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CERRO PRIETO
CONTENTS OF THE TECHNICAL INFORMATION FILES GENERATED AT THE FIELD

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ABSTRACT

The creation of a computer data bank for the Cerro Prieto Geothermal Field, resulted from the need for fast and flexible management of the increasing and voluminous information generated from the large number of wells drilled in recent years. The data are needed for updating the thermodynamic evolution of the field in order to define field history and validate mathematical analyses applications. This data bank compiles 20 files with all technical information issued from the time of initial field exploration to the end of 1986. To use the data bank, a series of programs and subroutines were created simultaneously for data base management to allow access and add new data as well as data analysis and data graphics.

Tables of global statistics of the informations contained in the 20 files are shown in the paper, as an example of one application of the general use of the data base. For particular and specific applications, depending on users' needs for the data.

INTRODUCTION

The Cerro Prieto Field has evolved greatly since its creation, having nowadays an installed electrical generation of 620 MW divided into: 1 unit of 30 MW and 4 of 37.5 in CP-I, 2 units of 110 in CP-II and 2 more units of 110 in CP-III.

This continuous evolvement is due to the favorable results obtained in the constant explorations that have been carried out in search of new explotation and expansion areas of the field, in such a way that from May of 1960, date of the first well drilled (M-1A), up to date there are more than 150 wells drilled between those that are exploratory and those in production. Their location is the following: 95% are located within the explotation area and its surroundings (including CP-IV) and the remaining 5% in the adjoining areas such as Riito, Tulecheck, Aeropuerto, Laguna Salada, etc.

Consequently, year after year, the volume of administrative and technical information has increased up to limits that handling it manually has become a very difficult and heavy task, this encouraged to search for more flexible and dynamical procedures to handle the information based on that advantages that a computer offers and on the fact that Cerro Prieto as well as CFE in general, have the neccesary and sufficient elements for the use of a computer.

OUTLINING OF THE PROJECT AND ITS OBJECTIVES

The outline to form the data bank, that is to say, the type, quantity and content of the files is based in: 3 premises in which the structure and the capacity of the data bank is indicated, plus 4 general objectives for application which convert it into an useful system and not into a duplicate of the information.

PREMISES

- To create computarized files which will contain all of the necessary and indispensable technical information for the understanding and development of the Field.
- The information in the files should contain all the data accumulated since the beginning of the exploration up to 1986 and it should continuously be updated.
- Elements of particular interest: reservoir, wells and superficial installations.

OBJETIVES

- To define the thermodynamic evolution, the detail and with a methodological rigor in time and space; analyzing the information by its dates, productive layers, not only pressure and temperature data but the combination of all parameters.
- To support modeling, establishing the initial conditions and matching the history and the simulation results, beginning from the previous objective, with a higher decgree of reliance for the prediction phase.

- To create systems of classification and arrangement of data, to form preliminary statistics, for the different group of wells, dates, flowing conditions, depths, recurrance of interventions, correlation of periods, indexes of growth and economical investment, etc.

- To facilitate the planning and fulfillment of the activities, specially those of monitoring, sampling and measurements of the wells through the periodical revision of the files, taking out the last data or group of data, related to a certain action and the date in which it was carried out, to be compared with the present information as well as measuring the time ellapsed; that is to say, this objective implies the presentation of the actual state of the wells and the Field.

The previous objectives generalize and cover most of the analyzing and calculating activities which are completed in the technical departments of the Field and Gerencia de Proyectos Geotermoeléctricos, however, we can mention some other specific objectives which would depend on the users of the data bank.

COMMENTS

The revision of the information before and after storage has permitted us to observe its evolution and the different stages through which it has gone during its 13 year history of production, arising that:

- The original formats of feeding data were to be corrected and up-dated in their presentation and in the units that report the information.

- More specific objectives were defined for monitoring, sampling and measuring, adjusting to the general objectives and being more careful with the quality of the results rather than the quantity.

Programs for calculations and handling of the files have been implemented, similar to those programs that handle the data base which correlates a group of files with the others as well as individually, with graphs and printed outputs.

The internal configuration (in the computer) of the data and files, is independent and different from the structure that it has in the original forms and in the printouts; being subjected to: no entry of any data that can be calculated from the others and using the least possible storage space with a built-in system of auto-protection to avoid the accidental erasing or loss of the information.

In the future, the number of files will be increased and diversified at once the information from other departments, such as the design and construction of plants, will be incorporated and addapted to this system.

