REPORT OF SAGA MEETING No. 4 OF THE ICELAND DEEP DRILLING PROJECT (IDDP), REYKJAVIK, ICELAND, JUNE 1-2, 2004.

The Iceland Deep Drilling Project (IDDP) is an investigation of supercritical phenomena in hydrothermal systems within the mid-ocean rift system in Iceland. This study will require drilling wells and sampling fluids and rocks to depths of 3.5 to 5 km and at temperatures of 400-600°C (See the IDDP web page at www.os.is/iddp.is). SAGA is the Science Application Group of Advisors to the IDDP. The SAGA meeting No. 4 was primarily concerned with responding to an invitation from the International Continental Scientific Drilling Program (ICDP) to expand upon and revise the IDDP proposal submitted in January 2004. This proposal received the ICDP identification: ICDP Project 07/04. The agenda for the meeting and the list of invited participants, is a part of this report.

The meeting was opened by Mrs. Valgerdur Sverrisdottir, the Minister of Industry and Commerce, who reaffirmed the interest of the Icelandic government in the IDDP. Björn Stefansson, Landsvirkjun, representing DeepVision, discussed potential ways in which the project could be funded. Then Geir Thorolfsson, speaking on behalf of Hitaveita Sudurnesja, discussed the ongoing plans and drilling of geothermal wells to supply the new 100 MW power plant at Reykjanes. After the opening session, Ulrich Harms, representing ICDP, explained the request of the ICDP for more information on the scientific program of the IDDP, and the request to develop less expensive drilling options. He also reaffirmed the invitation from the ICDP- Executive Committee to the PI's to visit Potsdam to discuss further development of the IDDP. Wilfred Elders then outlined the major scientific goal of the project and the willingness of the PI's to discuss different way of reaching these goals. In the succeding presentations, various possible funding sources, research activities, and potential applications were discussed.

After the lunch break there was extensive discussion of the geology of the Reykjanes peninsula, the drilling plans, including the various options, and of the scientific program. The meeting then divided into three sections, to discuss funding options, drilling options and the science plan. This discussion continued on the morning of June 2nd, and was a valuable input into the meeting of the SAGA members together with members of the Deep Vision that met that afternoon. The powerpoint presentations at the SAGA meeting will be made available on a CD on request.

At the executive meeting of SAGA that afternoon the focus was on developing a response to the inquiry from the ICDP. The PI's then met with the DeepVision Committee on June 5th to discuss a new strategy. The outcome of these extensive discussions is summarized in the attached document addressed to the ICDP-SAG, the Science Advisory Group of ICDP. It responds to the specific inquiries of SAG and outlines a revised, less expensive program, for the IDDP from 2005 to 2007.

ICDP Project 07/04

Some clarifications concerning the Science Program of the Iceland Deep Drilling Project (IDDP) and discussion of alternative work and budgetary plans, in the context of the ICDP-SAG recommendations.

This document was prepared in reply to the letter from the Chairman of the Executive Committee of the ICDP, dated 28th May, 2004 that requested amplification of proposal 07/04. SAGA, the science advisory committee of the IDDP, met on June 1st and 2nd 2004, and Deep Vision, the IDDP steering committee of the consortium of Icelandic energy companies concerned, met on June 5th.

During these discussions, a representative of the industrial consortium made it clear that it is only a matter of time before they drill much deeper into a high-temperature zone in Iceland. On the Reykjanes Peninsula, where the Mid-Atlantic Ridge emerges from the ocean, seven ~2.5 km deep wells have been drilled in the last four years, and five new ~2.5 km wells will be drilled in 2005, in the already developed Reykjanes geothermal field where temperatures can exceed 320^{o}C at that depth. Deep Vision has offered the IDDP the opportunity to take over one of them for scientific study to participate in a staged deepening of it. SAGA is fully committed to seeing that the international scientific community grasps this unparalleled opportunity to address important scientific questions concerning the coupling of hydrothermal and magmatic systems on mid-ocean ridges.

The following paraphrases the issues raised by the ICDP-SAG, in the order that they were raised, offers some clarification and comments about each of them, and then presents alternative drilling plans.

1. Descriptions of the main scientific targets.
ICDP-SAG: "*The proposal emphasizes the importance of the utilization of supercritical fluids for the geothermal development, and it also points out the scientific significance of drilling into an igneous complex at the spreading centre, but lacks any concrete scientific strategy to be investigated*."

