Certification Example

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Old And Modern Well Log Data And Its Reliability Through A Novel Certification Process.

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Abstract

The main objective of this paper is to present a certification process to achieve the reliability of well log data for any user, independently where or when the log was run. For example, the analog log data (old data) is digitally recaptured and processed through quality control criteria, edited and spliced curve by curve, where all technical steps are documented in the corresponding digital file in order to provide the user the details of how the technical process was used and made. Finally, a digital signature certifies all files. At that moment anyone can use the certified products for interpretations, correlations or petrophysical evaluations.

As is the case in most oil producing companies, two log data generations are present in Mexico: analog and digital. The analogical process began in 1904, when the first well was drilled, and the digital process began in 1979 through the "Cyber System Unit" used by Schlumberger. Those two generations, analog and digital log data, demand new technologies and processes to equalize the quality of old and modern data in order to use and manage this information in applications and databases.

The certification process includes an online log inventory using the log and services codification published by The American Petroleum Institute (API), log quality control routine for "Digital Log Interchange Standard" (DLIS), "Log Information Standard" (LIS) and "Log ASII Standard" (LAS), including: originals, edited and spliced logs. The authenticity and reliability of each file is warranted by a digital signature. It specifies who completed each step of the process and who accepted the final product.

The certification process was designed to equalize the quality of analog and digital log data sets, to establish the log reliability for any user and, finally to improve the data management. All these factors positively impact the quality of log database for timely project execution in the future.

Past, present and future of well log data

On September 5th, 1927[1], when the Schlumberger brothers ran the first electric log in a well in France's Pechelbronn field, the well logging era began and has lasted to nowadays. Many kinds of logs and logging technologies have been developed in order to obtain more information and details from the subsurface. Now, two well differentiated log data generations are present: analog and digital. Many efforts have been made in order to equalize the analog generation of data into the digital generation in terms of formats and quality controls.

To support this goal, the main scope of this initiative is to provide all logs: open and cased hole, to any user in quality standards of integrity and reliability, allowing the users to use those data directly, including the master log inventory, original, edited and spliced well log data. All products in this process have to be validated by the processor and certified for the data owner.

As this process is applied to preexisting log data, it also has to be applied to new log data (new acquisition) in order to guarantee similar standards for both log data generations. Finally all logs from existing or future wells are conceived as an integrated product where the analyst can use the master inventory and download the certified data that he/she requires for his/her technical activities. Figure 1 shows the general certification process and its products.

Well Log Data Certification Process

The general certification process includes open and cased well logs; however, for this paper only open hole logs will be considered.

The General Certification Process (Figure 1), includes the following sub process:

1. Certification Process for analog log data. (Figure 2)
2. Certification Process for digitally captured log data: LAS format (Figure 3)
3. Certification Process for digital-origin data: LIS / DLIS format (Figure 4)

1. Certification Process for Analog Log Data.

The certification process includes the processing of printed log information such as film, paper or other physical item. The process begins with the physical item selection and

evaluation (Figure 2), including its restoration in order to obtain the best image during the next phase, scanning. The image scanned has to be validated and certified to officially represent the physical item, in the database. After scanning, the physical item has a substitute (the scanned image) and physical preservation will be of secondary importance. This is important because a physical logs disintegrate with time.

The image quality control begins running the skew or stretch effects corrector in order to guarantee the accurate relationship between depth and scale axes. In addition, this warp correction will be used for future comparisons between image and LAS files, using a virtual light table. Also, it is useful for image printouts.

The following step is to digitize each curve over the image. In this case the quality control is made using a virtual light table and algorithms between curves and curves / formation response. At that time both the LAS original file and image are overlain and both of them are validated and certified.

The last step of this process is to run a quality control review over the LAS original file. It includes header integrity, logging speed, repeat section, calibrations, and other parameters in order to document the editing phase. The editing phase is performed on that and a new LAS file is generated which is called: LAS edited. All editing changes or adjustments are documented in the new LAS edited.

Finally, the splicing process considers the edited files by curve type. All merging is documented into the new LAS spliced file. After this step, every file has to be certified by the owner using a digital signature to complete the process.

2. Certification Process for Digitally Captured Log Data: LAS format.

This process (Figure 3) is run on the digital LAS files that comes from real digital or digitally captured log data. In this case it is mandatory to check the image and LAS file against each other, accomplishing the cross check for all quality control described on the certification process for analog log data.

The log quality certification for the LAS original file, editing, and splicing procedures, are equal to that described in the certification process for analog log data.

3. Certification Process for Digital Origin Data: LIS / DLIS format.

This process (figure 4) is completed for LIS / DLIS files. First of all, the LIS or DLIS file used in this process has to be certified by a digital signature in order to assure the first certified product in this certification process. After that, the log quality certification for LIS or DLIS files, editing, and splicing procedures, are equal to that described for analog log data.

