The Intellectually Dishonest Myth Regarding The Accurate Delivery Of A Standard Gallon Of Gasoline At Retail.

Dedicated to every American who ever purchased gasoline for any purpose ,

Authored/Compiled by

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01-13-2009

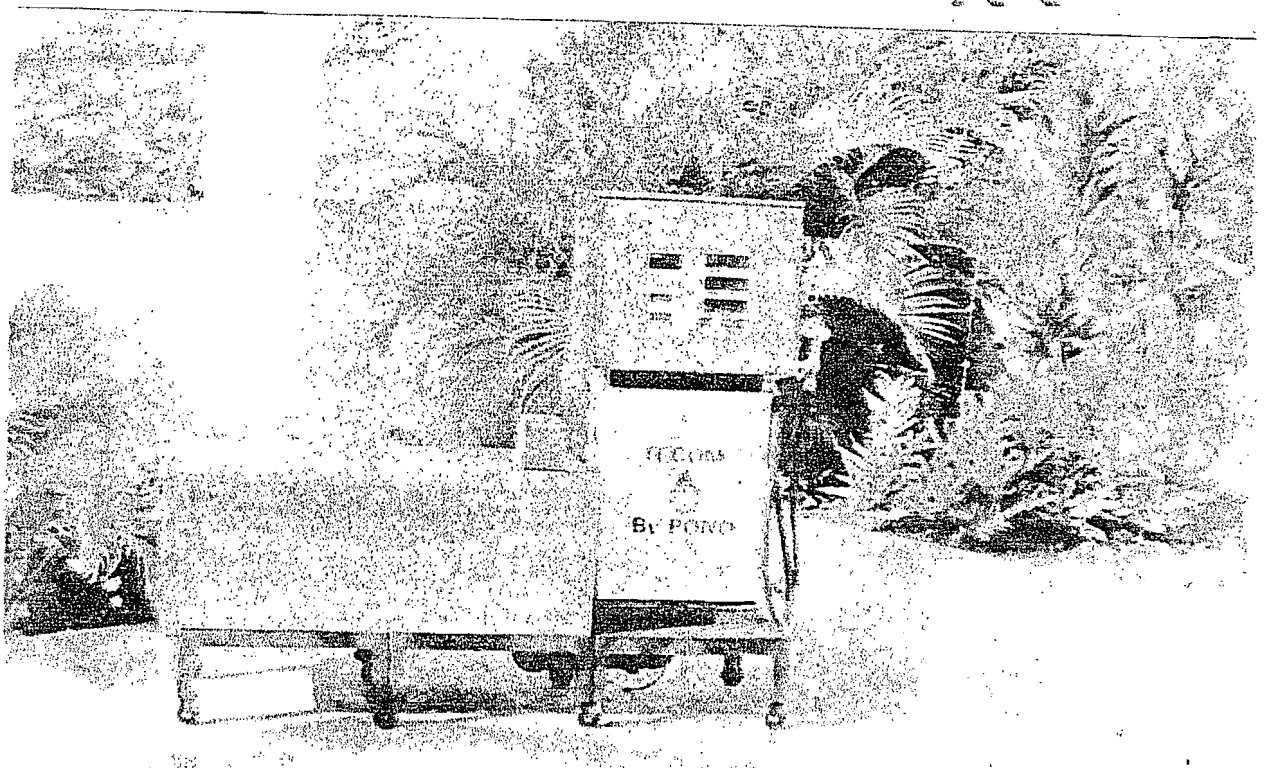
Honolulu, Hawaii

The First Known ATC Retail Gasoline Dispenser in The United States;

Note How Little Difference There Appears To Be

Between The TECOM ® Unit and The Non-ATC

Unit Currently In Use Today.



Circa 1974, Honolulu, Hawaii

DISCLAIMER

Considerable effort to be accurate, honest and correctly meaningful was expended in the compilation/presentation of the information contained herein. Gleaned from state and federal libraries, the respective publications of the National Bureau of Standards, the American Society for Testing and Materials, the American Petroleum Institute, the author's personal library, and more difficult to recall, from a rapidly tiring, exhausted memory.

There were protagonists and antagonists, at differing degrees of hostility, vocally and textually involved over the necessity for maintaining the "fidelity" of the definition of a "National Standard Petroleum Gallon." Including individuals of the National Bureau of Standards, who dispersed information conflicting with the very National Standard Petroleum Oil Tables they had established.

Lifetimes have come and gone, and the resolution, already at hand, as an "International Standard," remains confrontational in the United States. The players include the Petroleum Industry, the importers and exporters, transportation, shipping and pipe lines, and truckers, the retailer, the Consumer, the NTEP, NCWM, NIST, the U. S. Government and its Department of Commerce, among others. The activity, for the most part, is the assurance via ***someone***, "That Equity May Prevail."

As a nation we are embroiled in "class action" litigation over the inaccurate delivery of gasoline at retail. The only reason this legal action was necessary was due to the half-hearted inaction, on the part of the NCWM/NTEP to resolve difficult problems, internally. This issue should have never reached such a level of disagreement that its resolution rests with the judicial system.

The definition of a "National Standard Petroleum Gallon," exists, there is no option on whether or not to embrace it. The confirmation, accuracy verification, applicability, times, techniques, metrological capabilities, the dates, occurrences, data, VCFs, API Gravity conversions, weights per gallon, extrapolations "rounded," "truncated," or "transposed," including any inferences, implications stipulated or alluded, which may, or not be, correct or misconstrued, are irrespective, of that fact, solely the responsibility of the user.

NOTE TO MARILYN

To Ms. Marilyn K. White,

I want the world to know that there exists, yet, another dedicated Government employee, a most gracious lady, whom, though I've never had the pleasure of actually meeting her, when I was fortunate enough to contact her on the "cell" and explain my dilemma, she said, "No problem, I'll get on it right away." And, she did just that!

