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THE STATE OF ALASKA GEOTHERMAL PROGRAM

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ABSTRACT

The State of Alaska geothermal program presently consists of a regional hot spring reconnaissance project and 15 proposed site-specific projects. The general outline of this program is presented.

INTRODUCTION

The intent of this report is to outline a geothermal program that will lead to immediate geothermal energy development in Alaska. Any investigation and/or assessment program intended to encourage immediate geothermal development in Alaska should concentrate on hydrothermal (i.e. hot water and/or steam) systems rather than hot dry-rock or molten-igneous systems. This strategy is necessary since the technology for harnessing hot dry-rock and molten-igneous energy is poorly developed (Peck, 1975; Smith, 1978; and Murphy, 1979). Hydrothermal systems are being successfully used with existing technology as energy sources throughout the world (Armstead, ed., 1973; and Wehlage, 1979). In order to better use geothermal energy in Alaska, further investigations such as described here will need to be undertaken.

PLAN OUTLINE

The State of Alaska hydrothermal resource investigation program consists of two basic concurrent projects: hot spring reconnaissance, and site-specific assessment. The available hot spring resources will be catalogued regionally; this will be accomplished by reconnaissance examinations of all known hot spring occurrences in the state. The concurrent second project of the geothermal program involves detailed investigations of at least one potentially developable hydrothermal site each year.

The hot spring reconnaissance activities are composed of field studies designed to acquire new data on each of the state's geothermal hot springs. Special attention will be given to collecting samples and data that will allow preliminary reservoir capacity and temperature estimates to be made. The results of this work will be published as an atlas entitled "Geologic Atlas of Hot Spring Areas in Alaska".

A modular site-specific hydrothermal exploration and reservoir assessment plan is outlined in figure 1. This modular plan identifies the tasks that must be accomplished in developing a successful geothermal-energy facility. Its form and content has been influenced by other plans successfully executed elsewhere (Goldstein, 1977; Ward, 1977; and Ball et al., 1979).

The site-specific assessment plan consists of 13 steps that are organized in five phases:

Phase I, the initial assessment;
Phase II, initial reservoir definition;
Phase III, advanced assessment;
Phase IV, commercial feasibility; and
Phase V, development.

The steps within each phase contain one or more modules of critical tasks that should be completed and evaluated before proceeding to the next step.

The project design provides numerous checkpoints to terminate expenditures on a site if the accumulating data indicate a low probability of finding an exploitable energy source. The identification of specific modules of general tasks in this design allows flexibility in tailoring the details of a specific evaluation program to the peculiarities of the site involved. In this regard, figure 1 should be regarded as a general example for a hypothetical site which can be easily adjusted to fit local geological and logistical constraints.

