Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

August 13, 2010

FINDING OF NO SIGNIFICANT IMPACT

Drilling, Testing and Monitoring of up to 12 Temperature Gradient / Passive Seismic Geothermal Exploratory Wells, Deschutes County, Oregon DOE/EA-1758; DOI-BLM-OR-P000-2010-003-EA

AGENCY: U.S. Department of Energy, Golden Field Office (DOE)

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: This Finding of No Significant Impact (FONSI) was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality (CEQ) Regulations for Implementing NEPA, as amended, 40 CFR 1508.13; and DOE NEPA Regulations, 10 CFR 1021.322. This FONSI supports DOE's decision to provide cost-shared funding to Davenport Newberry Holdings LLC[a]'s (Davenport's) proposed project for drilling, testing, and monitoring up to 12 temperature gradient/passive seismic geothermal exploratory wells and describes the process by which DOE determined that funding the proposed project would not have a significant impact on the human environment.

The U.S. Department of Interior, Bureau of Land Management, Prineville District Office (BLM) was the lead federal agency and the U.S. Forest Service and DOE were cooperating agencies on the *Drilling, Testing, and Monitoring of up to 12 Temperature Gradient / Passive Seismic Geothermal Exploratory Wells (DOE-BLM-OR-P000-2010-002-EA)* (EA), which evaluates the potential environmental impacts associated with DOE's proposed action and a no action alternative. DOE was invited by BLM to participate in the NEPA process as a cooperating agency (40 CFR 1501.6 and 1508.5). DOE accepted formal cooperating agency status (by a Memorandum of Understanding signed February 23, 2010) and retained review and comment responsibility pertaining to the EA. The EA was prepared in accordance with NEPA, as amended, the CEQ Regulations for Implementing of NEPA (40 CFR 1500 to 1508), the Federal Land Policy and Management Act (FLPMA) of 1976, and BLM's NEPA Handbook (H-1790-1; 2008).

DOE hereby adopts the above referenced EA subject to DOE's supplemental cumulative impact analysis titled, "Impacts of Reasonably Foreseeable Actions That Would Be Cumulative With Those For The 'Drilling, Testing, And Monitoring Of Up To 12 Temperature Gradient / Passive Seismic Geothermal Exploratory Wells, Deschutes County, Oregon' DOE/EA-1758; DOI-BLM-OR-P000-2010-003-EA" (See Attachment A) and incorporates these documents by reference into this FONSI.

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[a] The original applicant was Newberry Geothermal Holdings, LLC, which later changed its name to Davenport Newberry Holdings LLC, effective December 29, 2009.

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In accordance with its NEPA implementation guidelines, DOE typically evaluates relevant past, present, and reasonably foreseeable future actions as cumulative impacts. Because DOE is aware of other actions in the Newberry Volcano area meeting these criteria, and in the interest of furthering information available to the public, DOE conducted an additional cumulative impact analysis (see Attachment A), which further addresses cumulative impacts.

PROJECT DESCRIPTION: Davenport proposes to drill up to 12 shallow exploratory monitoring wells to acquire scientific data about the geothermal resource and the subsurface geologic structure over a portion of its federal geothermal leases. DOE's proposed action is to match $5 million in financial assistance to Davenport under the *American Recovery and Reinvestment Act of 2009* for the purpose of "validation of innovative exploration technologies." By providing financial assistance to support this project, DOE would further its mission to reduce dependency on fossil fuels, as well as support national energy needs and the development of alternative fuel sources

The proposed project is located approximately 22 miles south of Bend, Oregon, on federal geothermal leases held by Davenport, and within the Bend-Fort Rock Ranger District of the Deschutes National Forest. The proposed project and the associated federal leases are on the western flank of Newberry Volcano, outside the Newberry National Volcanic Monument, in areas identified as appropriate for future geothermal use in the legislation that established the Monument (that is, the Newberry National Volcanic Monument Act, Public Law 101-522). Using the data from the proposed project, the applicant would decide where to pursue further exploration for the geothermal resource.

The proposed project consists of drilling up to 12 small diameter (4.5 inches or less), temperature gradient/passive seismic monitoring wells, each to depths of approximately 2,500 to 3,500 feet, which intentionally would not be deep enough to reach the geothermal resource. Drilling would be done with small, truck-mounted equipment, similar to that used to drill domestic water wells. Individual drilling sites would be less than 0.23 acre for each site, and located on or along existing spur roads. No new road construction would be needed. On some of the narrower spur roads, some trimming of vegetation would be necessary as well as some light grading in spots where the road has not been maintained. One of the drilling sites would be on an already prepared exploration pad with no additional disturbance required, so the combined total area disturbed for the entire project (12 wells) would be less than approximately 2.5 acres.

The wells would be "dual purpose" to minimize the number of wells needed. The upper portion of each well (down to approximately 600 to 1,000 feet) would be drilled using rotary reverse circulation technology. A 4.5-inch casing would be cemented in place and passive seismic monitoring would begin. At the completion of that portion of the testing, the equipment would be removed and a truck-mounted core drill rig would be used to drill the lower portion of the well to a final depth of 3,000 feet (plus or minus 500 feet), while producing a continuous core from the base of the 4.5-inch casing to the total depth of the hole. Each slim-hole would be completed with the placement of tubing, approximately 2 inches in diameter, and sealed at the bottom. Very low viscosity mud would be used as fill around the tubing in the completed hole. The tubes would be filled with water, providing a static column of water for obtaining temperature gradient data (changes in temperature at different depths).

The drilling of each well would take approximately two weeks for the upper section of the well and four weeks for the lower section. Temperature gradient data would be collected at about one month and again about six months after well completion. Once all data was collected, and if there was no possible future need for the wells, each well would be plugged and abandoned and each site would be restored to its original condition as required by the BLM and Forest Service.