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TABLE 1.- LIST OF FILES AND CONTENT OF THE PARAMETERS

FILE	PARAMETERS
1.- GENERAL INFORMATION ON THE WELLS.	Name of the well, coordinates, date of construction, company that built it, field, type of wells, observations.
2.- PRESSURE LOGS.	Well, log number, date, condition of the well, depth and maximum pressure, depths vs. pressures, observ.
3.- TEMPERTURE LOGS.	Well, log number, date, condition of well, depth and maximum temperature, depths vs. temperatures, observ.
4.- CALIBRATION LOGS.	Well, log number, date, condition of well, calibrating diameter vs. depth, observ.
5.- STATIC WATER LEVELS.	Well, quantification number, date, depth of level, observ.
6.- EVALUATIONS (DEVELOPMENT).	Well, evaluation number, method, date, diameter of the orifice, wellhead pressure, enthalpy, flowrate of steam, water and mixture, temperature observ.
7.- PRODUCTION DATA (MONTHLY REPORT).	Well, branch, date, diameter of the orifice, well head and separator pressure and flowrate of steam, water and mixture, enthalpy, temperature, vapor quality, water-vapor relation, observ.
8.- CHEMICAL ANALYSIS OF SEPARATED WATER.	Well, sample number, date, condition of the well, data: Na, K, Ca, Li, Cl, Sio_2, HCO_3, Mg, B, CO_3, SO_4, Ph, STD, observ.
9.- CHEMICAL ANALYSIS OF GASES IN THE WELLS, BRANCHES AND PLANTS.	Well, sample number, date, operating condition, data: CO_2, H_2S, NH_3, CH_4, N_2, Ar, H_2, He, totals, observ.
10.- CHEMICAL ANALYSIS OF THE INCRUSTATIONS IN THE WELL.	Well, sample number, date, depth from which the sample was taken, data: Na, K, Ca, Mg, Fe, S=, Sio_2, others, % of magnetic particles, observ.
11.- WELL COMPLETION OUTLINES.	Well, date, data on: casing head, holes, casing, accesories, slot liner, shot casing, plug casing, deviations, total depth, observ.
12.- LITHOLOGICAL COLUMN.	Well, lithology every 10 m., % of: mudstone, coffee-colored shale and/or siltsone, gray shale and/or siltsone, sandstone, other rocks. Mineralogy: sandstone cement, other minerals, fault traces and the temperature of the circulating drilling mud, observ.
13.- GEOPHYSICAL LOGS.	In process, information is being compiled.
14.- PERIODS OF THE WELL.	Well, name of period (stage), initial and final date, brief description, observ.(*)
15.- INTERVENTIONS (REPAIRINGS)	Well, type of intervention, initial and final dates, brief description, observ.(*)
16.- ELECTRICAL GENERATION.	Unit number, date, MW/hr, accumulated MW/day, vapor tons, plant factor, number of integrated wells, observ.

TABLA 1.- CONTINUATION

FILE	PARAMETERS
17.- PRESSURE TESTS.	Not defined.
18.- INJECTION.	Not defined.
19.- SUPERFICIAL INSTALLATIONS, SEPARATOR, SILENCER, VAPOR AND WATER LINES, ETC.	Not defined.
20.- AUXILIARY ELEMENTS FOR GRAPHS.	Coordinates, names of plants, highways, channels, evaporation lagoons, etc. (+), observ.

*.- The formation of a sub-file is in process to broaden the description of the period of intervention mentioned.

+.- The information from this file is for graphing at different scales and colors, schematic map of the field.

TABLE 2.- NOMENCLATURE OF THE FILES. PARAMETERS AND UNITS.

PARAMETERS	UNITS
COORDINATES.	DETENAL.
DATE.	YEAR/MONTH/DAY.
DIAMETER OF THE ORIFICE.	INCHES.
PRESSURE.	Kg/cm^2.
TEMPERATURE.	°C
ENTHALPY.	Kj/Kg.
FLOWRATE.	T/H.
CHEMICAL ANALYSIS OF WATER.	ppm.
CHEMICAL ANALYSIS OF GASES.	mg/Kg.
CHEMICAL ANALYSIS OF INCRUSTATIONS	% IN WEIGHT.
LITHOLOGY AND MINERALOGY.	% IN CONTENT.

TABLE 3.- LIST OF FILES AND QUANTITY OF PARAMETERS

FILE	WELLS (-)	INFORMATION OF (*)
1.- GENERAL INFORMATION ON THE WELLS.	160	160 WELLS.
2.- PRESSURE LOGS.	132	2530 LOGS.
3.- TEMPERATURE LOGS.	140	4525 LOGS.
4.- CALIBRATION LOGS.	120	927 LOGS.
5.- STATIC WATER LEVELS.	109	2019 MEASUREMENTS.
6.- EVALUATIONS (DEVELOPMENT).	120	256 DEVELOPMENTS.
7.- PRODUCTION DATA (MONTHLY REPORT).	109	180 MONTHS, 3456 MEASUREMENTS.
8.- CHEMICAL ANALYSIS OF SEPARATED WATER.	87	5627 SAMPLES.
9.- CHEMICAL ANALYSIS OF GASES IN THE WELLS, BRANCHES AND PLANTS.	90	3024 SAMPLES.
10.- CHEMICAL ANALYSIS OF THE INCRUSTATIONS IN THE WELL.	90(+)	1562 SAMPLES.
11.- WELL COMPLETION OUTLINES.	160	234 WELL COMPLETION OF OUTLINES.
12.- LITHOLOGICAL COLUMN.	160	160 LITHOLOGICAL COLUMNS.
13.- PERIODS OF THE WELL.	145	145 WELLS.
14.- INTERVENTIONS (REPAIRINGS).	68	141 INTERVENTIONS.
15.- ELECTRICAL GENERATION.		DATA ON 180 MONTHS OF EVERY UNIT, OF EACH PLANT.