Certification Process Products.

The main objective of all certification processes is to provide the user with well log data readily available for use. The analyst does not have to waste time anymore trying to find out what logs were run in a specific well. All logs and curves are coded according to the American Petroleum Institute (API) log coding scheme, and finally all logs are validated and certified by a digital signature.

Considering the general certification process (Figure 1), includes the following sub process /products:

1. Master Logs Inventory (Figures 5 and 6)
2. American Petroleum Institute (API) log codification[2]. Edited and spliced logs (Table 1)
3. Digital signature for well logs.

A description of these sub process /products is given below.

1. Master Log Inventory.

The Master Log Inventory (MLI) allows users to find out what logs were run or were tried to run in a specific well. The MLI contains operational information about what happened in the well in case the run failed.

Figures 5 and 6 show how the basic information is presented to the user. In this case of figure 5, it shows the basic information by run, and figure 6 by log type. It is important to mention that the MLI is also validated and certified, and it represents the first product of any certification process.

2. American Petroleum Institute (API) Log Codification.

Everyone who works with well logs has to deal with logs mnemonics. Basically mnemonics are a function of logging companies and not by its functionality. Considering that and what API has published about this issue, the authors highly recommend using the format suggested by API instead of mnemonics. In other words, the mnemonics will be present in the database but logs have to be identified by codes: log type (service) and which curves are contained in that service.

Figure 7 presents an example of this codification for an Induction service, which code is 06. The curves that are present in this service are: Induction Conductivity, Induction Conductivity Amplified, Induction Resistivity, Induction Resistivity Amplified, Focused Resistivity, Caliper, Gamma Ray, and Acoustic Interval Transit Time. The final codification for this service and curves will be: 06-110, 06-111, 06-120, 06-121, 06-220, 06-280, 06-310, and 06-520, respectively. It will be useful for the users to see what type of log they have available, and if it is in open hole or cased hole. Besides these advantages, it is also useful for data administration.

4. Digital Signature for Well Logs.

Digital signatures are created and verified by cryptography, and its use in the oil industry for well log files is currently under development. Well log files intrinsically represents an asset; in addition it needs to be digitally identified for any user. The digital signature presents the evidence of authenticity and integrity, assuring the analyst should be confident about its use.

The efficiency and logistics of well log data analysis through the use of a digital signature is significantly improved because each well log data file is self protected.

Conclusions

Many efforts have been made in order to improve the quality of well log data, and the process presented in this paper is the best for the technical user and DB manager. The certification process creates a reliable digital product where the users can make use of well log data directly for geological-

geophysical interpretation, as well as petrophysical evaluations, productions projects, etc.

The certification process emphases the need to equalize the quality of analog and digital log generations, to establish the log reliability for any user and, finally to improve the data management of existing logs and future logs

References

1.- Hill Pike and Exploration Technology: "Logging history rich with innovation", Hart's E&P (2002) 52-53.

2.- Recommended Standard Format for Recording Digital Well Log Data on Magnetic Tape (API Bulletin D9).

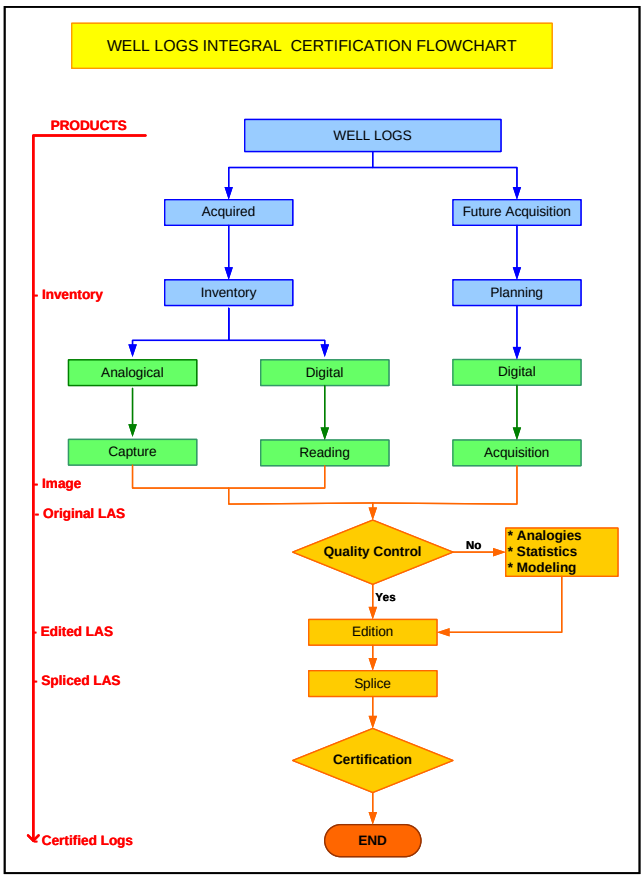

Figure 1 General Certification Process and its products.