IDDP: Although the aim of the industrial consortium is to investigate deep geothermal resources, Reykjanes offers an unusually attractive target for scientific drilling. The active rifting and volcanism in Iceland is usually regarded as being due to its location at the coincidence of the spreading centers of the Mid-Atlantic Ridge and a mantle plume. Iceland is the largest landmass straddling a mid-ocean ridge and lies at the center of an actively forming Large Igneous Province stretching from Greenland to Scotland (Figure 1). Typically rocks near the surface in Reykjanes are hyaloclastites and basalt flows, which overlie sheeted dike swarms. These undoubtedly pass downwards into mafic intrusives gabbros, which in turn should be underlain by ultramafic rocks typical of the upper mantle. With few exceptions, such as the Oman Ophiolite, ocean crust is not usually available to study at outcrop. However the Reykjanes offers the advantage of permitting drilling into an ophiolite sequence on land, and to directly study *active* formation of ocean crust.

The drill site offered to the IDDP is also ideally situated for a broad array of scientific studies involving reactions between basalt and seawater at high temperatures, reaching supercritical conditions where exceptionally high solubility and mass and energy transfer occur. The flux of seawater through mid-ocean rift hydrothermal systems is the major control of the chemistry of the oceans. However these processes are difficult to study by direct

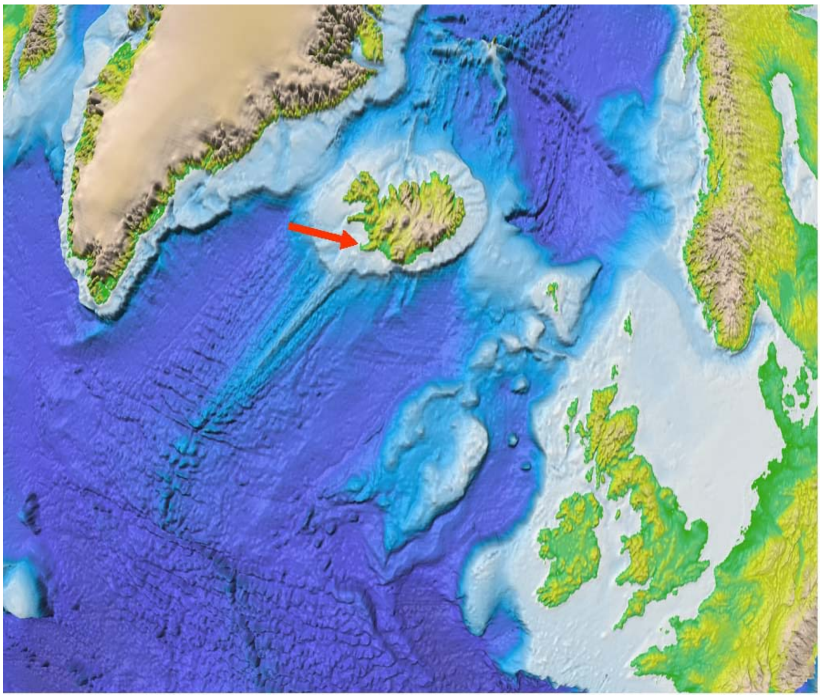

Figure 1. *The arrow shows the location of Reykjanes Peninsula on the Mid-Atlantic Ridge at the SW tip of Iceland.*

observation. Ocean drilling has penetrated only a few hundred meters into high-temperature marine hydrothermal systems. Furthermore ODP-type riser-less drilling does not allow fluid sampling. In contrast, the proposed drilling in collaboration with industry in Iceland will reach depths of 4-5.0 km. Furthermore, the Icelandic industrial partners will provide the associated engineering infrastructure and more than half of the necessary drilling costs.

The IDDP borehole described in proposal 07/04 was designed to reach 2.5, 3.7, and 5.0 km in successive stages. Depending on the fluid pressure, the drilled interval between 2.5 and 3.7 km should approach geochemical and pressure-temperature conditions similar to those of black smokers on oceanic spreading centers. The second phase of drilling and coring was designed to penetrate into supercritical fluids which couple black smoker hydrothermal systems with their volcanic heat sources. These environments have never been available for comprehensive direct study and sampling. Deep drilling will create a deep observatory to study the temporal behavior of this complex system.

2. What is the necessity of coring?

ICDP-SAG: *"The PI's do not mention why the planned scientific investigations of cores are important and what would be the beneficial outcome to the scientific community."*

IDDP: A pervasive requirement for the investigation of the systematics of magma-hydrothermal processes near critical conditions by drilling is the need for as much core as possible. More than half the projects proposed to the IDDP by the international scientific community would be impossible or severely compromised without core. Study of the coupling of the chemical and mineral alteration, fracture propagation, pressure solution, and fluid flow will be based on analysis of mineral-chemical, isotopic, geothermometric, and fracture geometric data. In Iceland use of downhole motors, for their high penetration rate while rotary drilling, produces very fine grained drill cuttings. Unraveling the nature and chronology of fracture failure and vein in-filling and detection of time serial fracture events and determination of constituitive rock properties requires core. Measurements of mechanical and thermal properties of core as a function of temperature are necessary to quantify processes related to brittle-ductile behaviour. The permeability and thermal diffusivity of fractured and intact, fresh and altered, basalt comprise essential baseline information for fluid circulation models.

