

Copy to Mike Wright 7/30/79
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State of Arizona Bureau of Geology and Mineral Technology



**Geological Survey Branch
Geothermal Group**
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July 26, 1979

MIKE - CAN YOU HAVE
THIS RESOLVED WITH THE
AR. FOLKS?
BEN

George Freund
EG&G Idaho, Inc.
Regional Hydrothermal Program
P.O. Box 1625
Idaho Falls, Idaho 83401

Re: Observations on the Baseline for Arizona Geothermal

Dear Mr. Freund,

The following comments on the Baseline document are made in the spirit of improving the quality of the product when revisions are undertaken.

Page 2-3 Geothermal Resources

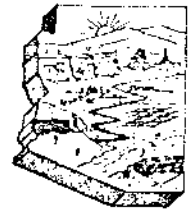
Confirmed reservoirs 20°C < T < 150°C: None
Prospects 20°C < T < 150°C: 20
Identified Warm Springs & Wells > 40°C: ~40

First - Should not read 20°C, rather it should be 30°C. 20°C = 68°F and in many areas this is less than the M.A.T. Therefore, by the 20°C criterion, just about every well should be part of the prospects.

Second - Wells > 40°C: ~40 -- unless I miss my count, there are between 240 and 250 wells above 40°C listed in Oil and Gas 6. Seven (7) wells report temperatures in excess of 100°C. Oil and Gas 6 is enclosed for your information along with WATSTORE.

Page 3-3

- B - do you want to include Aquarius because of the work being done by LASL? There seems to be quite a play in that area by ARCO.
- C - Figure 3.2 (actually on page 3-4) Resources < 150°C, shows 35-40 locations or dots. Refer to comment #2, pg. 2-3.
- D - Comments: should we state here the problems of lease permits? In review of permit rules, an additional 5 or 6 pages would be required. It is best to leave this section alone, although these are problems.



Page 3-5 "In numerous wells water at unusual high temperatures (generally less than 100°C) has been encountered." How about putting a number on the wells, such as, over 200 or approximately 300 wells which have reported temperatures in excess of 40°C?

Low and Moderate Temperature Resources - No real complaint here other than the word "numerous." We should be able to change that to read, "In excess of 200."

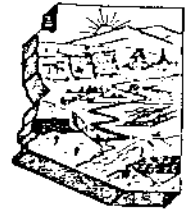
Table 3.1 - Pages 3-6 to 3-8

There are 50 wells and springs listed, 6 of which are over 100°C. Go back to page 2-3, warm springs and wells >40°C:
~40 ... not consistent with Table 3.1.

The problem with Table 3.1 is that it only uses the USGS GEOTHERM file. None of the Arizona Water Commission Bulletins, Oil and Gas Conservation Commission Reports, USGS water-supply papers, or Arizona Bureau of Geology and Mineral Technology (Geothermal Group) reports are included. Even the Arizona State Land Department lists some temperatures for wells. WATSTORE also represents a major data source with wide circulation within the Geothermal community. Two copies of WATSTORE have been included. The printout contains water chemistry and wells immediately adjacent to Arizona. The typed listing is Arizona only.

Page 4-1 Highlights. Fair first statement, except the timing is off. It reads as if there was a moratorium and it was just lifted. The leasing problem was solved by Arizona House Bill 2257, which was signed by the Governor on May 23, 1977. This bill gave the Arizona State Land Department the right to accept geothermal lease requests for state lands. It took over a year to settle the permitting procedures.

The State Geothermal Team must be a bunch of incompetents if they have only identified "more than 40 springs (and wells) yielding anomalously warm water." If only springs were included, the number would appear to be small (e.g., 40 is a small number). If the total geothermal picture were included, then maybe the 40 should read 400. I again refer you to the included copies of Oil and Gas 6 and WATSTORE. Our most recent computer-generated map has over 900 points, and we were working with less than half of our data bank!



Page 4-9 (Table 4.6) Test Wells in Arizona.

I assume by "test well" this table lists only those wells which were drilled explicitly for geothermal energy. There are 4 wells listed, 2 in Maricopa County and 2 in Pinal County. Please change the heading so it does not imply heat flow tests, water tests, oil and gas tests, etc.