That alone, was more than sufficient to incur the obligatory "thank you," but coupled with that "twinkle in her voice," as she asked, "Is there any thing else we can do for you?" Left me speechless.

What an outstandingly refreshing departure from the normal request for a "favor," thanks again and again...and again!

Me kea aloha pumehana

Matt

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The Bibliography cited herein was lifted verbatim from my Doctoral Dissertation, which was the primary resource utilized in the compilation of data for this document. It is entirely possible that some of the original cited documents are no longer available inasmuch as that was 27 years ago in1982.

To The Retailers, Consumers and the Guardians of the Marketplace.

Around the world there are two major measurement systems which are employed in the quantity determinations of the majority of the petroleum and petroleum products discovered or recovered each year.

One system was recognized at Runnymede, a few miles outside London, on June 15, 1215, it had much to do with alcoholic beverages, and to which the recalcitrant Prince John affixed his seal on the Magna Charta. The other, now the predominant system in the world, the SI, frequently termed the Metric System, saw the progenitor, of the U. S. Customary system, Great Britain, go Metric leaving the United States as the only major power that has refused to favor the SI over the English, even and adopt the SI.

Fortunately, the Petroleum Industry saw the need to have at hand Petroleum Measurement Tables that, with minor exceptions, are the equivalent of the ASTM D 1250-80 Petroleum Measurement Tables.

At Retail, the most vexing concern is Temperature. Any temperature other than 60° F, results in both a change in Volume and in API Gravity. **A temperature change does not, however, change the Weight of a 231 cubic inch gallon at 60° F, or of the expanded or contracted equivalent thereto, at any other temperature.**

ATC eliminates the retailers concern over varying temperatures (effecting volume) being delivered to themselves or the consumer. The temperature of the gasoline is continuously sensed, at the meter, as it is being measured. All gasoline, irrespective of it having a constant or a varying temperature is equated to the fixed displacement of 231 cubic inches x (VCF for the varying Product Temperature) = the ATC volume at 60° F. It is a beautiful system, with one drawback. Everybody gets treated equitably. Currently with gasoline over 60° F, the retailer and the consumer are short-delivered. Under 60° F, the retailer and the consumer are over-delivered. Neither is correct. ATC will eliminate that problem.

Words of Wisdom

The definition of a "Specific National Standard Petroleum Gallon," of Automotive gasoline is (1) a product Temperature of 60° F, (2) a Gravity of 58° API at 60° F, (3) a Volume of 231 cubic inches at 60° F, and (4) a Weight at 60° F of 6.216 pounds per gallon.

Does this mean, then, that gasoline cannot be sold equitably at temperatures other than 60° F? Absolutely not! The National Bureau of Standards', (NBS) "National Standard Petroleum Oil Tables," and their successors the American Society for Testing and Materials, (ASTM) "Petroleum Measurement Tables," were to provide quantifying equivalency factors that permitted all petroleum product transactions to be conducted on, or corrected to, a 60° F, Standard.

The very purpose for the development of The "National Standard Petroleum Oil Tables," and their successor, the "Petroleum Measurement Tables," was to provide the means to deliver accurately measured and equitably priced gasoline, at all levels of the petroleum product distribution hierarchy.

By some distorted logic there arose a surmised applicability or presumed utilization rights, on the part of some segments of the petroleum industry, to the exclusion of the retailer and almost always to that of the ultimate consumer.

Absent the methodology to accurately quantify the delivery of such petroleum products to the retailer and more specifically, their customers, whom had heretofore been excluded from such "fair dealing" was beyond the available technology until the late 1970's.

Hawaii's underground stored gasoline temperature, at the service station level, was determined to average 84.12° F. After seeking and having been rebuffed, by nearly all of the mainstream retail gasoline dispenser manufacturers, TECOM ® was developed in Hawaii. It was the first, known Automatic Temperature Compensated retail gasoline dispenser in the United States, predating its counterpart in Canada by about ten (10) years.

Retail Automatic Temperature Compensation is the means to implement the "National Standard Petroleum Oil Tables," as developed by the "National Bureau of Standards," (NBS). The "Table" development was to assure delivery of accurate, equitable and uniformly quantified volumes of gasoline to all parties to such transactions.

231.0000 cubic inches of the cited gasoline, heated from 60° F, to 80° F, will expand and occupy 234.1612 cubic inches, it will still weigh 6.216 pounds per gallon. (Nominally, this "specific" gasoline will expand or contract 3.1 cubic inches per gallon for each 20° F, increase or decrease, in temperature.)

Since only heat has been added (or subtracted) to the original 231.0000 cubic inches at 60° F, it is apparent that the weight remains constant at 6.216 pounds per gallon irrespective of the gasoline temperature. This characteristic is a valuable asset when filling 55 gallon drums or when filling one quart cans of motor oil---they are essentially each temperature corrected in as much as the W (weight) of a National Standard Petroleum Gallon doesn't change with temperature, neither will its fractions or multiples thereof.

It is not in compliance with the spirit or intent of the NBS "National Standard Petroleum Oil Tables," or the successor ASTM D 1250-80, "Petroleum Measurement Tables," to deliver 231 cubic inches of 80° F gasoline and represent it as a National Standard Petroleum Gallon.

It would appear a misrepresentation to knowingly, short deliver nominally 3.1 cubic inches for every gallon delivered through a retail gasoline dispenser. Logically, it would appear a misrepresentation to deliver any gasoline, as a gallon that is not temperature corrected to 60° F, since that is how it is defined. 231 cubic inches at 60° F, is one National Standard Petroleum Gallon. In the case where a "Specific API Gravity" is stipulated, it may be prudent to consider means to include its influence, irrespective of magnitude, on the accuracy of delivery. The Hawaii TECOM ® Unit was so equipped.