Lost circulation is often encountered in drilling Icelandic geothermal wells. It prevents recovery of drill cuttings and furthermore use of borehole televiewers and many other logging tools is hindered, or precluded, by high temperatures. Thus drilling without core risks having no information on the strata penetrated. Furthermore, coring is a part of all major scientific drilling projects today. The philosophy is that utilization of core will increase as science progresses in the future and cores constitute a robust archival record.

3. What are the scientific models to be tested by drilling?

ICDP-SAG: *" The PI's should point to the kinds of scientific models they expect to reveal by drilling."*

IDDP: We do not know how oceanic and hydrothermal and magmatic systems couple together. Studies of exposed "fossil" ocean-ridge systems indicate that supercritical seawater-derived fluids, remarkably have pervaded every cubic centimeter of their basaltic host rocks. We do not know if this occurs by diffusion from spaced-out fractures, or by microfracturing and fluid advection on a sub-millimeter scale. Similarly although supercritical phenomena are very important in nature, the physics and chemistry of supercritical geothermal fluids in the Earth's crust are poorly known. Large changes in physical properties of fluids occur near the critical point. Orders of magnitude increases in the ratio of buoyancy forces to viscous forces occur that can lead to very high rates of mass and energy transport. Because major changes in the solubility of minerals occcur above and below the critical state, supercritical phenomena play a major role in high temperature water/rock reaction and the transport of dissolved metals. Hitherto, study of such supercritical phenomena has been restricted to either small-scale laboratory experiments or to investigations of extinct supercritical systems exposed in mines and outcrops. Furthermore mathematical modeling of the physics and chemistry of supercritical fluids is hampered by a lack of a reliable thermodynamic database over the range of temperatures and pressures of the supercritical state, particularly for saline fluid compositions.

Thus a major aim of the science program of the IDDP is to investigate an *active* subcritical to supercritical transition and determine pressures, temperatures, and fluid compositions and gain insight into the physics and chemistry of the supercritical state in nature. Samples from the IDDP well will give us a first-hand look at these active processes and allow us to study the fracture history and permeability. Because the thermodynamics of supercritical solutes is poorly known, at the transition from sub- to supercritical conditions at the magma-hydrothermal interface, the paired samples of fluids and minerals from the IDDP borehole will be extremely valuable for testing and improving our numerical models of fluid-rock reactions that control the compositions of both fluids and minerals under supercritical conditions.

The depths at which supercritical conditions are reached depend on temperature and pressure gradients that may be controlled by cold or hot water hydrostatic conditions or, deeper in the system, by lithostatic load, depending on the permeability. If a natural hydrostatic hydrothermal system is boiling from the surface down to the critical point, the maximum pressure and temperature at each depth is determined by the boiling point/depth curve, and the critical point for pure water would be reached at about 3.5 km depth. For saline systems the critical point occurs at higher pressures and temperatures, and therefore at greater depth. At the site of the proposed for the IDDP, in the Reykjanes geothermal system, the fluid concerned is modified seawater, so the critical temperature will be elevated to about 410°C. Based on data from existing wells on the Reykjanes Peninsula, we anticipate temperatures in the range of >320°C at 2.5 km and approaching 400°C at 3.7 km, so that reaching supercritical temperatures in modified seawater will require drilling deeper.

Athough the hydrostatic boiling point-depth curve controls the maximum P-T in many high-temperature geothermal systems, exceptions are common, depending on how the hydrothermal system couples with its magmatic heat source (Figure 2). The line A-B in the