PUBLIC INVOLVEMENT IN THE EA PROCESS: BLM initiated the scoping process to provide an early and open process to gather information from the public and interested agencies on the issues and alternatives to be evaluated in the EA. In October 2009, scoping letters were mailed to more than 400 individuals, organizations, agencies, and central Oregon tribes to provide notification of the proposed project and to solicit comments. During the same month, Davenport sent an email that provided information on the upcoming project proposal to about 250 people on its own electronic mailing list. On November 4, 2009, the local Bend Bulletin newspaper included an article about the opportunity to submit scoping comments. In addition, print and internet media coverage regarding continued exploration efforts in the area have been extensive since late 2008, likely exceeding four to five dozen total coverage events in local, statewide, and regional media.

The BLM continued consultations throughout the NEPA process with the Confederated Tribes of the Warm Springs Reservation, the Klamath Tribes, and the Burns Paiute Tribes.

BLM received four letters as a result of the scoping effort: two from local chapters of national and state environmental organizations that have been following geothermal projects at Newberry Volcano for years, one from a congressman representing a district in the Portland metro area, and the fourth from a local citizen. All but the fourth expressed concern about the project, and mostly about future large-scale geothermal development. The citizen's letter conveyed support for the proposal. All of the letters were reviewed and used to help develop issues and guide the environmental analysis and preparation of the EA.

BLM prepared the Draft EA and made it available for public comment for 30 days beginning April 19, 2010. The Draft EA was available on BLM's website and BLM issued a news release.

BLM received a total of one tribal comment letter and three public comment letters during the 30-day comment period. One of the public comment letters was in support of the project and is not addressed further. The letter from the Klamath Tribes was in opposition to the project as being harmful to an area they considered to be sacred. One of the public comment letters was from the Sierra Club, which included several claims, including: (1) that awards of stimulus funds were made by the DOE without appropriate public environmental analysis, (2) that evaluations were being done "piecemeal" without addressing cumulative impacts, (3) that there was inadequate public notification and scoping, (4) that there would be adverse visual impacts to views from the Newberry Volcanic Monument, and (5) that proposed project areas had not been surveyed for wildlife species. The final public comment letter was from Oregon Wild, which reiterated a recommendation to drop one of the proposed exploratory well sites as being too far removed from the others and asked for project clarification with regard to a scoping effort performed in 2007 for another action.

Responses to the comments were provided as part of the *Prineville District FONSI Determination and Decision Record* issued by BLM on their EA; that is, the BLM EA incorporated by reference into this FONSI. Changes resulting from review comments were incorporated into the BLM EA by presenting them in the BLM FONSI and Decision Record.

A question was raised as to DOE's process for carrying out its responsibilities under NEPA for the Proposed Action. To respond, DOE conducts its NEPA review consistent with its implementing regulations at 10 CFR 1021. In brief, DOE conducts a rigorous environmental analysis through the NEPA process for all proposed funding actions to evaluate the potential environmental impact associated with the project and public comments are sought at various points in the process. Here, as a cooperating agency to the BLM EA, DOE was involved in the development and review of the EA. The draft EA was available to the public and to Federal, state and local agencies for review and comment prior to a final decision on the Proposed Action. Likewise, DOE provided the public an opportunity to comment on DOE's supplemental cumulative analysis.

DOE prepared the supplemental cumulative impact analysis and made it available for public comment for 15 days ending August 5, 2010. The supplement was available on DOE's website and DOE issued postcards to potentially interest parties announcing its availability. The comment period was subsequently extended two days to August 7, 2010 when it was learned the website posting was inadvertently removed for two days.

DOE received two comments on the supplemental cumulative impact analysis: one from Oregon Wild and a second, joint submittal, from the League of Wilderness Defenders – Blue Mountains Biodiversity Project, Cascadia Wildlands, and Gaia Ki.

The Oregon Wild comment identified the Deschutes National Forest's "geothermal consent-to-lease" action as another action that should have been considered in the cumulative impacts analysis. Oregon Wild also pointed out the importance of water in the project area and stated its position that the impacts of water use of the proposed EGS Demonstration in combination with the 12 temperature gradient wells and the "consent-to-lease" project were not adequately explained.

In response to the Oregon Wild comment, it is noted that the Deshutes National Forest's Geothermal Consent to Lease Project is an action that just completed a public scoping period on July 30, 2010. The project is administrative in nature and, as described in the Public Scoping letter issued by the Forest Service, will be evaluating 29 parcels that are not currently under leases or for which existing leases will soon be expiring. For each parcel, the Forest Service's project will determine whether it should be made available for leasing or if it should be removed from the program, and if selected for leasing, what site-specific stipulations, if any, should be placed on its future use. The project will not authorize any lease, exploration, or development activity; rather it will identify which parcels BLM can lease and BLM would then be responsible for any subsequent environmental analyses and decisions on what could be done on those parcels within the stipulations set by the Forest Service. Even when the Deshutes National Forest project is complete, it will not identify specific physical actions that can be addressed for

environmental impacts and, hence, was not applicable for a discussion of cumulative impacts. Once it is determined which parcels can be leased, proposed leases and uses can be defined and potential impacts can be evaluated.

