2 deliverables validated and registered to become part of the NGDS following a documented process.

Outcome: Allows participants to expose data, metadata, and catalogs to the NGDS as soon as they are available using a standard registration, validation, and publication process that provides data consumers with confidence in the quality of the products.

STATUS: Resources are being registered by entering metadata in USGIN repository or submitting Excel Workbooks with metadata loaded into a spreadsheet table.

Subtask 5.2 Implementing data exchange software 'wrappers' to provide for interoperability of databases

Purpose: Provide tools and guidance to map data into interchange formats used by web services to make data available interoperably.

Approach: Project technical staff will prepare training manuals ('cookbooks') and offer workshops on how to encode information for transmission and integration into NGDS. The technical staff will consult by phone and online with data providers. For providers without the technical staff to implement the interchange mapping, the AZGS project staff will do it for them. Schema and vocabulary mapping necessary to produce the interchange formats may be done using queries in a database, through xml transformations, or using custom software. Standardization of the interchange formats will reduce the amount of development required by enabling reuse of components and workflows.

Milestone: Each data delivery package will require implementation of access through NGDS services using standard interchange formats, so the mapping of data schema and vocabulary, and document formatting required to produce interchange-format documents will be coupled with data delivery (subtasks 2.2, 2.3, 2.4). Training and assistance will be carried out continuously throughout all Phases.

Outcome: Data providers will have the ability to transform their own data and assistance and tools will be available for others to map their data into NGDS interchange formats.

STATUS: Templates for interchange formats are at http://stategeothermaldata.org/data_delivery/content_model_templates. Templates created for AASG Geothermal Data project are at various stages of review process to be recommended for all NGDS data projects.

Task 6.0 “Uploading” data to the NGDS

Purpose: To make each provider’s data accessible to the NGDS through standard web service interfaces.

Approach: Providers will publish their data via services, which they may implement themselves, or work through arrangements with other providers or the NGDS core. Services will follow documented NGDS service conventions.

Milestone: Have multiple NGDS nodes delivering data live in an operational prototype network for the data delivered in the first Phase One data acquisition cycle, with at least one operational, production OCG CSW catalog service. Later, have data services implemented and in production operation for data delivered in the second Phase One cycle, and have services implemented and tested for inclusion of data delivered at the end of the third Phase One cycle.

Outcome: Data available to NGDS clients; establish pattern and technology for open data publication that will enable growth of the data cloud independent of any particular project.

STATUS: Ongoing. Initial milestone of having multiple NGDS nodes delivering data live in an operational prototype network is complete. Nodes include the hub states as well as states that are self-serving data such as Indiana, Kansas, and Colorado.

Task 7.0 Establishing links and/or virtual portals to the retrieved/collected/developed data

Purpose: To make data and service products available through the NGDS Geothermal Desktop and other web portals

Approach: Project technical staff will work with the NGDS Geothermal Desktop developers and external groups to create necessary web services, ontologies, and interface standardization to link the aggregated data resources of the project to NGDS web portal and enable other, independent portals to interface with the System. Work with other client application developers to implement connectors to NGDS catalog and data services. The objective is to enable widely used, off the shelf, ideally low-cost or free, software to access data provided by NGDS.

Milestone: Demonstrate access to at least one NGDS data service by client applications (desktop or web based). Demonstrate access to all implemented NGDS services by at least one client application. The NGDS Prime Geothermal Desktop is an obvious first choice of clients, but software development for this application is under control of the NGDS core project, so AZGS cannot set milestones based on development if its functionality.

Outcome: Software applications are available that will access and utilize project resources.

STATUS: Project technical staff has created a client application for ESRI ArcMap product for searching the NGDS catalog and data services, in addition a BETA web based search portal is available. Our plan is to improve upon the search portal and continue working with application developers to create access points. At this time we cannot report on interactions with the NGDS Geothermal Desktop developers as the scope of the Geothermal Desktop has changed. Boise State University announced that they will not be building the user interface and desktop tools described in the original NGDS (“Design and Test”) proposal, nor was it their intent to do so. Thus, we are reallocating resources from this project and other USGIN projects to fulfill this critical project component, at least at a basic level.