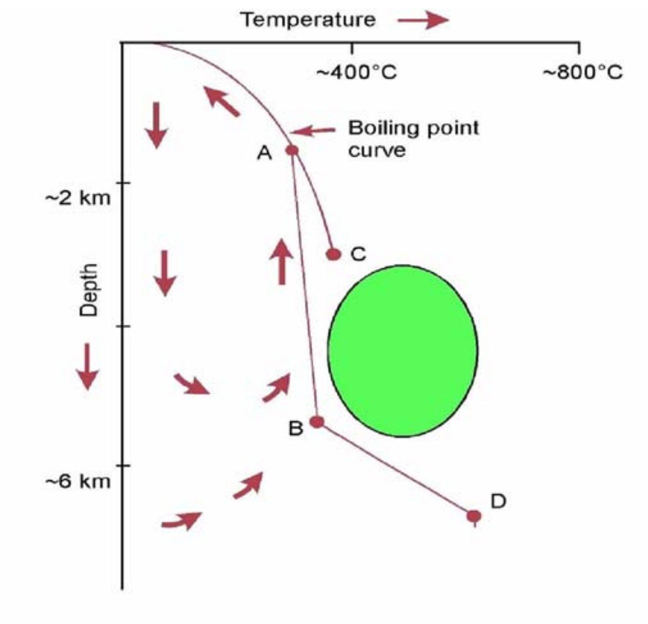

Figure 2.
Conceptual model of temperature-depth relations in a convecting hydrothermal cell. Adiabatic gradient A-B; critical point C; and conductive gradient B-D. The ellipse represents the target region for the IDDP.

figure represents an adiabatic gradient in an ascending plume of subcritical hot water that intersects the boiling point/depth curve and boils as pressure declines. The fundamental control over pressure in the Reykjanes hydrothermal system could be the hydrostatic gradient in the cold seawater that surrounds the peninsula. The higher the gradient of fluid pressure, the shallower the depth at which supercritical temperatures and pressures will be encountered. On the other hand, water-rock reaction and self-sealing might permit strong horizontal gradients of pressure in the system, and lower fluid pressures cause the critical point to be deeper.

An important goal of the science program of IDDP is gaining information on how deep hydrothermal cells penetrate in a mid-ocean ridge environment. Conventional wisdom suggests that the base of a hydrothermal cell is controlled by decrease of permeability due to transitions from brittle to ductile behavior with increasing temperatures. Thus the line B-D in Figure 2 is drawn as a conductive thermal gradient near a magmatic heat source. However we do not know the depth of the permeability change shown at point B. Many black smokers on ocean spreading centers, and hydrothermal systems on land seem to have an upper temperature limit of <400 ^{o}C and this might imply that permeability effectively ceases at that

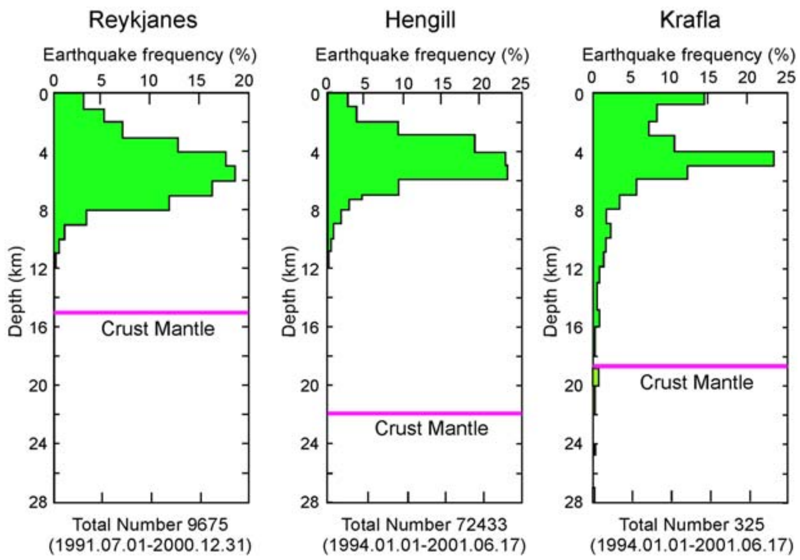

Figure 3. Earthquake frequency with depth beneath three developed geothermal fields in Iceland, at Reykjanes, Nesjavellir (within Hengill volcano) and Krafla.

temperature. On the other hand, this limit might be controlled by transitions from supercritical to subcritical behavior, as seismic evidence indicates that fracturing persists to greater depth and to temperatures exceeding 400 ^{o}C. Figure 3 shows that for almost 10,000 earthquakes in a nine-year period at Reykjanes the greatest frequency in depth of hypocenters occurred at slightly more than 5 km and that frequent seismicity persisted to 8 km. In the laboratory the brittle-ductile transition in basalt occurs at about 600 ^{o}C so this is the likely temperature at 8 km. However, the temperature of this transition is strain rate dependent. The active rifting at Reykjanes should result a high strain rate, permitting short-lived episodes of fracture failure at even higher temperatures. Thus the temperature at 8 km could be >600 ^{o}C.

The data from the permanent network of seismometers covering the Reykjanes region, and the seismic studies that will be done as part of the IDDP, will allow us to relate seismicity to the fracturing and hydrothermal processes observed in the borehole. In the same way that deep drilling will allow us to investigate possible transitions to supercritical conditions, by drilling into the seismogenic zone beneath Reykjanes, we can investigate the relationships between temperatures, fluid pressures, fracturing and seismicity, and possibly creep due to transitions to ductile behavior.