With respect to the evaluation of water use, the supplemental cumulative impact analysis noted that water use would be an important evaluation factor for the EGS Demonstration and would be addressed in detail in the environmental analysis for that project. It is further recognized that water use is a relatively minor element for the other two projects described in the cumulative impact analysis (that is, the proposed temperature gradient wells project and the single deep slim-hole project). Because the most important element of foreseeable water use is not yet well defined and not ready for more detailed evaluations, DOE believes the discussion of the water use in the supplemental cumulative impact analysis is at an appropriate level of detail. The analysis provided information on the relative magnitude of the water that would be needed for the identified projects and pointed to the evaluation of water use that would be necessary for the EGS Demonstration (once defined well enough for evaluation) as the significant element of cumulative impacts.

The jointly developed comment (from League of Wilderness Defenders – Blue Mountains Biodiversity Project, Cascadia Wildlands, and Gaia Ki) was in the form of a letter and an associated package of exhibits. The comment letter identified the Appeal and Petition of Stay filed against the original action proposed by BLM and, with regard to DOE's supplement analysis, provided some discussion on the position that "Federal agencies cannot legally supplement the analysis record after a decision has been made without first withdrawing that decision and conducting a new public analysis process." The associated package of documents included: (1) copies of the Appeal and Petition of Stay, the cover letter sending the petition to the Department of Interior Board of Land Appeals, and a cover listing the exhibits included with the original petition; (2) a copy of scoping comments sent to the Forest Service on its Geothermal Consent to Lease project; and (3) two brochure-, or flyer-like documents prepared by commenter groups on potential problems or hazards associated with geothermal energy projects. A common element running through the documents submitted with the joint comment was the commenters' position that an Environmental Impact Statement is needed to address the range of geothermal projects being implemented or proposed for the area of the Newberry caldera.

The package of information is accepted into the comment record, but only the original, jointly-signed letter provides any specific comment on DOE's supplemental cumulative impact analysis. In response to the comment on the impropriety of supplementing the analysis record after a decision has been made, DOE's decision in this project is whether to provide financial support for the drilling, testing, and monitoring of up to 12 temperature gradient / passive seismic geothermal exploratory wells. DOE has not yet made that decision, and will not until the NEPA process has been completed.

DETERMINATION: Based on the information presented in the Final EA and the DOE supplemental cumulative impact analysis, DOE determined that providing funding to support Davenport's proposed project as described above would not be a major federal action significantly affecting the quality of the human environment, as defined by NEPA.

The applicant-committed environmental protection measures identified in the Final EA shall be incorporated and enforceable through DOE's funding award documents. The measures include incorporating mitigating features in the project design and selection of drill sites to minimize potential adverse effects to forest resources, performing preconstruction surveys to determine the presence of nesting raptors, having an archaeologist present during the drilling operations at specific locations of concern to monitor for any inadvertent heritage resources, and conducting weed prevention and monitoring actions.

The preparation of an Environmental Impact Statement is not required and DOE is issuing this Finding of No Significant Impact.

Copies of the Final EA, DOE Supplement, and FONSI are available at http://www.eere.energy.gov/golden/Reading_Room.aspx or from:

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Issued in Golden, Colorado, the 13th day of August, 2010.

Carol Battershell
Executive Director for Field Operations

Attachment(s): Impacts Of Reasonably Foreseeable Actions That Would Be Cumulative With Those For The "Drilling, Testing, And Monitoring Of Up To 12 Temperature Gradient / Passive Seismic Geothermal Exploratory Wells, Deschutes County, Oregon" DOE/EA-1758; DOI-BLM-OR-P000-2010-003-EA

Supplement To The Cumulative Impact Analysis of The "Drilling, Testing, And Monitoring Of Up To 12 Temperature Gradient / Passive Seismic Geothermal Exploratory Wells, Deschutes County, Oregon" DOE/EA-1758; DOI-BLM-OR-P000-2010-003-EA

SUPPLEMENT TO THE CUMULATIVE IMPACT ANALYSIS OF "DRILLING, TESTING, AND MONITORING OF UP TO 12 TEMPERATURE GRADIENT / PASSIVE SEISMIC GEOTHERMAL EXPLORATORY WELLS, DESCHUTES COUNTY, OREGON" DOE/EA-1758; DOI-BLM-OR-P000-2010-003-EA

1. BACKGROUND

This document presents information supplemental to the Environmental Assessment (EA), *Drilling, Testing, and Monitoring of up to 12 Temperature Gradient / Passive Seismic Geothermal Exploratory Wells, Deschutes County, Oregon* (DOE/EA-1758; DOI-BLM-OR-P000-2010-003-EA, March 16, 2010) prepared by the Bureau of Land Management (BLM). The Final EA is available at http://www.eere.energy.gov/golden/Reading_Room.aspx. BLM was the lead-agency for the EA effort and Department of Energy (DOE) was a cooperating agency along with the U.S. Department of Agriculture, Forest Service. DOE intends to adopt the EA subject to this supplemental cumulative impact analysis.

DOE is aware of other geothermal actions being pursued in the same general area as those described in the EA. In accordance with guidance included in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements, Second Edition* (December 2004), the DOE evaluates any relevant past, present, and reasonably foreseeable future actions as cumulative impacts. Accordingly, this document addresses potential impacts associated with other proposed future geothermal projects in the area of the Newberry National Volcanic Monument that may be cumulative with those described in the EA.

The Proposed Action (also referred to as the "Temperature Gradient Wells Project") set forth in the EA is summarized as a project to drill, test and monitor up to twelve shallow temperature gradient/passive seismic geothermal exploratory monitoring wells to acquire scientific data about the geothermal resource and the subsurface geologic structure. The other proposed future geothermal projects, described in more detail below, consist of (1) drilling a single, deep slim-hole, which is a follow-on phase of the Proposed Action, and (2) a separate project that would involve demonstration of enhanced geothermal systems (EGS). In both cases (that is, the drilling of the single slim-hole and the EGS Demonstration Project), there are potential impacts that could be cumulative with the Proposed Action. However, the drilling of the slim-hole and the EGS Demonstration Project are in the early phases of development so there are unknowns with regard to specific project detail and locations. Accordingly, their potential impacts can generally be described only in qualitative terms and limited quantitative terms.