Task 8.0 System testing in conjunction with NGDS

Purpose: By the time AZGS is in late Phase I and Phase II, where they are starting to register data services with catalogs and implement data exchange standards, the NGDS will still be in development and testing of key components of the system.

Approach: Work with NGDS Core development team to test services and data formatting. NGDS core has stated intention to implement service status monitoring, and AZGS hopes to include conformance testing of data services against technical specifications. An operational network will require ongoing monitoring, and standardized performance and reliability testing. In collaboration with NGDS core developers, define standard tests of NGDS services that can be run to determine if service instances are functioning properly.

Milestone: Development of system to monitor service availability and make current status of system services visible to users. Implement more than one functional unit test modules by end of project.

Outcome: Beta-style development, deployment, and testing of key components of NGDS increases reliability of services and quality of data and metadata.

STATUS: We are awaiting deployment of NGDS catalog node by BSU team to test interoperability of metadata. We have harvested metadata from the SDSC GEON catalog, but the quality of the metadata was poor and no records were imported. Preliminary testing of harvest from USGS National Digital Catalog was successful, but the records were incomplete; further USGS development is under way and we anticipate bi-directional harvesting in the next quarter.

Task 9.0 Assurance of the integrity of the original data set

Purpose: Establish criteria that can be used to filter data and categorize them according to established and user-defined quality levels.

Approach: Research will be necessary to identify automated processes that may be used to assess quality of data offered by a service. Automation can be used to assess conformance to usage of controlled vocabularies and schema cardinality requirements, the percentage of data fields that are null or have invalid data type values, and other similar metrics. More subjective judgment of data quality can be made by the data provider and provided in metadata data quality elements, but these will probably not be mandatory in the near term because the information is commonly not available. A system for user feedback on data quality will be investigated as well. Implementation of such complex advanced features is not within the scope of the current project, but AZGS will work with NGDS core developers to identify approaches that can be implemented with resources available. Available quality information will be reported with each metadata search. When data with incomplete metadata is identified the entity responsible for the metadata will be notified.

Milestone: Criteria will be reviewed with the NGDS Prime project during service development. At least one integrity test will be selected for implementation with service per year

Outcome: The system will assist users to evaluate data quality and enable filtering of datasets according to their needs.

STATUS: AZGS participates in the NGDS Architecture Design phone calls which occur every other week. Data submitted by states is reviewed in spread sheet formats before deployment as a web service. We have developed a rule based validation tool to test metadata records for conformance with specifications, and are experimenting with FGDC web service status-checking service as an approach to monitoring service up-time and response time. This will be a major focus during the last year of the project.

PHASE 3 – EXECUTION OF DATA MAINTENANCE SUSTAINABILITY PLAN

Task 10.0 Formulation of the data maintenance and sustainability strategy

Purpose: Ensure availability, reliability, and update of data and services in the NGDS during and beyond the project.

Approach: Educate system data providers and users through workshops at the regional technical resource centers. Data provided by state geological surveys can be hosted by the originating survey, at one of the regional centers, or by the NGDS core, and depending on policies developed by NGDS may be mirrored by other NGDS system servers. Regional centers will mirror and backup data for their region, and provide redundant service instances to prevent a single point of failure. Develop a business model to sustain system maintenance for data and services by engaging stakeholders who have financial resources available and an interest in continuing system operation.

Milestones: Create a network of NGDS servers with the regional centers, and determine what resources each center will mirror and backup. Implement mirroring and backup during Phase 3. Sustainability plan must be in place

Outcome: Data and services are backed up and a system is in place for continuity beyond the duration of the project.

STATUS: Ongoing. Initial meeting between hub participants occurred to initiate sustainability plan.

Subtask 10.1 Implementation of regional aggregation services and back-up of data

Purpose: To ensure data backup, continuity of service, and the potential for a permanent repository

Approach: Each regional center will host a data server that provides multiple functions: mirrored services for state servers in that region to ensure data backup, continuity of service, and the potential for a permanent repository.

Milestone: Multiple regional backup and mirroring systems will be set up and configured.

Outcome: Data are backed up and aggregated for enhanced functionality.