4. What is the benefit for the international scientific communities?
ICDP-SAG: *"Do results of the project have some scientific outcome or benefits if applied to similar geologic fields elsewhere in the world or if utilized by scientists who are not directly involved in the project?"*

IDDP: A prime scientific objective is to investigate the circulation of fluids, at or near supercritical conditions (around 410^o C) and their physical and chemical variations, within oceanic-type crust at an active spreading center. This will greatly enhance our understanding of the fundamental way in which the Earth loses heat through volcanism and hydrothermal circulation at the mid-ocean ridges. The implications of this process range from plate tectonics, to the controls on oceanic chemistry and even the origin of life. The international science community has made investigation of hydrothermal systems at mid-ocean ridges a high priority as demonstrated through funding of programs like RIDGE and InterRIDGE, and extensive scientific drilling conducted by the Ocean Drilling Program (ODP). One of the least understood, least accessible, but most crucial, aspects of lithosphere-hydrosphere interaction is the transition from subcritical to supercritical conditions in the hydrothermal environments near mid-ocean ridge magma chambers.

This high-priority research target has hitherto been beyond the technical capabilities of the ODP, but can be best addressed by scientific drilling on land in the Reykjanes magma-hydrothermal system. Indeed the Reykjanes Peninsula should be regarded as a *Mission Specific Platform* for the IODP to study ocean ridge hydrothermal systems. The proposed deep drilling represents a unique opportunity for the international research communities to make a giant leap forward in understanding one of the most fundamental energy and mass transfer process between the interior of the earth and the oceans. In addition, for the geothermal research community the IDDP has the potential to improve the economics and availability of alternative energy wherever high-temperature geothermal resources occur, for example in Italy, Greece, Turkey, Japan, Indonesia, the Philippines, Kamchatchka, New Zealand, in western North America, and in Central America.

In distributing subsets of cores, cuttings, fluid samples and borehole data to interested scientists we envisage following a protocol similar to that used by the Ocean Drilling Program. For a limited time such distribution would be limited to the IDDP science team. The moratorium on distribution would then be lifted and the materials will be made available to scientists worldwide. We expect that they will be archived in the sample repository of the Natural History Museum of Iceland but we will seek the advice and approval of the ICDP and other funding agencies on this issue.

5. Policy on proprietary nature of data.
ICDP-SAG: *"Is there any proprietary consideration that would limit the release of the data or samples obtained by the ICDP-funded part of the project to the scientific community?"*

IDDP: An important aspect of the current rapid expansion of the energy industry in Iceland is a spirit of collegiality between the industrial and government entities involved. The invitation of the consortium to the scientific community to participate comes without any restrictions based on proprietary considerations on the use of data or publication of results. On the contrary, the consortium is willing to release to the public domain reports based on the comprehensive geoscientific data from the extensive drilling on the Reykjanes Peninsula adjacent to the IDDP well. This release would, of course, exclude sensitive economic information related to topics like power sales contracts, etc. Thus the science team will be able to put the scientific information from the IDDP well into its three dimensional context, by integrating it with proprietary data from other wells and from geophysical surveys. Deep Vision will, as required, supply written confirmation of this policy.

6. Alternative drilling and budget plans.
ICDP-SAG: *"The budget and drilling plan are overly ambitious. The PI's need to present a variety of alternatives with respect to drilling/coring, total cost and potential scientific return."*

IDDP: Details of various engineering options, budgets and alternative sources of funding are under active discussion and will doubtless be modified and improved as the project develops. If carried out, the IDDP borehole as described in proposal 07/04 would have yielded fluid samples from the flow tests at depths 2.5, 3.7, and 5.0 km, drill cuttings down to 2.5 km depth, drill core from 2.5 to 5.0 km depth, and pressure, temperature and flow-meter logs over the whole drilled interval. This plan is technically challenging and therefore expensive. Few boreholes in the world have ever been drilled at temperatures of >400 ^{o}C. The costs of drilling and fully sampling and testing a 5 km deep well for the needs of both the industrial and scientific partners was estimated in the IDDP Feasibility Report of 2003 to be 14.5 to 15.5 million USD, whereas the cost of drilling a straightforward 5 km deep exploration well without coring, scientific sampling and logging was estimated to be 8 to 9 million USD. Engineers with extensive experience of drilling geothermal exploration and production wells in Iceland developed the drilling plans and costs cited in that report. However since then the US dollar has been devalued significantly.