Similar to the Proposed Action, DOE is considering providing financial assistance to partially fund two other projects in the project vicinity for the purpose of promoting renewable energy exploration for geothermal resources: 1) drilling the single slim-hole and 2) the EGS Demonstration Project. By necessity, DOE's decision to provide funding for the geothermal projects is progressing in a phased approach and each phase has been, or will be proceeded by a NEPA Determination that documents the level of NEPA analysis required for the specific phase. In this manner, the projects can proceed with the first phase that collects information to determine whether the subsequent phase(s) is (are) feasible and to define specific details on how

the subsequent phase(s) would occur and where. Once the drilling of the single slim-hole and the EGS Demonstration Project have progressed to the point where detailed actions and locations can be proposed, they would be ready for their own NEPA Determinations; which could result in additional environmental analyses being required for the projects. In the future environmental analyses, with project details fully defined, cumulative impacts would also be discussed and at that time more quantitative evaluations of the activities associated with drilling the single slim-hole and the EGS Demonstration Project would be discussed in addition to the Proposed Action (Temperature Gradient Wells Project).

The long-range goal of the Temperature Gradient Wells Project, the drilling of the slim-hole, and the EGS Demonstration Project are to show the feasibility of a geothermal resource recovery facility (or facilities) in the area outside the Newberry National Volcanic Monument and, as applicable, the eventual construction of that facility (or facilities). The premise of actually designing and constructing any geothermal resource recovery facility in this area is not mature enough at the present time for such an action to be addressed as a reasonably foreseeable action. Whether or not DOE were to be involved in such a future action to fund a geothermal resource recovery facility, it would be fully subject to NEPA requirements. That is, such an action would have to be fully evaluated for potential environmental impacts before it would be authorized on these public lands. The potential for future geothermal resource recovery facilities is not addressed further in the evaluations that follow.

A question was raised as to DOE's process for carrying out its responsibilities under NEPA for the Proposed Action. To respond, DOE conducts its NEPA review consistent with its implementing regulations at 10 CFR 1021. In brief, DOE conducts a rigorous environmental analysis through the NEPA process for all proposed funding actions to evaluate the potential environmental impact associated with the project, and public comments are sought at various points in the process. Here, as a cooperating agency, DOE was involved in the development and review of the EA. The draft EA was available to the public and to Federal, state and local agencies for review and comment. Likewise, DOE is providing the public an opportunity to review and comment on DOE's supplemental cumulative analysis prior to DOE making its final determination.

Section 2 describes the other geothermal project actions of which DOE is aware and which could present impacts cumulative with those of the Temperature Gradient Wells Project. Section 3 provides a discussion of cumulative impacts for various resource areas normally considered in DOE NEPA evaluations. Section 4 provides a summary of the evaluations.

2. DESCRIPTION OF OTHER GEOTHERMAL ACTIVITIES

The section identifies past and reasonably foreseeable future geothermal exploratory actions that occurred or might occur in the same general area as the Temperature Gradient Wells Project.

2.1 Slim-hole/Deep Exploration Well (Potential Future Activity)

A slim-hole/deep exploration well may be drilled following the temperature gradient wells and geophysical testing and analysis described in the Proposed Action to verify the findings of such

program. The drilling of the well is contingent upon a go/no go decision based upon the results obtained from the temperature gradient program. The final specifications (depth, diameter, etc.) for this well will be dependent upon the proposed well location and other results obtained from the temperature gradient program. If a deep exploration well were to be drilled, it could be similar in depth and diameter to the previous wells drilled by Davenport in the project area (approximately 11,000 feet deep and 8.5 inches in diameter at the bottom). Because the location of this possible well is not yet known, site specific analysis cannot be done at this time. It may be located on an existing permitted well pad in which case no additional surface disturbance would occur. If a new pad were to be built, it would be approximately 1.5 acres in size. Such slim-hole activity, if not located on a previously permitted well pad, would require further environmental analyses and approvals from BLM and other regulatory agencies.

2.2 Newberry Volcano Enhanced Geothermal Systems (EGS) Demonstration Project (Potential Future Activity)

The Newberry Volcano EGS Demonstration project would develop an EGS reservoir in an area of high temperature, low permeability resource present in volcanic formations on the northwest flank of the Newberry Volcano. The project team would quantitatively demonstrate stimulation techniques to successfully induce and sustain fluid flow and heat extraction from one injection well and two production wells, culminating in a theoretical, conceptual model of a commercial-scale well-field and power plant. The only new surface disturbance would result from the drilling and installation of down-hole micro-seismic array (MSA) boreholes (up to approximately 700 feet deep) at up to 10 locations. These sites are expected to average about 50 feet by 50 feet per site for a total disturbed area of less than 1 acre. All of the project activities would be accessible by existing Forest Service roads. No new roads would be constructed. The majority of the EGS activity is the development and stimulation of an EGS reservoir, which occurs below ground. This activity would take place from previously permitted well pads and would not create any additional surface disturbance. The EGS Demonstration project would require further environmental analyses and approvals from BLM and other regulatory agencies.

2.3 Geophysical Surveys

A number of geophysical surveys have already been permitted or may occur in the near future. These include gravity surveys, magneto-telluric (MT) surveys and micro-seismic surveys. All of these geophysical surveys occur on the surface and therefore are non-intrusive, do not involve drilling rigs, and do not involve any disturbance of vegetation.