The Temperature, the API Gravity and the Volume are all variable though inter-related. A change in Temperature will result in a change

to the apparent Volume and the apparent API Gravity, such temperature change will not, however, affect the defined Weight.

Simply put there are four parts to the definition of a "Specific National Standard Petroleum Gallon." The easiest way to remember them is through the acronym:

Thank God for Voluptuous Women.

Temperature = 60° F.
Gravity = 58°API at 60° F.
Volume = 231 cubic inches at 60° F.
Weight = 6.216 pounds per gallon at 60° F.

Question 1: We have the T, G, and V, how do we find W?
Response : We use Volume XI, Table 8, page 7, enter the fourth column from the left, API Gravity at 60°F, find 58.0° API, move horizontally to the fifth column and read W = 6.216 pounds/gallon.

Question 2: We have G, V, and W, how do we find T?
Response : Weight being the non-variable gives us the temperature at which the volume of gasoline weighs 6.216 pounds per gallon. Unfortunately we do not usually have access to a scale, however we can avail ourselves of the inter-relationship between the API Gravity at the observed temperature of 58° API and the corresponding API gravity at 60° F, where they are the same, so T is equal to 60°F.

The same general logic prevails for V, (volume) with the exception that "Volume Correction Factors" are found in Volume II, Table 6B, page 213. Enter Table at, "API Gravity at 60° F," find temperature at far right (or far left) column, move horizontally from the left column, eight columns to the right, (from the right column six columns to the left,) under the heading 58.0° API, find VCF for correcting volume to 60°F. The VCF = 1.0000 so 231.0000 cubic inches x 1.0000 = 231.0000 cubic inches, the definition of a National Standard Petroleum gallon.

From D 1250-80 Petroleum Measurement Tables, we read:

"FOREWARD

The complete collection of the jointly issued API/ASTM-IP tables of which this volume is a part is the result of close cooperation between the American Petroleum Institute (API), the Institute of Petroleum (London) (IP), and the American Society for Testing and Materials (ASTM). The overall objective of this effort was to meet the ***worldwide need*** for a uniform and authoritative publication, based on the most accurate information available. This publication serves as a basis for standardized calculations on measured quantities of petroleum fluids regardless of point of origin, destination, or units of measure used by custom or statute. To meet the objective of worldwide standardized measurement practices, the American National Standards Institute (ANSI) and the British Standards Institution (BSI) have also been closely involved nationally, resulting in the acceptance of the revised tables as an "American National Standard" and as a British Standard. In addition in their respective capacities as Secretariat of the International Organization for Standardization T/C/28 and of TC/28 SC3, ANSI and BSI have been instrumental in progressing the revised tables towards their adoption as an international standard by the International Organization for Standardization." (Underscoring added) (International Standard adopted).

(Redundant Historical Notes Intentionally Omitted.)

"Present Development"

"Downer and Inkley (1972) demonstrated that the original tables were not satisfactory representations of many petroleum fluids of current importance. In 1974 the American Petroleum Institute (API) and the United States National Bureau of Standards (NBS) initiated a research program funded by the API which intended to provide the solid scientific base for the development of more accurate, consequently more equitable, measurement tables. The result of this program was precise

density data on 349 different fluids representing a wide variety of refined products and 66.8 percent of the world crude production in 1974. The completion of this five year, $500,000 project in March 1979 opened the way for modernizing the tables. Using the NBS density data and taking advantage of publications of outstanding technical authorities, a joint API-ASTM Physical Properties Working Group produced this present collection of Petroleum Measurement Tables."

It appears that the positions expressed in the D 1250-80 Petroleum Measurement Tables, were intended for one segment of the reading public and those expressed to the Kansas City Star reporter Steve Everly were intended for yet another group.

The "Tables" were a proposed panacea, "...to meet the worldwide need for a uniform and authoritative publication, based on the most accurate information available." This was a commendable, honorable and long overdue approach, trusting that **"worldwide"** includes retail gasoline consumers, whom, it appears have seldom, if ever, before been recognized as one of the petroleum industries biggest assets.

The Kansas City Star reported on petroleum industry positions that were hostile to the need for accurate, equitable, retail gasoline deliveries to the retail consumer. **"We've never supported it for retail," "It isn't worth fixing," "It doesn't make sense,"** and the most misleading comment of all, **"It could cost $25,000 to purchase a new pump that adjusts for temperature."**

Yes indeed! Anything is possible, not probable, but possible! One wonders just how much of the industries inferred cost of $25,000 is attributable to Automatic Temperature Compensation.

Automatic Temperature Compensation does not adjust temperature! In fact Automatic Temperature Compensation doesn't adjust anything. It resolves the incorrect assumption that the 231 cubic inches positively displaced through the meter, as a gallon, meets the definition of a Standard Petroleum gallon, which it seldom ever does.

The gasoline temperature established ***at the time of delivery to the customer*** is a major consideration in the design of an ATC retail

dispenser. Which temperature is constantly being "sensed" as the gasoline is being measured, through the meter, to the customer, assuring accuracy unavailable through a non-ATC dispenser.

That is the fundamental reason for the inclusion of a temperature sensor. Perhaps of near equal benefit to the retailer, is that one of the several mysteries relating to the reconciliation of inventory, (that is product received versus product sold,) will more closely agree, since the volumetric changes caused by temperature differentials will be referenced to a common base of 60° F. It's a whole new ballgame.

In the beginning....