Our approach has been to assume that the industrial partners would finance the cost of an exploration or production well and the science program would finance the additional operational costs, such as coring, etc., incurred by the science program. This was reflected in the 3.76 million USD budget submitted in proposal 07/04. This sum represents the difference between rotary drilling and continuous coring from 2.5 to 3.7 km, plus the rig time necessary for specialized logging and fluid sampling for the science program and associated costs. The main way to reduce the incremental drilling costs for the science program is to reduce the amount of coring, but this must be done in a way that minimizes the negative impact on the science. Options range from (a) complete wireline coring from the surface down, (b) wireline coring below 2.5 km, (c) spot coring during rotary drilling, to (d) no coring at all. Option (a) is too expensive, and does not take advantage of the 2.5 km deep well being offered by industry. Option (b) was the option that was presented in Proposal 07/04. Option (c) is expensive of drilling rig time because of the number of round trips necessary to retrieve a core barrel and resume drilling. It is estimated that attempting a single 8 m long core deep in the borehole could cost up to 100,000 USD, depending on the number of trips of the drill string. Option (d) is unacceptable to the science program for the reasons stated above in section 2. We are therefore presenting a compromise approach with emphasis on obtaining only the cores most vital to the science program.

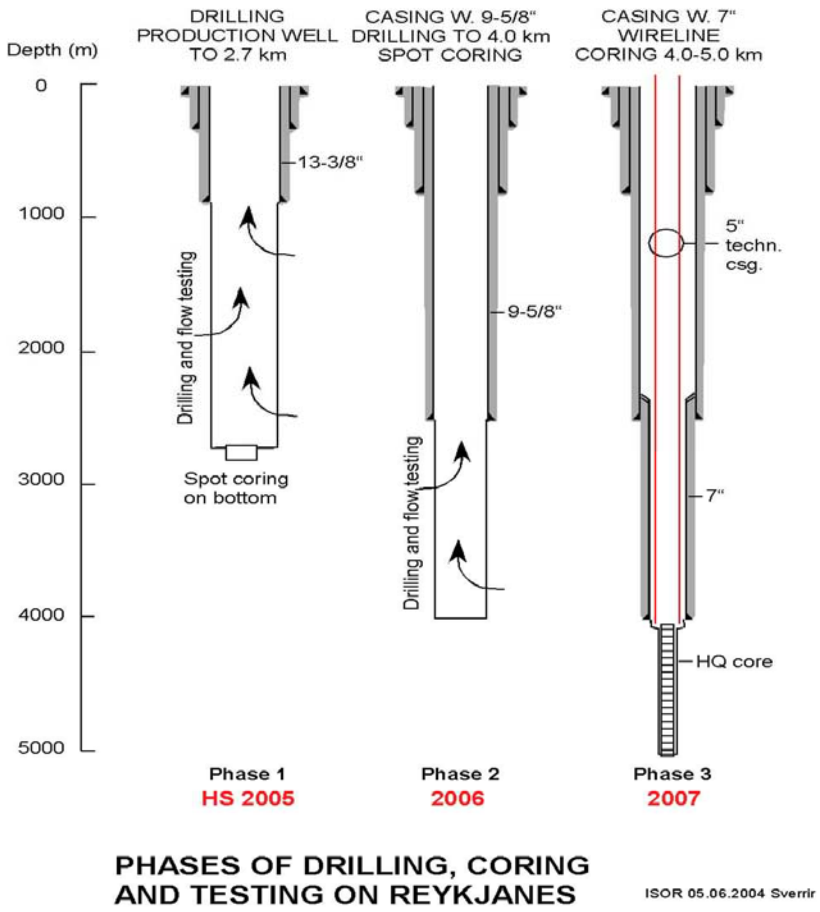

Figure 4: *An alternative drilling plan for the IDDP borehole at Reykjanes (05 June2004).*

Figure 4 and Table 1 show this compromise approach with spot coring only at shallower depths where they are less expensive, or at bit changes, and wireline coring deeper than 4.0 km in the hotter part of the system, near the subcritical to supercritical transition, in the seismogenic zone.

The sequence of operations proposed is shown in Table 1 and discussed below:-

Phase I – Pilot Phase (0-2.7 km): In February 2005 Hitaveita Sudurnesja intends to complete a bare-foot production well 2.7 km deep (extended from 2.5 km at our request) with 13 3/8 inch production casing to 800 m. One or two 8 meter-long spot cores will be drilled at 2.7 km depth, and a full suite of logs, including specialized high-temperature tools, will be run. Working on the drill cuttings and limited core will be used as a “shakedown cruise” of the field petrographic laboratory, and Data Information System. A full-scale flow test will carried out in August to October. The cost of drilling, logging and testing the 2.7 km deep well, estimated to be about 3 million USD, will be paid by Hitaveita Sudurnesja. The incremental operational cost of the science program in 2005 is estimated to ~150,000 USD (rig time for coring, specialized logging, fluid sampling, field laboratory, etc.)