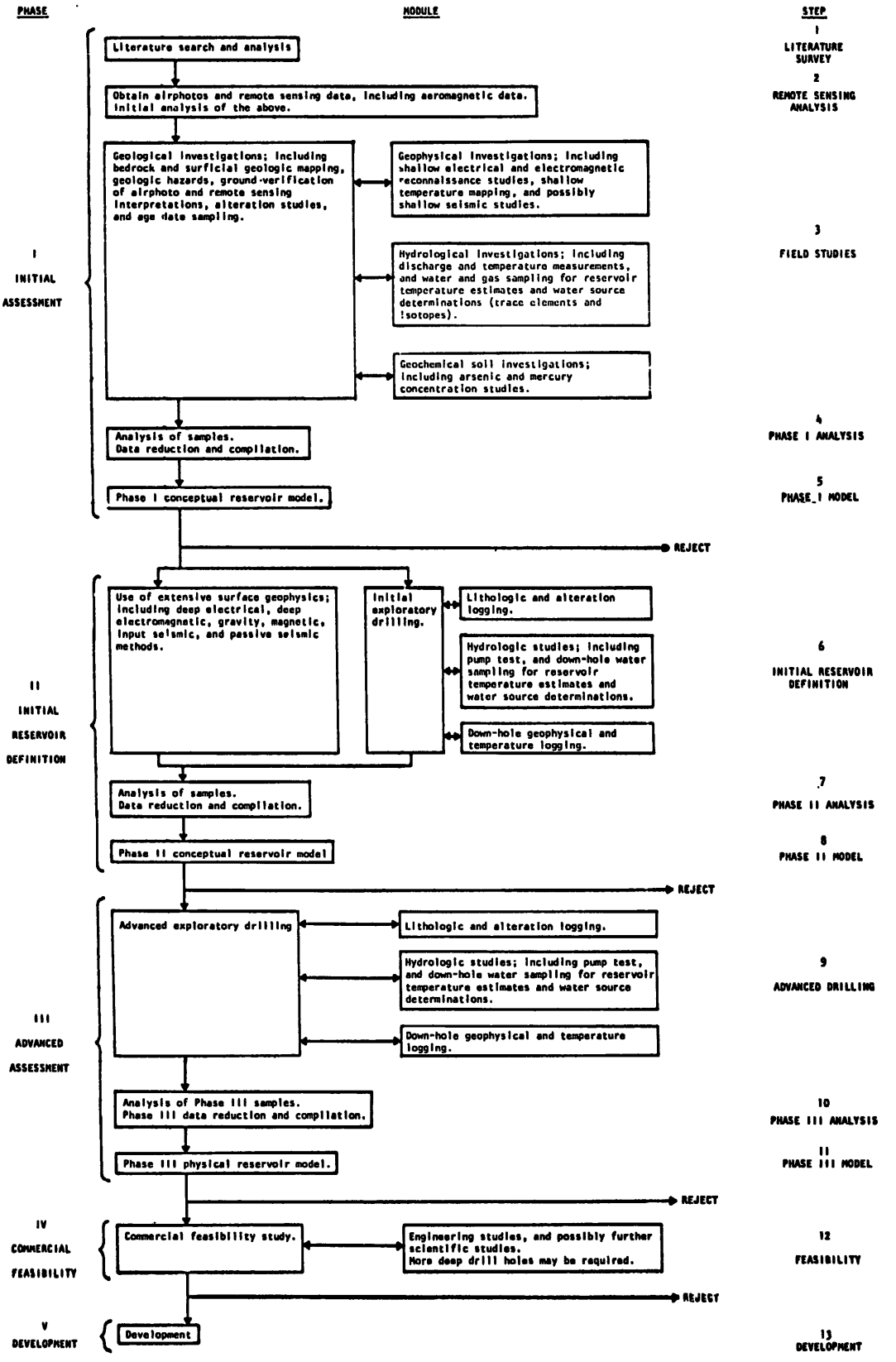

Figure 1. A modular site-specific hydrothermal exploration and reservoir assessment plan.

POTENTIALLY DEVELOPABLE SITES

Hydrothermal systems in Alaska are, in general, related to geologically young volcanoes, to fractured granitic plutons, and/or to large sedimentary basins. A tentative selection of 15 potentially developable hydrothermal sites, representing all of the above mentioned geological settings and a broad regional distribution throughout the state, is proposed for development consideration. These sites are:

Pilgrim Springs,
Kotzebue,
West side of Mount Drum (Klawasi),
Willow,
Chena Hot Springs,
Circle Hot Springs,
Manley Hot Springs,
Horner Hot Springs,
Clear Creek Hot Springs,
Central Baranof Island (Sitka Hot Springs),
Tenakee Hot Springs,
Northern part of Unalaska Island,
Umnak Island,
Emmons Caldera, and
Northeastern Atka Island.

This proposed site selection for hydrothermal development is based on the works by Waring (1917), Miller (1973), Miller and Barnes (1976), Turner et al. (1978), Markle (1979), Wescott and Turner, eds. (1979), and Turner and Forbes, eds. (1980). These sites are subject to change as new data become available from sources such as: the hot spring atlas project, mandates of the Alaska Legislature, and expressed needs of Alaskans.

The foregoing project plan for site-specific investigations, figure 1, has been adopted to these 15 selected sites. The exploration scenario developed for each site includes exploration techniques, required time, and estimated cost. The feasibility and development considerations for the sites are beyond the scope of these plans.

IMPLEMENTATION

General reconnaissance of Alaska hot springs required for the statewide atlas compilation is presently underway, funded by both the State of Alaska and the U. S. Department of Energy. This project should be completed within two years.

The number of detailed site-specific investigations to be undertaken in the near future will depend upon funding. Because field seasons are usually restricted to the summer months, Phase I field work should be conducted during the first summer of the funding period, where Phase II work should not be conducted until the following summer. Naturally, there are exceptions. For example, exploratory drilling can be performed any time of the year at the Kotzebue site. But, for most Alaska hydrothermal sites, at least two years will be required just to accomplish a detailed hydrothermal assessment. Actual development of any site could easily require several more years. Site-specific hydrothermal investigations should be initiated immediately if Alaska is to realize its hydrothermal resources in the near future.

CLOSING

Unfortunately, the temperatures of most known hydrothermal systems in Alaska are too low for large electrical generation. Also, the systems are located in regions so remote and distant that transport of hydrothermal waters to communities is not feasible. In fact, most of the sites used in this program are probably uneconomical to develop at present.

Since a hydrothermal reservoir must yield 160 degree C waters before it is usually considered commercial for electrical generation (Greider, 1978), large electrical generation from hydrothermal resources is presently possible only in the Alaska Peninsula, Aleutian Islands, and possibly in the Wrangell Mountains. Thus, hydrothermal site-specific investigations in these regions should be strongly encouraged.

Hydrothermal systems which could be used for space heating are suspected near Alaskan communities such as Kotzebue, Shismaref, Saint Michael, Sitka, Copper Center, and Unalaska. Numerous other communities in Alaska may be located over presently unknown hydrothermal systems useable for space heating. Remote sensing, geological, and hydrological expertise should be combined in an effort to locate such hydrothermal systems at or near existing Alaskan communities.

Large electrical power generation is presently unlikely from low-temperature (under 160° C) waters (Abbin, 1978; and Demuth, 1979) of most known hydrothermal systems in the state. However, serious investigation of several low temperature remote sites should be of great importance. Such investigations would determine the actual value of such resources for direct use and small electrical power generation.

In general, the geothermal potential of Alaska is great; yet it is hardly used. Such energy resources should not be ignored as they have been in the past.

ACKNOWLEDGEMENTS

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