(-).- Quantity of wells in which the information is compiled.

(*).- Quantities reported in the third column, refer to groups of classified data and not to the number of entry records; example: In the temperature record files, if an average of 25 pairs of data per group is considered, then a quantity of 113125 computer records is obtained. This situation is the same for other files.

(+).- In the file of chemical analysis incrustations, we consider not only the 90 wells reported but superficial instalation analysis of: plants, branches, separators and silencers.

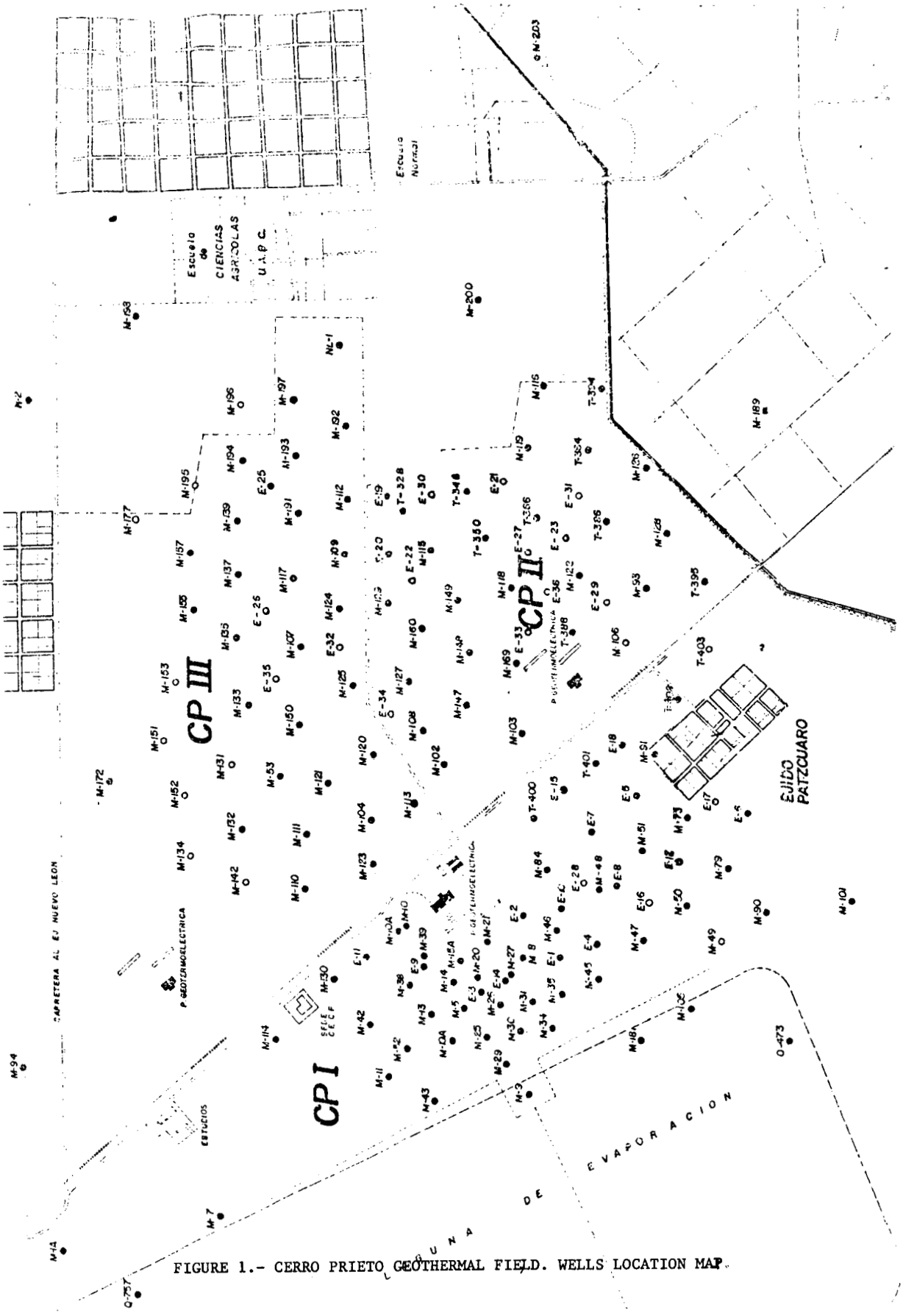

FIGURE 1.- CERRO PRIETO GEOTHERMAL FIELD. WELLS LOCATION MAP.