IDDP Workplan
2005-2007

	Actions:	
DATE:		
2005	**Rotary Drilling**	**Logging**
Jan-Feb	Drilling with 12 1/4" bit	conventional
0.0 - 2.7 km	0.8-2.7 km open hole	plus high-T tools
		petrography & fluid -
	spot core at bottom	inclusions & DIS
Aug-October	**Flow test 1**	conventional
2006	Casing with 9 5/8"	conventional
Aug-October	Drilling with 8 1/2" bit	plus high-T tools
2.7 - 4.0 km		petrography & fluid -
	Core at bit changes	inclusions & DIS
		Initial corestudy
Dec-March	**Flow test 2**	As applicable
2007	**Core drilling**	**Logging**
Aug-October	Casing with 7"	HSDP-model
	Technical casing 5"	for core handling
4.0 - 5.0 Km	DOSECC coring 3.8" bit	
Nov-Dec.	**Flow test 3**	As applicable

Table 1. *Proposed work plan for an IDDP borehole at Reykjanes (05 June 2004).*

Phase 2-(2.7-4.0 km) Rotary Drilling. Starting in August-October 2006, 9 5/8 inch casing will be cemented to 2.7 km and rotary drilling commenced with an 8 1/2 inch bit down to 4.0 km. Spot cores will be taken at bit changes, and high-temperature logs run. A flow test of the open interval 2.7-4.0 km will be carried out between December 2006 and March 2007. The time for drilling from 2.7 to 4.0 km in Phase 2 is about 50 days. The cost of rotary drilling is estimated to be about 3.7 million USD, which would be shared by the consortium of the Icelandic energy companies and the government, and other collaborators, subject to approval by the entities concerned. The incremental operational cost of the science program in 2006 (spot coring, sample handling, specialized logging, fluid sampling, field laboratory, etc.) is estimated to be 0.5 million USD.

Phase 3 (4.0-5.0 km). Wireline Coring. Starting in August-October 2007, a 7-inch casing will be cemented to 4.0 km and wireline HQ drilling commenced through a 5-inch technical liner. Coring from 4.0 to 5.0 km and testing, logging and downhole experiments would take about a hundred days and cost 5.5-6 million USD, which would be a charge to the science program in 2007, subject to negotiation with the energy consortium and possible international partners. A flow test from the cored hole of the interval below 4.0 km would also be attempted.

A tentative estimated yearly funding flow is as follows:-

Year	Industry Program	Science Program
2005 (Pilot Phase)	3.0 Million USD (from Hitaveita Sudurnesja)	0.15 M USD (from ICDP)
2006 (Phase 2)	3.7 M USD (from Deep Vision)	0.5 M (USD) (from ICDP)
2007 (Phase 3)	0.5 M USD (flow test, etc.) (from Deep Vision)	5.5-6 M USD (from ICDP, NSF, & other funding agencies)

Spacing the program out over several years is a result of discussions involving availability of drill rigs, environmental restrictions in the spring during bird nesting, and the realities of funding both on the part of the industry consortium and science funding agencies. Each of these phases will yield valuable sample and data that will lead to important scientific results whether or not the subsequent phase proceeds as planned.