What was the temperature for the Nix Drilling Co. well in T5S, R.24E? It must not have been much because it isn't listed in Table 3.1. If the text is correct, the table lists "Test wells in Arizona" (pg. 4-9), a vague term that could imply "other" wells such as for mineral, water, gas or oil. Maybe this is why only 4 wells are listed in Table 4.6, whereas Table 3.1 includes:

San Simon	T.13S., R30E	134.0°C
Picacho	T.8S., R.8E	116.0°C
San Louis	T.11S, R24W.	138.0°C

Doesn't anyone else outside of Arizona know about:

T.2S., R.6E., Sec. 1ad	120°C @ 2783 m
T.2S., R.6E., Sec. 1da	117.8°C @ 2768 m
T.16S., R.15E., Sec. 5ca	146.7°C @ 3824 m
T.7S., R.8E., Sec. 8cd	106.7°C @ 2441 m

These were listed in Oil and Gas R.I.-6 and in the Geothermal Group's semiannual report, July 1978 (see enclosure).

Table 4.8, pg. 4-13

There are 4 resorts listed, page 2-3, Sec. B, Statistical Data shows under Operational Hydrothermal Systems spas: three. This does not compute. While we're on the subject of operational systems, how many greenhouses are there in Arizona that have used, or are now using hot water? Whitewing Ranch has an inoperative greenhouse, and I'll bet if you check around there will be a great number of such systems. How do you classify the use of "warm or hot irrigation waters" when they are used during the winter to prevent freezing of crops? These occur throughout the State. Do they have a reservoir that is proven? Should they be listed on page 2-3?

9.1 Bibliography SELECTED REFERENCES

pg. 9-1. -- This Baseline is for Arizona, not Utah.



Overall this Baseline report suffers from the lack of data. Most, if not all of the problems could be excused if the only data available to the Baseline Team came from the GEOTHERM file of the USGS. The bibliography indicates otherwise. Several times I have referred to Oil and Gas R.I.-6, or the Arizona Geothermal Group's semiannual report of July, 1978, for additional data. Although the references cited in the test do not appear in the Section 9; Bibliography, the Group's report does. Curious too is the listing of NMEI-6 in the bibliography because it too contains a number of recent, first-hand observations and chemical determinations. Since NMEI-6's contribution is shorter than the Group's, I have compared their values with those that appear in Table 3.1. Only measured temperatures greater than 40°C were examined. The following locations do not appear in Table 3.1.

<u>No.</u>	<u>Location</u>	<u>Well or Spring</u>	<u>Temperature</u>
1	T.4S., R.28E., Sec. 35ba	Spring	42.0°C
2	T.4S., R.30E., Sec. 18dc	Spring	48.0°C
3	T.5S., R.12W., Sec. 9acc	Hot Pumped Well	41.6°C
4	T.10S., R.28E., Sec. 36da	Hot Artesian Well	41.1°C
5	T.11N., R.6E., Sec. 3	Verde Hot Springs	40.0°C

Twenty-nine wells and springs listed in NMEI-6 had water temperatures in excess of 40°C. These were turned in for the GEOTHERM file. A check of our old printout of GEOTHERM shows some, but not all of NMEI-6's data had been entered.

Therefore, the conclusion must be drawn that the authors of the Arizona Baseline Report were not in full possession of all data that has been provided to GEOTHERM. This applies to the NMEI-6 data, the Geothermal Group's July, 1978, Report, and all the supplemental data supplied on a spot basis. The Baseline document cannot be faulted from the standpoint of the data presented in it if there is a question as to how much data the authors had in their possession. The document can, however, be questioned for its lack of internal consistency. The use of vague terms, such as "numerous" may indicate the author's feeling that they were not in possession of all the data, and, therefore, they tried to hedge in Arizona's favor. This is only a guess, but it appears to fit the facts as presented in the document.

Time does not permit me to totally revise the report using the most recent data. I hope that these comments will aid in its future revision by calling attention to the use of vague terms and the lack of internal consistency. No document of this nature can be "complete." The purpose of such a document is to provide those who are interested in the resource development an opportunity to assess the area through a thumbnail sketch.

George Freund
EG&G Idaho, Inc.
Page 5



It can also help the elected official to evaluate future funding of projects within the State. Therefore, the document should be factual, current and concise. The authorship of such a work is faced with a real challenge; one that is never totally free from such letters as this one.

Sincerely,

A handwritten signature in cursive script, appearing to read "Nile O. Jones".

Nile O. Jones
Senior Geologist

NOJ:ls

cc: Ben Lunis, EG&G

Enclosures