(1) The first and only titled "United States Standard Petroleum Oil Tables, C-57, approved by the U. S. Department of Commerce, its Director of the National Bureau of Standards, (NBS), and published through the U. S. Government Printing Office, Washington, D.C., it became available **May 11, 1916.**

(2) The "*National Standard* Petroleum Oil Tables, Circular 154," (superseding C-57), approved by the U. S. Department of Commerce, its Director of the National Bureau of Standards, (NBS) and published through the U.S. Government Printing Office, Washington, D.C., it became available **May 29, 1924;** or eight (8) years after C-57.

These tables were almost exclusively utilized in bulk exchanges, upstream of retail, since there were no ATC retrofit packages or original-equipment retail dispensers manufactured with such capabilities. Generally, those capabilities weren't readily available until after WW II for bulk meters and until the late 1970s for retail dispensers. Even then, only two known pump manufacturers were interested enough to investigate the potential for ATC retail dispensers.

One meeting was set up by a Mr. Claude Parent, Gilbarco's West Coast representative who sold the dispenser to Pono Industries, Inc. for the development of the Hawaii TECOM ® ATC project. In addition to Parent there was also a senior sales representative of Gilbarco, (possibly a V.P.) at the meeting in Burlingame, California.

The second meeting was with Tatsuno, of Japan. A Mr. Shoji Kawai, President, flew in from Japan to Honolulu and met with the State of Hawaii, Deputy Director of Measurement Standards and witnessed the workings of the TECOM ® ATC dispenser.

Nothing came of those meetings except a great gift of icosahedron dice that resulted from a conversation on random number generators for determining the sample size of a "lot" of pre-packaged items. The use of the two 20 sided die was short lived when store management complained that Weights and Measures Inspectors were "shooting crap" in the super market, with their employees.

(3) The supplement to the National Standard Petroleum Oil Tables, C 154, "Abridged Volume Correction Table for Petroleum Oils," approved by the U.S. Department of Commerce, its Director of the National Bureau of Standards (NBS) and published through the U. S. Government Printing Office, Washington, D.C., it became available **October 8, 1925;** nine years after C-57.

(4) The "National Standard Petroleum Oil Tables, Circular 410," (superseded C-154), and was perhaps the best known, and most universally used NBS Petroleum Tables, approved by the U.S. Department of Commerce, its Director of the National Bureau of Standards, (NBS), and published through the U. S. Government Printing Office, Washington, D.C., it became available **March 4 1936;** 20 years after C-57. Circular C-410, its predecessors, and its abridged supplements served the industries and the government over 36 years, through their gradual phase-out, in 1952-1954.

(5) The supplement to National Standard Petroleum Oil Tables, C-410, (superseded NBS publication, "Abridged Volume Correction Table for Petroleum Oils, Circular supplement to C-154,") (See 3 above); it published through the U.S. Government Printing Office, Washington, D.C., it became available **April 20, 1937;** 21 years after C-57. It served the petroleum industry through the gradual phase-out cited above.

(6) ASTM D 206-36, "Standard Abridged Volume Correction Table for Petroleum Oils," published in the standards of the American Society for Testing and Materials, Philadelphia, Pennsylvania, adopted in

1925, revised **1934** and again in **1936**, superseded by Table 7 of ASTM-IP Oil Measurement Tables and withdrawn in 1952, in favor of ASTM D-1250.

(7) ASTM D 1250, Original Printing 1952, Title page Approvals, "Approved as an ISO Recommendation by the International Organization for standardization Ref. No. ISO/R91-1970, American National Standard Z11.83-1956 (R1971); Approved as Federal Test Method 9001.4, Method Standard No. 791b.

(8) ASTM D 1250 (See "OFFICIAL APPROVALS," under the first printing of the ASTM D-1250, "Petroleum Measurement Tables, page iii, **October 1952**, we read, "Official approval of the Petroleum Measurement Tables has been given by the American Society for Testing and Materials, the American Petroleum Institute, and The Institute of Petroleum. ASTM Designation D 1250, API Standard 2540, and IP Designation 200 apply to all of the 41 tables which appear in this volume and in the British Imperial and Metric systems of measurement.

(9) (See "SUPERSEDED TABLES" page v, of "FOREWARD" (same document) where we read, "With the consent and help of those concerned, the opportunity was taken to recalculate and extend both the '"National Standard Petroleum Oil Tables,"' Circular C 410, published in United States units of measurement by the (National Bureau of Standards,) (sic) and the "Tables for Measurement of Oil, published in British units by the Institute of Petroleum in 1945. ***The recalculation confirmed the original data and those parts common to the various collections are numerically identical.*** It is now agreed by the two issuing societies that both of these publications should be superseded by this collection of tables and it is hoped that they will receive the same broad usage as have their predecessors."

(10) (See, page vi,-vii, "ACKNOWLEDGEMENTS," (same document, cited above) Chairmen, L.C. Burroughs, and H. Hyams, "...being cognizant of the spirit which pervaded their two committees over the ***five years that these tables were in preparation,*** wish to pay the highest tribute to the warm cooperation and goodwill in which discussions and negotiations were at all times conducted between

their two organizations, and without which ***the seals of ASTM and IP could not have appeared on these volumes of tables."***

(11) The ASTM D 1250, **(1952)** compendium was re-titled "Petroleum Measurement Tables," and published in the Standards of the American Society for Testing and Materials, Philadelphia, Pennsylvania, (1952). Even though these tables were updated and expanded, over C-410, they were based upon the research of NBS, and updated to include new petroleum products developed or improved or resulting from advanced refining processing.

(12) They continued as "National Standards" inasmuch as that authority was originally conveyed to the United States Department of the Treasury, its subordinate, the National Bureau of Standards, in the Organic Act of 3 March 1901, 31 Stat. 1449 (Public Law 177---56 Congress). And, as continued in subsequent legislation, through congressional action, including those amendments to the original Organic Act, by the Act of 22 July 1950, 64 Stat. 371 (Public Law---619, 81 Congress). The original Organic Act at Sec. 2, and the subsequent amendatory Act, at section 2-a, provided "That the functions of the bureau shall consist...in the comparison of the standards...with the standards ***adopted or recognized*** by the Government."