Gudmundur Ómar Friðleifsson
ÍSOR, Iceland GeoSurvey

Wilfred A. Elders
University of California, Riverside

AGENDA

IDDP - SAGA Meeting 2004
Landsvirkjun - Dispatch Center

June 1st		
Transport from Hotel Vik	08:30	
Opening	9:00 - 9:10	Mrs.Valgerður Sverrisdóttir, Minister of Industry and Commerce
Introduction	9:10 - 9:20	Guðmundur Ómar Friðleifsson, IDDP Workplan
Organization	09:20-9:25	Wilfred Elders - Purpose of the SAGA meeting
IDDP DeepVision	9:25 - 9:45	Björn Stefansson - Financial issues and future prospects
IDDP at Reykjanes	09:45-10:05	Albert Albertsson - The Reykjanes plant and IDDP drillsite
10:05 -10:45	Coffee Break	
ICDP-participation	10:45 -11:05	Ulrich Harms ICDP perspective on IDDP
Funding prospects	11:05 -11:20	Wilfred Elders - Progress and future prospects
EC-participation	11:20 -11:35	Ólafur Flóvenz - EC- FP6 Energy Program
EC-participation	11:35 -11:50	David Mainprice - Montpellier activities within FP6-proposal
EC-participation	11:50 -12:05	Johannes Kulenkampff - GFZ-activities within EU-FP6
Canadian participation	12:05-12:25	Daniel Fraser et al. Industrial opportunities
High-T H2 production	12:25-12:40	Ágúst Valfells - Overview on H2 - What's in it for geothermal?
Worldwide research drilling	12:40-12:55	Dennis Nielson - A global perspective on research drilling
13:00 -14:00	Lunch break	
IDDP Drill site	14:00-14:15	Hjalti Franzson - Revised Geothermal Model at Reykjanes
IDDP Drillling Plan	14:15-14:30	Sverrir Thórhallsson Drilling Plan - overview and current plan
IDDP Drillling Plan	14:30-14:45	Axel Sperber - Coring / No coring /alternative drilling plans
IDDP Science Plan	14:45-15:00	Wilfred Elders and Guðmundur Ómar Friðleifsson
15:00-15:30	Coffee break	
Group work	15:30-17:00	
Group 1		Funding plan - Sveinbjörn Björnsson
Group 2		Drilling Plan - Alister Skinner
Group 3		Science Plan - Robert Fournier
Group review	17:00-17:30	10 min review from each group
17:30-20:00	Reception - Dinner at Dispatch Center	
Transport to Hotel Vik	~20:00	
June 2nd		
Transport from Hotel Vik	08:30	
Review and discussion	09:00 - 10:15	
10:15 - 10:30	Coffee break	
Group work	10:30 - 12:00	
Group review	12:00 - 12:30	10 min review from each workgroup
12:30-13:30	Lunch break	End of open meeting - Adjourn
Minibus/taxis to airport		In time for afternoon flights
Transport to Skidaskalinn	13:30	Visit Hellisheidi Plant - under construction
SAGA Group meeting	14:30-17:30	**At Skidaskalinn** - Hellisheidi in the Hengill area
SAGA dinner	18:00-20:00	At Skidaskalinn
Transport to Hotel Vik	~20:00	

Invited guestes and participans:

Friðrik Sophusson	Landsvirkjun
Guðmundur Þóroddsson	Orkuveita Reykjavikur
Júlíus Jónsson	Hitaveita Sudurnesja Ltd
Þorkell Helgason	National Energy Authority
Ólafur Flóvenz	ISOR Icelandic GeoSurvey
Bent Einarsson	Iceland Drilling Ltd.
Kristján Skarphéðinsson	Ministry of Industry
Helgi Bjarnason	Ministry of Industry
Páll Magnússon	Ministry of Industry
Vilhjálmur Lúðvíksson	Ministry of Education
Hans K. Guðmundsson	Icelandic Centre for Research
Kristján Kristjánsson	Icelandic Centre for Research
Ásgeir Margeirsson	Orkuveita Reykjavíkur
Agnar Olsen	Landsvirkjun
Bjarni Bjarnason	Landsvirkjun
Árni Gunnarsson	Landsvirkjun
Geir Þórólfsson	Hitaveita Sudurnesja Ltd
Eiríkur Bogason	The Samorka Federation
Ingvar B. Friðleifsson	UNU Geoth.Training Progr.
Sveinbjörn Björnsson	National Energy Authority
Hallgrímur Jónasson	Icetec
Þorsteinn I. Sigfússon	University of Iceland
Jón Björn Skúlason	Iceland New Energy
Þór Gíslason	Iceland Drilling Ltd.
Sturla F. Birkisson	Iceland Drilling Ltd.
Kristinn Ingason	VGK Consulting Engineers Ltd.
Matthías Matthíasson	VGK Consulting Engineers Ltd.
Claus Ballzus	VGK Consulting Engineers Ltd.
Teitur Gunnarsson	VGK Consulting Engineers Ltd.
Bjarni Pálsson	Landsvirkjun
Sverrir Þórhallson	ISOR Icelandic GeoSurvey
Ómar Sigurðsson	ISOR Icelandic GeoSurvey
Grímur Björnsson	ISOR Icelandic GeoSurvey
Ásgrímur Guðmundsson	ISOR Icelandic GeoSurvey
Halldór Ármannsson	ISOR Icelandic GeoSurvey

Hjalti Franzson	ISOR Icelandic GeoSurvey
Knútur Árnason	ISOR Icelandic GeoSurvey
Gestur Gíslason	Orkuveitu Reykjavíkur
Ingi Th. Bjarnason	University of Iceland
Ágúst Valfells	National Energy Authority
DeepVision	
Albert Albertsson	Hitaveita Sudurnesja Ltd
Björn Stefánsson	Landsvirkjun
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