2.4 Past Geothermal Activities

Geothermal exploration projects have occurred in the Newberry area in the past. A total of approximately two dozen exploratory wells have been drilled in and around Newberry Volcano, including within the Crater. Most wells have been plugged and abandoned as required by BLM and the Oregon Department of Geology and Mineral Industries (DOGAMI) except for two deep wells drilled by Davenport in 2008, which are still being monitored and would be utilized in the EGS Demonstration project. There is also approximately 80 feet of surface casing on a well in the project area that is scheduled to be plugged and abandoned this year.

There are currently six large production-size well pads (each approximately 5 acres in size) located on the western flank of Newberry, plus one pad that was partially built. These are currently in active status and are being maintained by the geothermal leaseholder or operator under terms specified by BLM and Forest Service. When no longer needed, these sites will be reclaimed and restored to a natural condition. Except for the existing wells and pads noted, all other sites (approximately 19) have been reclaimed and restored to a natural condition.

3. CUMULATIVE IMPACTS

CEQ regulations define cumulative effects as "...the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions" (40 CFR 1508.7).

This section discusses cumulative impacts to each of the resource areas that are normally evaluated in a DOE EA. In several instances these resource areas were not carried into a full analysis of potential impacts in the EA. In such instances, the first paragraph in each of the following discussions summarizes how the resource area was presented in the EA.

3.1 Land Use

Land use was not a resource area specifically described for potential impacts in the EA. Section 1.6 of the EA does, however, describe how the Davenport Newberry proposed project would conform to existing land use plans. Because it was determined that the action was consistent with the U.S. Forest Service's applicable Land and Resource Management Plan (LRMP), it was not necessary to carry land use into the full analysis for potential impacts.

Both the proposed EGS Demonstration Project and the slim-hole/deep exploration well would be expected to be consistent with the LRMP as well and therefore any cumulative impacts to Land Use would be consistent with the LRMP as well.

3.2 Air Quality

Air quality was not specifically described for potential impacts in the EA. Given the unlikelihood that activities associated with the Proposed Action would have more than a minor impact on air quality, it was not necessary to carry air quality into the full analysis for potential impacts in the EA. To provide context for DOE's supplemental cumulative impacts analysis, the following information regarding the air quality impacts of the Proposed Action (Temperature Gradient Wells Project) is included. The proposed project would result in construction and drilling-related effects on air quality. These would include equipment and vehicle exhaust emissions and fugitive dust from traveling on dirt roads. No new roads would be required and, although some leveling with a backhoe might be required at the drill sites, each site would be no larger than approximately 100 feet by 100 feet (Section 2.2 of the EA). Effects to air quality would be relatively minor due to the small scale of the temperature gradient program and would be temporary in nature. Because there is only a single truck mounted drill rig involved, it is

expected the total number of vehicles and other fuel burning pieces of equipment (such as generators) in use would be ten or less.

Future geothermal activities involving drilling activities would have similar effects (that is, exhaust emissions from a few vehicles and pieces of equipment and fugitive dust, primarily from traveling on dirt roads) on air quality. The number of vehicles and pieces of equipment involved in these future activities would be expected to be similar to that described for the temperature gradient program (that is, ten or less per project). To the extent that some of the future actions could occur at the same time as the proposed project, the air emissions could have cumulative effects on local air quality and emissions of greenhouse gases from burning of fuel would add to those of the earth's atmosphere. However, this would involve the addition of small quantities from each of the projects and the totals would not be expected to have any measureable effect on air quality of the region or on levels of greenhouse gases in the earth's atmosphere.

3.3 Geology and Soils

The resource area of geology and soils was not specifically addressed for potential impacts in the EA. To provide context for DOE's supplemental cumulative impacts analysis, the following information regarding the impacts of the Proposed Action (Temperature Gradient Wells Project) is included. The small size of the proposed project (less than 2.5 acres of total disturbed area) and its temporary nature (all sites would be restored to their natural condition) would not result in any permanent disturbance to soils or geology.

The slim-hole/deep exploration well (0 to1.5 acres of surface disturbance anticipated) and the EGS Demonstration Project (less than 1 acre of surface disturbance anticipated) would have a similarly minimal impact to soils. In total, it is estimated that all three projects could disturb up to approximately 5 acres of soils within the approximate 40,000 acres of geothermal leases held by Davenport in the project area. A more detailed environmental analysis on the potential impacts to geology will be conducted for the EGS Demonstration Project in the future as a result of the need to address induced seismicity. This future analysis would include an evaluation of cumulative effects from the various other projects, but because these other projects would have minimal effects on geology and soils, cumulative effects would be expected to result primarily from those attributed to the EGS Demonstration Project.

3.4 Water Resources

Water usage by the project was discussed in the EA as part of the description of the proposed project (Section 2.2 of the EA). Water resources were not identified as a resource to be brought forward for further analysis during the scoping process, therefore water resources were not specifically described for potential impacts in the EA. To provide context for DOE's supplemental cumulative impacts analysis, the following information regarding the impact on water resources resulting from the Temperature Gradient Wells Project is included. A total of approximately 432,000 gallons (1.3 acre-feet) of water would be pumped from local shallow groundwater wells to supply water for drilling the temperature gradient wells over the length of the project. Because only one well would be drilled at a time, up to 36,000 gallons of water would be needed per well at an average rate of approximately 970 gallons per day. The

groundwater wells have been permitted by the Oregon Water Resources Department (ODWR) and groundwater mitigation credits have been purchased from the Deschutes Groundwater Mitigation Bank, operated by the Deschutes River Conservancy in accordance with the ODWR permit. As a result there would be no net loss of water to the Deschutes river basin.