(13) The following versions of the industry published ASTM Designation D-1250, API Standard 2540, and IP Designation 200, of which there were eleven (11), separate publications, beginning with **January 1953**, the second printing was in **July 1954,** The third was in **September 1959,** the fourth in **October 1962,** the fifth in July 1965, the sixth in **January 1967,** the seventh in **March 1968,** the eighth in **December 1970,** the ninth in **October 1972,** the tenth in **September 1973,** and the eleventh in **July 1974,**

Most contained a Table Seven, (7) titled, "Reduction of Volume to 60°F against API Gravity at 60°F. Which table, was not a part of those included in the National Bureau of Standard's, "National Standard Petroleum Oil Tables," or their predecessors.

The Table (7) was set up with eight "averaged group ranges" of API gravity, which approach sacrificed accuracy, and was later dropped

from the tables. The group ranges might be construed as tolerance on the refining process. It provided that any Gravity from 51.0° through 63.9° API, at 60° F, would be considered a 58.0° API Gravity gasoline.

That table prevailed until 1980---,

> ***"All blends of gasoline and benzene are (were) considered to fall in Group 3;*** when the presence of benzene is uncertain, the oil shall be classified in Group 3 if the gravity is numerically less than 51.0° API and the 50 percent distillation recovery point less than 293°F."

The range of API Gravity, at 60°F, in Group 3, is 51.0 to 63.9, or 12.9°API. The coefficient of expansion per °F for each component of the group was essentially treated as if they each had a coefficient of expansion of 0.00060. (This feature compromised the accuracy of the actual API Gravity and the table has been eliminated.

The legend, following, was appended to Table 7;

> "It is very important to note that the Group classification of the oil is determined by its API Gravity at 60°F. Large errors (up to 0.5 per cent) may arise if the gravity at the observed temperature is used to determine the proper group from which to determine the thermal coefficient of expansion...."

That admonition was directed to Table (7), not to any of the other Tables in D 1250. Unfortunately there are those who still believe this 12.9° API gravity range is an official license, or tolerance range, applicable to the API Gravity of an automotive gasoline.

Additional Publications as petroleum standards

(14) API Standard 2540, "Petroleum Measurement Tables," published in the Standards of the American Petroleum Institute, New York, and then Washington, D.C.

(15) Designation 200, "Petroleum Measurement Tables," published in the Standards of The Institute of Petroleum, London, England.

(16) International Standards Organization R-91, "Petroleum Measurement Tables," published in the Standards of the International Organization for Standardization, Paris, France.

(17) ANSI Designation Z11.83, "Petroleum Measurement Tables," published in the Standards of the American National Standards Institute, New York, New York.

The basic density data from which these tables derive was determined by the National Bureau of Standards, from samples, supplied by the petroleum industry. The actual individual volumes were supplied in one quart containers. (A sample of one teaspoonful, was drawn, and (5 milliliters) from that source were injected into a vibrating "U" shaped densitometer, the instrumentation of which provided the factual density data to the NBS scientists.

Clearly any expressed concern over the need to temperature correct retail gasoline deliveries is a non-issue, and is clearly supportable inasmuch as the Tables themselves were determined from 5 milliliter samples, or a little more than the amount of sugar, one might stir into their morning coffee. Any arguments about retail sales being so small that temperature correction is inapplicable and unnecessary are fallacious.

One Quart cans of motor oil and four fluid ounce cans of 3 in 1 sewing machine oil, are all filled in terms of the weight referenced to a Standard 231 cubic inch gallon at 60° F, and the applicable API Gravity at 60° F.

On March 3, 1901, under 31 Stat. 1449, (Public Law 177--56 Congress) the name of the then "Office of Standard Weights and Measures" was changed to the "National Bureau of Standards," which had been, and at that time, remained a function of the Treasury Department.

It wasn't until the Act of February 14, 1903 (32 Stat. 825) that the Department of Commerce and Labor was created, to which, the National Bureau of Standards was transferred from Treasury.

Under Act of March 4, 1913, (37 Stat, 736), or over ten years later, Congress spun-off several labor oriented activities to a newly created Department of Labor; the National Bureau of Standards remained in Commerce. And, it remains there to this day.

At the time of the writing of the U. S. Constitution it was patently unclear as to where the framers drew the line between the intended meaning of the definitions of "National," "Department," "Bureau," "Office," Division," and "Institute." The meanings are unclear even in Blacks Law Dictionary, 4th. Ed. today.

The forerunner to the National Bureau of Standards/National Institute for Standards and Technology, was an agency of the U.S. Treasury, whose early functions were to assure the accuracy of the weights and measures utilized in the Custom Houses, and in such similar activities involving income derived from Taxes, Duties, Imposts, and Excises which were the major source of income needed to fund the fledgling U. S. Government.

It was in 1905 that, after four years of cajoling, Dr. Samuel Wesley Stratton, Director of the National Bureau of Standards, convinced seven State Directors of Weights and Measures and their counterpart representing the District of Columbia to attend what was to become the precursor to the "National Conference on Weights and Measures." At that meeting the Chief, Division of Weights and Measures, Louis A. Fischer, delivered his now celebrated historic document on the evolution of U. S. Weights and Measures.

Of little significance to those eight individuals in attendance was Fischer's detailed explanation of the difference between a **"Unit" gallon and a "Standard" gallon.** As the agrarian nation changed to an industrialized society the meaning of "Standard Gallon" took on greater significance.