STATUS: Scheduled to begin in Year 3

Task 11.0 Adding new technical or institutional data

Purpose: Add new data from participants and add participants

Approach: Participants will revise their Scopes of Work regularly in accord with guidance from the Scientific Advisory Board. Project management will be seeking participation by additional data and service providers throughout the project.

Milestone: Participants will quantify and identify their data to be provided at the beginning of the project and update plans regularly as new data become available.

Outcome: The system operates in a mode of continual update and expansion.

STATUS: Ongoing. Project management is continually seeking new avenues and data providers for the system. Perhaps the most significant partnership this year is that of WRP. In addition, the new IGSN sample repository will provide integration with the network and mechanisms for subrecipients to deliver geoscience sample data to the system (this will require that SOWs are revised to reflect the new repository).

Task 12.0 Publicizing addition of the new data

Purpose: To keep providers and users aware of new data available

Approach: Use the project Technology Transfer plan (Subtask 13.4) and provide notification and syndication features in the servers and portals so that users can receive automatic notification

when new data are available, including ability to select only data from certain areas or of certain type.

Milestone: Technology Transfer and public outreach have begun during the project negotiation phase and will be ongoing throughout the project.

Outcome: Increase the use and value of the NGDS.

STATUS: Ongoing. New data sets and services are listed on the project website – www.stategeothermaldata.org, and highlighted on the main page with an active feed listing the latest additions. Presentations at national meetings (GSA, AGU, GEA, ESIP) are being used to increase visibility and awareness of the system.

Task 13.0 Project Management and Reporting

Purpose and Approach: Reports and other deliverables will be provided in accordance with the Federal Assistance Reporting Checklist following the instructions included therein.

Comprehensive reports at the end of each project phase will serve as the basic milestones for each of the tasks and their subtasks. These reports will serve as the basis for go / no-go decisions for the project as a whole and for the various tasks. It is anticipated that the review of the reports will also lead to revisions of the tasks and subtasks as necessary.

Outcome: Quarterly and Phase I Reports.

STATUS: Ongoing. All ARRA Jobs Reporting and Quarterly Reports were submitted on schedule and approved. This report completes the Annual Report requirement as outlined in the Federal Assistance Reporting Checklist.

Subtask 13.1 Implementation of organization structure

Purpose: To achieve project goals on budget and on schedule

Approach: Establish a management team at AZGS for the project; outline duties of the Management and Scientific Advisory Boards and appoint members; coordinate with the external Technical Advisory Board; implement the project Communications Plan; develop the Technical Training Plan.

Milestone: The Management Team is already in place, with the hiring of a full-time project manager and administrative assistant. The MAB and SAB duties will be established and members appointed by the official start of the project. The Communications Plan is under development and will be completed during the beginning of Phase I. The web developer/graphic designer has been hired. The Technical Training Plan will be developed during the beginning of Phase I.

Outcome: The Management Team is in place prior to the project kick-off to ensure that project goals will be met.

STATUS: Complete. Over the last year changes in project team staffing occurred and the Technical Advisory Board was absorbed by the NGDS wide committee.

Subtask 13.2 Coordination among participants, collaborators, NGDS, and stakeholders

Purpose: To ensure the project meets the needs of the NGDS, as well as project participants, collaborators, and stakeholders.

Approach: Establish advisory boards (describe in Tasks 2, 3, and 13.1); integrate NGDS key personnel into the project management and technical processes; hold regular meetings with NGDS and participants; establish formal affiliations among participants and collaborators; develop regular working relationships among the parties.

Milestone: The formal relationships will be largely complete prior to the project kick-off. Informal working relations are established and will continue to be nurtured. Schedules

and plans for formal meetings and reviews will be partly completed prior to the project kick-off and finalized during the beginning of Phase I. Meeting schedules will be set on a regular basis.

Outcome: AZGS will have a well-coordinated and effective interactions and collaboration among all parties.

STATUS: Ongoing.

Subtask 13.3 Milestones

Purpose: To coordinate the project deliverables with the NGDS

Approach: Management and technical staff from the project and from NGDS are working collaboratively and will be formally integrated into the respective projects.