Water usage by the slim-hole/deep exploration well and the EGS Demonstration Project would be analyzed in detail during any future NEPA environmental review of those actions. It is anticipated that both projects would obtain water through local groundwater wells permitted by the ODWR with mitigation credits purchased from the Deschutes Groundwater Mitigation Bank, operated by Deschutes River Conservancy. Furthermore, water usage by the EGS Demonstration Project (preliminary estimates are up to 235 million gallons) is much higher than for the proposed project or the slim-hole well, but would be temporary in use with the majority of water being injected back into the ground, though probably not into the aquifer from which it was withdrawn. Also, the projects would be expected to be spread out over time, thereby reducing impacts to water resources due to natural recharge. The estimates of water usage for the EGS Demonstration Project are only preliminary and would be evaluated in detail during the NEPA environmental review for that project once that project has been defined in sufficient detail to allow for a complete analysis of water usage, but the project cannot be evaluated in such detail at the present time.

The water resources impact resulting from the Temperature Gradient Wells Project is expected to be minimal with no net loss of water to the Deschutes river basin. Given the relatively small water needs of the Temperature Gradient Wells Project, its contribution to the cumulative impacts for water resources is expected to be negligible in relation to the proposed EGS Demonstration Project (432,000 compared to 235,000,000 gallons). As noted previously, once the proposed EGS Demonstration Project is better defined, DOE will evaluate its impacts to water resource in greater detail during the NEPA environmental review.

3.5 Biological Resources

3.5.1 Wildlife

Effects to wildlife from the Temperature Gradient Wells Project were analyzed in detail in the EA. Specifically related to DOE's supplemental cumulative impacts analysis, numerous field surveys were conducted and a Biological Evaluation was prepared by the USFS. Due to the small area of vegetation to be removed (2.5 acres) and mitigation measures (timing restrictions during the breeding season) it was determined minimal negative effects to wildlife would occur.

The proposed EGS Demonstration project activity is expected to occur primarily on existing well pads. The total additional disturbed area would be less than 1 acre. The slim-hole/deep exploration well drilling may occur on an existing permitted well pad. Accordingly, any additional impact to wildlife resulting from EGS Demonstration Project and the drilling of the slim-hole/deep exploration well would be negligible. If a new pad were to be built for the slim-hole/deep exploration well, it would be approximately 1.5 acres in size. With a total disturbed area of 5 acres or less for all three projects combined, the cumulative effects on habitat loss would be minimal. Also, any additional site disturbance would be subject to the same timing

restrictions during the breeding season as the proposed temperature gradient wells, which would further minimize any potential cumulative negative effects to wildlife.

3.5.2 Disturbance to Existing Plantations and Established Tree Stands

Disturbance to existing plantations and established tree stands was analyzed in detail in the EA. As relevant to DOE's supplemental cumulative impacts analysis, due to the small size of each of the drill sites, their location adjacent to existing roads and clearings, and because the trees to be removed are for the most part smaller diameter trees, the disturbance to existing plantations and established tree stands was determined to be minimal.

The proposed EGS Demonstration Project would result in less than 1 acre of new disturbed area. These sites would also be located in previously created openings off of existing Forest Service roads. If the slim-hole/deep exploration well is drilled on an existing well pad, no additional disturbance to existing plantations or tree stands would occur. If a new well pad were to be constructed, approximately 1.5 acres would need to be disturbed. In total, it is estimated that all three projects would disturb up to approximately 5 acres of land within the approximate 40,000 acres of geothermal leases held by Davenport in the project area. The impact to existing plantations and established tree stands is unknown at this time, as the specific location is unknown. In the past, an effort has been made to site well pads in previously disturbed areas. It is anticipated a similar effort would be made in locating any new well pads. As a result, cumulative effect of the projects in terms of disturbance to existing plantations and established tree stands would be minor.

3.6 Cultural Resources

Cultural resources were not specifically described for potential impacts in the EA, but were discussed as part of mitigation measures (Section 4.5 of the EA). To provide context for DOE's supplemental cumulative impacts analysis, the following information regarding the impact on cultural resources resulting from the Proposed Action is included. A total of five heritage resources were identified or re-recorded during the heritage survey as part of the EA. Three of the sites, all historic period resources, would be easily avoided during drilling operations. Two prehistoric sites would be tested for subsurface deposits prior to drilling and site deposits would be avoided during drilling. As a result of these mitigation measures, there would be little to no impact to cultural resources.

A similar cultural resources survey would be conducted for all future land disturbing activities associated with either the slim-hole/deep exploration well or the EGS Demonstration Project. With similar mitigation measures for all three proposed projects, it is expected there will be minimal impacts to cultural resources under either an individual or cumulative analysis.

3.7 Socioeconomics

The EA does not specifically address the potential for socioeconomic impacts to the area or region, but it does describe the work force that would be required to support drilling of the 12 temperature gradient wells. As relevant to the DOE supplemental cumulative impacts analysis,

the EA states each well would take about 6 weeks to complete and each would be supported by two crews of up to 6 people each, with each crew working 12-hour days. If it is assumed that the two crews (12 people in total) worked every day for the 6 week period, that would be approximately 6,000 man-hours of labor per well. If it is further assumed that 2,000 hours represents a normal man-year, then each well would involve 3 man-years. Although the project would represent a significant economic benefit to those directly employed in the effort, these crews would be expected to be from a broad region and, as a result, the project would be expected to have only a minor beneficial impact to any specific area or community. There would be effects to local businesses (for example, stores, restaurants, and hotels) in communities close to the project site (such as Bend and possibly Three Rivers or La Pine) from the influx of workers. But again, the number of workers involved would be small, as well as temporary, and would not be expected to impact community services, but would provide some minor economic benefit.