(The "National Standard Petroleum Gallon" is, defined as a "Unit gallon" of 231 cubic inches to which has been appended the given temperature, of 60° F, accordingly, 231 cubic inches at 60° F, is the definition of a "National Standard Petroleum Gallon."

A **"Specific National Standard Petroleum Gallon," is defined as a "National Standard Petroleum Gallon" (cited above) in addition to which, there is appended a specific API gravity at 60° F, accordingly, 231 cubic inches at 60° F, with a Gravity of 58° API, at 60°F, is the definition of a "Specific National Standard Petroleum Gallon."**

And, it was Stratton (1901-1922), and Fischer (1901-1921, and the two Office of Weights and Measures scientists, Bearce (1908-1921), and Peffer (1913-1921), that conducted or were involved in the original research on the effect of different temperatures, on the samples, provided to them, by the petroleum industry.

(Note: The information in parenthesis reflects the tenure, not the life span, during which time these individuals served as head or were employed by the OWM or in the case of Stratton as Director of NBS.)

The research was, participated in, thus unquestionably known to the "petroleum industry," just as it was to the Office of Weights and Measures, the National Bureau of Standards, and the parent Department of both, the United States Department of Commerce.

(Note: the U. S. Government purchases all petroleum products in terms of a "Standard Petroleum Gallon of 231 cubic inches at 60°F," or a "Specific Standard Petroleum Gallon of 231 cubic inches at 60°F, having a stipulated Gravity of "X°"API, at 60°F.

It was with the knowledge and concurrence of the Department of Commerce that the "National Standard Petroleum Oil Tables" were identified as a "National Standard." The endorsements were in printed text form or by inclusion of agency imprimatur. (See various title pages for confirmation, under "Documents, Cover Sheets." Pages 41-42.

The "National Standard Petroleum Oil Tables," were intimately known to the respective leaders of the "Office of Weights and Measures," an agency of the National Bureau of Standards, by virtue of their individual involvement in the research and development of these Tables.

Most personnel involved in Weights and Measures or in Measurement Standard pursuits are familiar with the history and research works of Henry W. Bearce and Elmer L. Peffer, especially with their involvement in the development of the "National Standard Petroleum Oil Tables," but how many of you knew that these two scientists were employees of the Office of Weights and Measures, and one, Henry W. Bearce, even became its Chief.

The early, long lasting relationship of these two stellar scientists with their counterparts in the petroleum industry may well have played a role in the industry suggestion that the "National Standard Petroleum Oil Tables," were accounting tools and accordingly, for the use of the petroleum industries accounting departments.

There is no known evidence to support this supposition, and there is no room for it in Black's Law Dict. P. 1175, 4th ed. Where "National," reads, "Pertaining or relating to a nation as a whole; commonly applied in American law to institutions, laws, or affairs of the United States or its government, as opposed to those of the several states."

It is a well established fact that the "States" surrendered the authority to, "...fix the standard of weights and measures, in both the Articles of Confederation, and through the U. S. Constitution to the Government of United States under the enumerated powers in Article 1, Section 8, Clause 1 through 18.

Under "National Agency," "[The] Mexican government contributed to [the] capital of [an] association, and was represented on [its] governing board and [it] even subsidized [the] association [however this] did not render [the] association a 'national agency.....'" That sounds a lot like NCWM. See Black's law Dic., same page, cited above.

With the increasing interest in bulk Temperature Compensation the "National Standard Petroleum Oil Tables," were almost exclusively relegated to the respective accounting departments of the petroleum industry. This was more than likely due to an increased "Table" use in contractual agreements, between bulk buyers and sellers, than any sub-rosa agreement limiting their application to any bulk transactions.

As gasoline prices increased the search for better accuracy and a rapid resolution to the problem introduced by the inability of the mechanical Veeder-Root computers to accommodate the constantly increasing price per gallon. The additional display "wheels" were a very temporary fix, and it seemed that the higher the price the greater was the number of "wheels" required. It soon became evident that this magnificent mechanical wonder had to go.

But to what? One suggestion was to display half pricing and double the charge. That led to all sorts of headaches. There was one well meaning suggestion that we throttle the supply, reduce the flow rate and increase the time it took to fill 'er up, such approach would presumably slow down the peripheral speed of the extra "Wheels" and minimize the added wear and tear on the mechanical computers. There were others, however, the most sensible one appeared to be to, "Go Metric," and since Hawaiians are a very sensible people that is precisely what they did.

A short time after the last metric conversion was completed, including new price signs to explain what was going on, a not so well informed State Senator contacted Measurement Standards and demanded to know just who authorized the adoption of that (expletive) foreign system.

The Senator pushed a bill through the State Legislature requiring two signs, one the price per gallon and the other the price per liter. The sale of gasoline by the liter died a slow lingering death, and the mechanical Veeder-Root computers died with them. These venerable Veeder-Root mechanical computers served both the industry and the consumer well unfortunately demands beyond their design limits contributed to their demise.

All during the course of the arguments for and against Metrication, little was heard about the costs that would be incurred by the petroleum industry in assisting the consumer to spend less time at the pumps and in tying up (1) the window washer, (2) the motor oil checker, (3) the tire inflator, (4) the pump man, and (5) the nearly always present goodwill station ambassador, the manager, or his representative,---now all eliminated, as are the attendant costs, for these services. Now days, if you want it, you do it.

In retrospect alternate approaches have centered upon newer electronics and the elimination of analog in favor of digital register displays. Valuable experience was gleaned in the development process of integrating the "National Standard Petroleum Oil Tables," into bulk measurement meters. Which were among the predominate uses of Automatic Temperature Compensating devices, utilized, early on, in the industry.