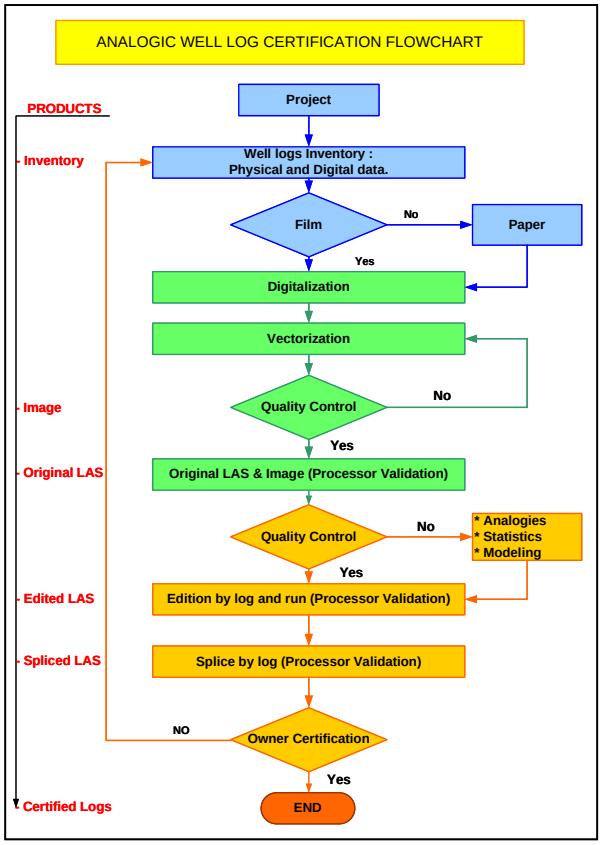

Figure 2 Process Certification for analogical log data.