Milestone: NGDS standards and protocols will be developed during Phase I and implemented for project data concurrently. Networking functions will be implemented during Phase II.

Outcome: NGDS standards and protocols will be available to project data providers at the appropriate time to contribute to the NGDS

STATUS: Ongoing. Setbacks related to the NGDS Architecture Design have delayed implementation of NGDS standards and protocols. We have implemented USGIN compliant standards and protocols in the interim. Since USGIN is the platform for the NGDS, the data will be interoperable.

Subtask 13.4 Technology Transfer

Purpose: To reach out beyond the project participants and collaborators

Approach: Make presentations at geothermal and geosciences meetings and conferences; exhibit at technical and industry conferences (in partnership with NGDS core, AASG, and others as opportunities permit); maintain and contribute to Web site(s); hold workshops and seminars (for data providers) opened to non-SGS's; prepare and distribute training materials (cookbooks and online tutorials) freely to anyone.

Milestone: Presentations and exhibits are already being made prior to the kick-off. A regular work plan will be developed in the beginning of Phase I and updated as needed.

Outcome: Effective communications to data and service providers and users about the NGDS capabilities and opportunities.

STATUS: Ongoing. Tutorials are developed based on user and subrecipient feedback. Conferences and exhibits are selected using the following criteria: a) applicability to field of informatics, b) AASG sponsored or heavily attended events, and c) geothermal industry sponsored or heavily attended events.

Attachment 1

Participants in Project

AK – Alaska Division of Geological & Geophysical Surveys
AL – Geological Survey of Alabama
AR – Arkansas Geological Survey
AZ – Arizona Geological Survey (AZGS)
CA – California (performed by AZGS)
CO – Colorado Geological Survey
CT – Connecticut (performed by MAGS)
DE – Delaware (performed by VADGMR)
FL – Florida Geological Survey
GA – Georgia (performed by VADGMR)
HI – University of Hawaii
IA – Iowa Department of Natural Resources-Geological & Water Survey
ID – Idaho Geological Survey
IL – The Board of Trustees of the University of Illinois, Illinois Geological Survey
IN – Trustees of Indiana University, Indiana Geological Survey
KS – University of Kansas Center for Research, Inc., Kansas Geological Survey
KY – University of Kentucky Research Foundation, Kentucky Geological Survey
LA – Board of Supervisors of Louisiana State University and A&M College, Louisiana Geological Survey
MA – Massachusetts Geological Survey (MAGS) & Connecticut Geological and Natural History Survey
MD – Maryland (performed by VADGMR)
ME – Maine Geological Survey
MI – Western Michigan University-Department of Geosciences
MN – Minnesota Geological Survey
MO – Missouri Geological Survey, Department of Natural Resources, Division of Geology and Land Survey
MS – Mississippi Department of Environmental Quality
MT – Montana Bureau of Mines & Geology
NC – North Carolina Geological Survey
ND – University of North Dakota (UND, Dr. Will Gosnold)
NE – Nebraska (performed by UND)
NH – New Hampshire Geological Survey
NJ – New Jersey Geological Survey
NM – New Mexico Institute of Mining & Technology
NV – Board of Regents, NSHE, obo University of Nevada, Reno, Nevada Bureau of Mines and Geology
NY – New York State Geological Survey
OH – Ohio Dept. Natural Resources, Division of Geological Survey
OK – The Board of Regents of the University of Oklahoma
OR – Oregon Department of Geology and Mineral Industries
PA – Pennsylvania Geological Survey
RI – Rhode Island Geological Survey
SC – South Carolina Geological Survey
SD – Sinte Gleska University
SD – South Dakota Akeley-Lawrence Science Center, USD (In-kind Services only)
TN – Tennessee Division of Geology
TX – Texas Bureau of Economic Geology
UT – Utah Geological Survey
VA – Virginia Division of Geology and Mineral Resources (VADGMR)
VT – Vermont Office of Department of Environmental Conservation
WA – Washington State Dept. of Natural Resources
WI – Wisconsin Geological and Natural History Survey
WV – West Virginia Geological and Economic Survey
WY – Wyoming State Geological Survey