The inclusion of a "pulsing device" (the Hawaii TECOM ® dispenser utilized a shaft angle encoder) paved the way for readily digitizing the register displays on retail dispensers and substantially minimized the little extra effort and expense incident to the inclusion of Automatic Temperature Compensation capabilities in the manufacture of ATC retail dispensers.

The major additional cost, excluding labor, is probably that of the temperature sensing device, which conceivably may be reduced by using other than a noble metal for the probe itself. The Hawaii TECOM ® ATC retail dispenser utilized a platinum probe---platinum is not cheap!

The U.S. Letters of Patent 4101056, have long since expired which means that software could be obtained almost anywhere, and while reticent to mention it, this fact should not be overlooked.

Quantity purchases from competing American or foreign bidders, through-out the world, could conceivably result in reducing the costs involved in the transition to ATC. Canada has at least two manufacturers of retrofit packages, and they might be interested in sharing some of the action bound to be generated by this long delayed interest in accurate retail gasoline dispensing. One positive point in favoring Canadian suppliers is that they have, for the most part, already achieved Measurement Canada approval, and several years in which to debug their product.

Much of what is required for ATC including, to a degree, the on-board electronic computer are currently in place in non-ATC, digital display registers, excepting the temperature sensor, and selected additional sub-assembled computer boards, with the necessary "chips" to provide VCF and possibly API Gravity data, all of which would not

entail prohibitive, albeit additional costs for labor or parts, over what is required in the present manufacture of non-ATC digital register dispensers.

The sinister situation, involving what we have now, doesn't get the job done. What is this nonsense over attempting to rationalize an incorrect dispensing device---into a correct dispensing device?

Wrong is wrong and non-ATC dispensers are by design, wrong. They were designed to deliver 231 cubic inches irrespective of the temperature of the gasoline, and unfortunately that is what they do.

Simply stated contemporary non-ATC retail gasoline dispensers are positive displacement pumps that are totally insensitive to the temperature of the gasoline. They are incapable of competing with the delivered accuracy of an Automatic Temperature Compensated Dispenser, because they are incapable of determining product temperature.

Being unable to determine the gasoline temperature, there is no way that a correction to 60° F. is possible.

Non-ATC dispensers should be removed, or retrofit, to deliver 231 cubic inches at 60° F, or the expanded or contracted equivalent thereto at any other temperature. To permit their continued use, in view of the two year temperature study of gasoline at retail, where it was disclosed that the delivered temperature of gasoline to the overall American consumer was 64.7° F, means that the overall average American consumer was being short-delivered "Hot" gasoline.

Why is it acceptable for the petroleum industry to ignore, even flaunt, the definition of a Standard Petroleum Gallon? To deliver less than a defined Standard Gallon was never visualized as providing, "Equity in the Marketplace.

The current price quoted by petroleum industry representatives in their attempted justification for NOT purchasing Automatic Temperature Compensating retail gasoline dispensing devices "contend(s) that it could cost $25,000 to purchase a new pump that

adjusts for temperature." Maybe so! But at issue is the fact that the present systems simply fail to deliver gasoline in compliance with the Petroleum Measurement Tables. And that is inexcusable.

Incidentally the term, "adjusts for temperature," is a misnomer there is no adjusting the flow of the gasoline for temperature or otherwise. There are computer corrections of an otherwise inaccurately displayed, inaccurately computed and inaccurately charged gasoline delivery, to the consumer. (See Kansas City Star article on "Hot Gasoline," of Monday, August 28, 2006.)

The National Conference on Weights and Measures, despite its valued contributions to the profession of accuracy assurance in the field of metrology, has had a checkered past in some respects. While that is a separate issue that should be addressed at a later date, the frequently utilized problem of "doing nothing" or "tabling" a specific issue, effectively condoned the present inaccurate system of dispensing gasoline by utilizing an alleged gallon measure, which is inconsistent with the gallon measure utilized in bulk transactions, upstream of retail. This practice, which continues today, is a blatant one, and should be corrected by the mandatory adoption of Automatic Temperature Compensation at every level of the petroleum product distribution hierarchy.

We would listen, if there were any meaningful justification for inaccurate, inequitable measurement of gasoline at any level. The present approach does not deserve the creditability of being termed a system. It should be brought into conformity with the National Standard Petroleum Oil Tables.

There is simply no justification for the continued disregard of the requirement to correctly deliver the same volume of a standard petroleum gallon at retail, as that which is delivered, upstream in bulk transactions.

ATC will correct that inequity, because the temperature is constantly taken while the gasoline is being measured, through the meter.

There have been serious discourses involving the fact that taking "no action" or making "no decision" was tantamount to the non-

governmental body, (NCWM) assuming quasi-legislative authority over an issue and/or the adopting, or prohibiting of a weights and measures device, law or regulation, absent NCWM performance criteria.

A Bureau of Standards proposal which would have required the net weight, measure, or numerical count of contents, be printed on sealed packages was accomplished, in 1913, but not by an amendment to National Bureau of Standards field of involvement, but rather to the then ***Pure Food and Drug Act*** .

In 1915, Congress passed a Standard Barrel law, but efforts of the Bureau to promote national legislation to define the weights and measures used in everyday trade, to fix the sizes of other common shipping units besides the barrel "...and to require certification by the Bureau of all weights and measures manufactured and sold in the Unites States, ***got nowhere.*** (See Measures For Progress, A History of the National Bureau of Standards, Cochrane, Rexmond. pp 89-90, 1966.)

From the U. S. Constitution, at Article 1, Section 8, we read:

> "Congress shall have Power To lay and collect Taxes, Duties, Imposts, and Excises, to pay the Debts and provide for the common defense and general Welfare of the United States; but all Duties, Imposts, and Excises shall be uniform throughout the United States;..."