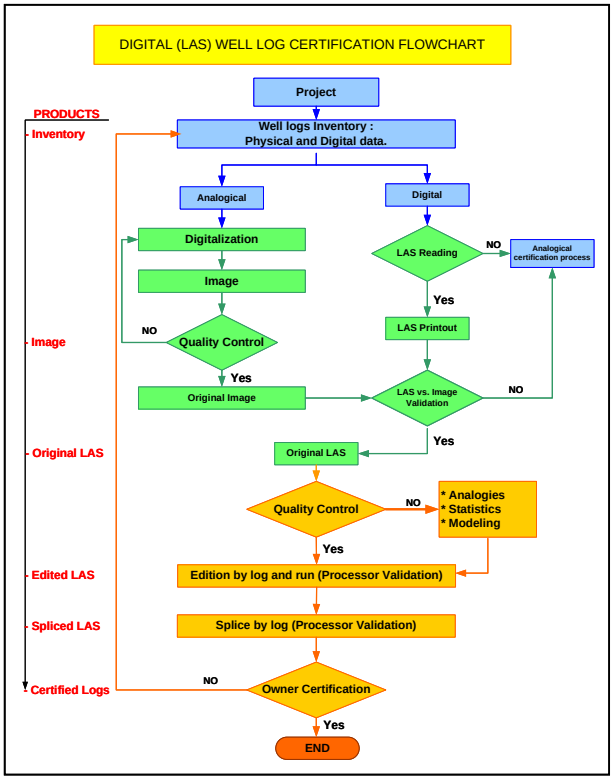

Figure 3 Process Certification for digital LAS format log data

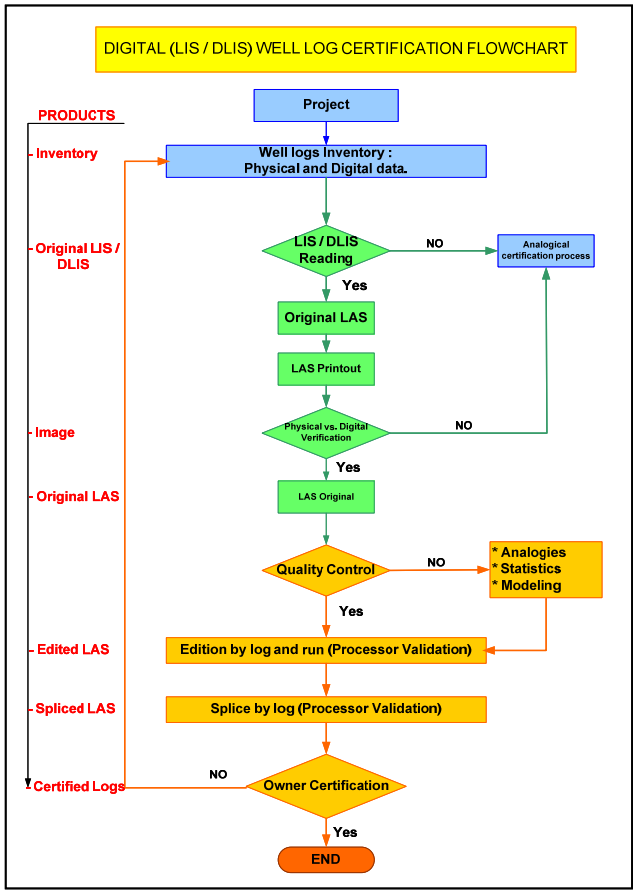

Figure 4 Process Certification for digital LIS / DLIS format log data

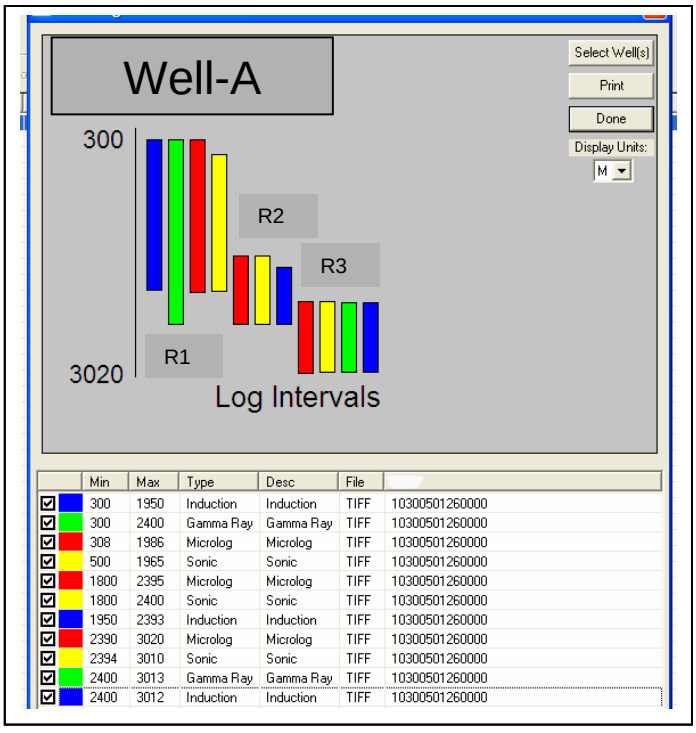

Figure 5 Master Logs Inventory view by runs.

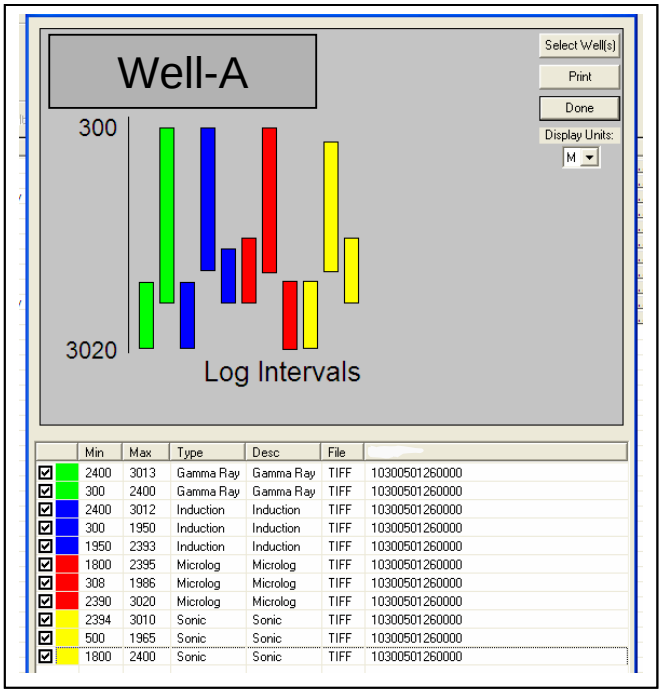

Figure 6 Master Logs Inventory view by logs.

American Petroleum Institute (API) Log Codification			
Code	Log Tipe	Curve Tipe	Curve Tipe
06	INDUCTION	110	Induction Conductivity
		111	Induction Conductivity, Amplified
		120	Induction Resistivity
		121	Induction Resistivity, Amplified
		220	Focused Resistivity
		280	Caliper
		310	Gamma Ray
		520	Acoustic Interval Transit Time

Table 1 American Petroleum Institute (API) Log Codifications.