It is expected that the drilling of the slim-hole would have less potential for socioeconomic impacts than the Proposed Action (Temperature Gradient Wells Project). The deep slim-hole would be expected to take longer to drill than one of the temperature gradient/passive seismic wells, but there would not be the potential for multiple crews working multiple wells at the same time. Also, because the slim-hole action would occur after the temperature gradient wells were completed, it would not be additive in the sense of occurring over the same time period. The EGS Demonstration Project is not yet well defined with respect to the number of people that would be working on the project and the period of time over which they would be in the area. However, it is expected that the EGS Demonstration Project would likely be less intensive with respect to size of the work force required than that expected for the Temperature Gradient Wells Project. Even if the EGS Demonstration actions were to overlap in timing with the temperature gradient wells or the single slim-hole well, thus representing a combined demand on community services, potential socioeconomic impacts would be expected to be minor, but overall beneficial.

3.8 Health and Safety

The topic of health and safety was not specifically addressed for potential impacts in the EA. However, general safety measures as well as training and preparation for possible hydrogen sulfide were addressed in the EA as part of the project description (Section 2.2 of the EA), safety meetings were described as a routine part of the drilling program (Appendix B of the EA), and specific safety measures were described as part of best management practices that would be used on the project (Appendix C of the EA). As relevant for this cumulative impacts analysis, drilling of the temperature gradient wells would be conducted in accordance with rules established by both the BLM and DOGAMI to protect the health and safety of both the workers on site and the public.

Both the slim-hole/deep exploration well and the EGS Demonstration Project would be conducted in accordance with the same safety rules and precautions described for the proposed project. In general, work accident records are maintained in terms of incidents per hours worked, so the more hours worked, the higher the potential for accidents to occur. That is, taken together, the various projects would represent a greater potential for accidents than individually. However, there is no reason to suspect that the projects would involve unusual risks for workers

and, either separately or combined, risks would be expected to be minor, in line with similar work activities performed elsewhere in the country.

3.9 Noise

Noise effects from the drilling of the temperature gradient wells would be temporary and of short duration (6 weeks per well). Because of the short term nature of the Proposed Action, impacts due to noise would be minimal and therefore were not carried forward for detailed analysis in the EA. As specifically related to DOE's supplemental cumulative impacts analysis, the potential for cumulative noise effects on wildlife was included in the Biological Resources discussion (Section 3.5) where it was noted there would be time restrictions on field activities during breeding season when such disturbances could have their most harmful results.

The Proposed Action may overlap with future geothermal activities in the general area, so there is potential for increased noise intensity (from adding sources) as well as increased noise duration. Noise effects from the slim-hole/deep exploration well and the EGS Demonstration Project will be addressed in the subsequent environmental review for those future projects, but would be temporary and short term, and therefore would most likely be minimal. Sound levels from drilling a deep well are estimated to be up to 45 A-weighted decibels at a distance of 0.5 miles.[a] This sound level is consistent with that of a library or a quiet room in a residence. Activities would be dispersed over a large area and non-project individuals that might be exposed to noise would be expected to be few in number, being limited primarily to visitors to the national forest. As a result, even if the activities were to overlap in the time they occurred, cumulative noise impacts would be expected to be minor.

3.10 Aesthetics and Visual Resources

Visual Resources were analyzed in detail in the EA. Given its relatively small scope, temporary duration, limited size, and minimal amount of surface disturbance, the project was determined to not contribute a significant cumulative effect in terms of surface area or visual resources.

The proposed EGS Demonstration Project would occur primarily below ground and on existing well pads. The total additional disturbed area would be less than one acre. Thus, the project would not make a cumulatively considerable contribution to loss of visual quality in the area. The slim-hole/deep exploration well would occur on an existing permitted well pad or on a newly created well pad. If a new well pad were to be constructed, a clearing of approximately 1.5 acres may be created. In total, it is estimated that all three projects would disturb up to approximately 5 acres of land within the approximate 40,000 acres of geothermal leases held by Davenport in the project area. Given its relatively small scope, temporary duration, limited size, and minimal amount of surface disturbance, when compared to the extensive vegetation management and large scale projects that have occurred or would occur in the local and greater vicinity, the cumulative effect contributed by this project (particularly after the sites have been reclaimed), would be negligible.

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[a] Newberry Geothermal Pilot Project Final Environmental Impact Statement, June 1994.

3.11 Utilities, Energy, and Materials (Infrastructure)

The resource area of utilities, energy, and materials was not addressed for potential impacts in the EA. As relevant to DOE's supplemental cumulative impacts analysis, the Proposed Action would occur on National Forest land, which has limited infrastructure that could be affected. The drilling crews would use existing roads and pads to the extent practicable and would bring their own fuel with them to support vehicle and equipment use. Fuel (gasoline and diesel fuel) used during the project would represent a consumptive use of these resources, but it would be temporary in nature and relatively small in quantity (sufficient for ten or less vehicles and other fuel burning pieces of equipment) compared to the volume moving through, and being used in the regional market. The work force associated with the project would similarly not be expected to affect utilities available in local communities where they might be staying during the duration of the project.

Similar to previous discussions, the drilling of the deep slim-hole would be expected to have less impact on utilities, energy, and materials than the Proposed Action. The EGS Demonstration Project is not yet well defined at this point, but it would also be located on National Forest land where there would be limited infrastructure that could be affected. Again, the proponent would carry their own fuel with them to support vehicle and equipment use, but the volumes would be relatively small, estimated at volumes sufficient for ten or less vehicles and pieces of equipment, and the work force staying temporarily in local communities would be expected to have no noticeable effect on the communities' utilities. The cumulative impacts from the various projects, particularly in the case of fuel consumption, would be minor.

3.12 Waste and Hazardous Materials

The topic of waste and hazardous materials was not specifically addressed for potential impacts in the EA. However, management of the routinely generated materials drilling mud and cuttings were addressed in the EA as part of the project description (Section 2.2 of the EA) and the general proper management of waste was described as part of best management practices that would be used on the project (Appendix C of the EA). The proposed project would use sumpless drilling and is not expected to use nor produce hazardous materials. Drill cuttings and spent drilling mud would be contained in surface tanks and be disposed of offsite at the Cary Matthews ready mix plant.

Any future drilling activity associated with the slim-hole/deep exploration well or EGS Demonstration Project would occur on either previously constructed well pads or on a newly constructed well pad. Drill cuttings and mud would be contained within a double lined sump on the well pad. All drill cuttings and mud would be disposed of at an authorized site in compliance with state and federal laws. Thus, while the projects would contribute to cumulative effects on waste and hazardous materials, those impacts would be minimized through the disposal of wastes at an authorized facility.

3.13 Environmental Justice

Environmental justice was not a topic addressed for potential impacts in the EA. Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to address environmental and human health conditions in minority and low-income communities. The evaluation of impacts to environmental justice is dependent on demonstrating that significant, adverse impacts from the proposed geothermal exploratory action are not disproportionately borne by any low-income or minority groups in the affected community. The project location is on National Forest land and the proposed actions would have very limited potential for direct effects on communities that border the National Forest land. As such, analyses in the EA do not indicate a potential for more than minimal adverse impact to the human population.

Drilling of the deep slim-hole would similarly be located in an area away from human communities and would not be expected to have a disproportionate impact on any minority or low-income groups. The same statement is applicable to the EGS Demonstration Project even though it is not well defined at the present time.

3.14 Transportation

During the public scoping period for the EA, transportation was not determined to be an issue to be carried forward for detailed analysis due to the small scale and duration of the project. Best management practices for Forest Service road maintenance are presented in Appendix C of the EA.

Similar to the Proposed Action, the drilling of the deep slim-hole and the EGS Demonstration Project would not be expected to involve transportation concerns. These projects would involve only a small number of vehicles and pieces of equipment (estimated at ten or less per project), which are routinely moved across the highway system to get to the various sites where they are used. As a result, the projects would be expected to have minimal to no cumulative effects on transportation.

4. CONCLUSION/SUMMARY

DOE has evaluated the potential for the Proposed Action to be cumulative with other actions of which it is aware that might occur in the same Newberry area. DOE has considered and described in this document the past, present, and reasonably foreseeable future geothermal exploration activities in this area. The potential future activities of primary interest are: (1) the drilling of a deep slim-hole that would be located based on the findings of the temperature gradient wells (Proposed Action); and (2) the EGS Demonstration Project. Both of these potential future actions would be subject to individual NEPA determinations and separate environmental analysis documentation would be developed as required by the applicable determination. All of the past, present, and future geothermal exploration activities in the area of the Newberry Volcano have the objective of determining the feasibility of a geothermal energy recovery facility or facilities. However, at the present time the feasibility of such facility or facilities has not been determined and construction and commissioning of a facility cannot be

considered a reasonable foreseeable future action. Should such an action be determined feasible in the future, it would have to be evaluated under its own NEPA evaluation.

DOE's evaluation of cumulative impacts considered the slim-hole exploratory well and the EGS Demonstration Project as future actions that could be taken in addition to the action described in the EA. Conclusions of the evaluation are summarized as follows:

- There were several resource areas for which potential impacts would be expected to be negligible or very minor for each of the actions and the cumulative impacts would be minor. The resource areas in this group are: (1) land use; (2) cultural resources; (3) noise; (4) utilities, energy, and materials; (5) waste and hazardous materials; (6) environmental justice; and (7) transportation.

- Air Quality – Air emissions could occur at overlapping times and, as a result could have cumulative effects on local air quality, but even combined, the emissions would be minor and would not be expected to affect the compliance status of the region's air quality. To the extent that some of the future actions could occur at the same time as the Proposed Action, the air emissions could have cumulative effects on local air quality and emissions of greenhouse gases from burning of fuel would add to those of the earth's atmosphere. However, this would involve the addition of small quantities from each of the projects and the totals would not be expected to have any measureable effect on air quality of the region or on levels of greenhouse gases in the earth's atmosphere.

- Geology and Soils – The future EGS Demonstration Project would be evaluated for seismic effects on geology, but the other projects would have minimal cumulative impacts beyond those identified for the EGS Demonstration Project.

- Water – The future EGS Demonstration Project would be evaluated for potential impacts to water resources, and the other projects would be expected to have very minor cumulative effects to those of the EGS Demonstration Project.

- Biological Resources – Wildlife and vegetation (that is, existing plantations and established tree stands) impacts could be cumulative due to increased land disturbance. Although there is insufficient data currently available to evaluate specifics of the future actions, it is expected that impacts would be minimal whether the projects would be considered individually or in combination.

- Socioeconomics – Impacts from the projects could be cumulative, but individually they would be expected to have only minor beneficial impacts and together the impacts would still be expected to be minor.

- Health and Safety – Impacts would be cumulative in that the more work performed, the greater (on average) the risk for accidents. However, risks of accidents, either cumulatively or individually, would be expected to be minor, consistent with similar activities performed elsewhere in the country.

- Aesthetics and Visual Resources – Impacts would be expected to be cumulative due to increased land disturbance and the potential for the disturbances to be present at the same time. However, individually and combined the projects would be expected to have minimal effects due to the temporary nature of drilling activities.