In addition, under Clause 18 of the Enumerated Clauses, in Article I, Section 8, we read;

> "To make ***all laws*** which shall be necessary and proper for carrying into ***Execution*** the ***foregoing powers,*** and all other Powers vested by this Constitution in the Government of the United States, or in any Department or Officer thereof."

(The foregoing powers are those referred to as the ***Enumerated powers*** some of which, including Clause 5, "fix the standard of weights and Measures, had previously been ***surrendered***, by the former colonies, to the Continental Congress, and subsequently to the U. S. Congress.

All laws means, all laws, Fix means to Adjust or regulate and ***Execution means carrying out some act or course of action to its completion.*** (all definitions consistent with Black's Law Dic. 4th Ed.)

Just how the "National Conference on Weights and Measures," satisfies these prerequisites is not entirely clear, when read in concert with the position expressed by Dr. Ernest Ambler, then Acting, soon to then become, Director, of the National Bureau of Standards, in his letter, dated September 15, 1976, responding to the Senior Senator from Hawaii, Daniel K. Inouye's questions regarding the absence of specifications and tolerances relating to Automatic Temperature Compensation and its potential use in the retail sale of gasoline, to the ultimate consumer, the response is included below:

> **"The regulation of gasoline metering devices and the method of sale of gasoline comes under the authority of the State and local jurisdictions," so advised Dr. Ernest Ambler.**

This, at a time when the scale manufacturing industry, was losing a number of orders to small local welding fabricators who, with considerably more flexibility, using structural steel members, and "load cells" were consistently displacing the older fixed pattern, cast-iron lever scales, to meet newer type individual applications.

A whole new market opened up in the grain industry due to the design capability to hydraulically lift one end of the motor truck scale grain receiving deck, with the loaded grain truck still on the deck, causing the dumping of the load of grain in a fraction of time that it took previously, and vastly reducing the labor costs incident to such deliveries.

In the embryonic stages of an activity supported by some few segments of industry, concentration on the development of standards for electronic load cells, such as the Simmons-Ruge SR-4 strain gauge, and its potential application to weighing and measuring devices, resulted in the Office of Weights and Measures, being pressured to establish a "National Type Evaluation Program," (NTEP) much akin to that proposed, to Congress, by the "Bureau" in 1915, which then, however, got nowhere.

This resurfaced program proposed increased oversight of manufacturers of metrological equipment, which required in most cases, the submittal of proposed or newly developed devices to NTEP, or subsequently to NTEP approved laboratories, for pre-sale inspection and compliance qualification authorizing its commercial applicability, through receipt of "Certificate of Conformity," and the payment of any due fees, or other ancillary expenses. (The "Certificate" issued by NTEP may be entitled or named differently.) If NTEP concluded to their satisfaction, that they were confronted with, "a cart before the horse," situation, where the NCWM may not have recommended ***established*** requirements in NBS/NIST Handbook 44, "Specifications, Tolerances and other Technical Requirements for Commercial Weighing and Measuring Devices," among other additional requirements, then, NTEP was constrained from issuing a "Certificate of Conformance," for want of criteria against which to test the proposed device.

The more onerous fact is that ATC dispensers would have quickly revealed what non-ATC dispensers have effectively concealed.

Among the ATC dispenser's superior attributes are the recognition of deviation from established correlation. The mutual complementary correlation involving Temperature, Gravity, Volume and Weight are established in petroleum product measurement tables which permit commercial intercourse on an international basis. There is no justification for one standard for the intra-industries' exchanges and none, or a plethora of them at any old temperature for transactions involving the retailer and the consumer.

The ATC retail dispenser utilizes contemporary electronics to recognize the temperature of the gasoline, or any variations while it is being metered. If the product temperature is 60° F, the dispenser looks up the proper code and calls up the VCF and (in this case it is 1.0000) variations from and if there are none detected, the delivered volume of gasoline is multiplied by its computer located Volume Correction Factor (VCF) of 1.0000, which as we recognize would mean that the gasoline delivered was quantified as a Standard Petroleum Gallon of 231 cubic inches at 60° F.

The delivery of 231 cubic inches is not an acceptable delivery of a Standard Petroleum gallon, except at a temperature of 60° F.

Even though the absence of such "Specifications and Tolerances," may have been the result of unfavorable action, or even inaction, on the part of the National Conference on Weights and Measures' voting contingent, NTEP, in its early days, was led to believe that they were required to deny the issuance of a "Certificate of Compliance," for any device not previously receiving recognition as a potential commercial weighing or measuring device, and for which "Specifications and Tolerances," had not been established. They had one whale of a time with finalizing the S and T for Load Cells.

The actual intent of this proviso was to recognize that small welded-steel fabricators might conceivably enjoy an economic advantage, in design flexibility, as well as overheads costs, over the older long established mainline scale manufacturers, whose equipment was essentially "grandfathered" in, especially those firms married to cast iron lever systems.

The intent was to mandate a "Certificate of Conformance" before a weighing or measuring device could even be sold, let alone used commercially. Which may be the way to go but it strikes of being the harbinger of another Automatic Temperature Compensated retail dispenser boondoggle. You can smell stagnation.

The petroleum industry replaces its retail dispensers, frequently for cosmetic purposes, but also to minimize attrition, with its attendant costs.

The inclusion of Automatic Temperature Compensation will be a major accomplishment at enhancing performance and overcoming the disdainful uttering of those who have dismissed the long belief that the accuracy of gasoline deliveries was always suspect as to the accuracy of delivery and the extended cost of the transaction.

Provincialism, an ever present concern, where a representative of a given state or local jurisdiction may be reticent to agree to adopt ATC for retail, in his jurisdiction, because the annual average temperature of gasoline stored underground was, say, determined to be 54.7° F,

which means that the Weights and Measures administrator would have to explain to his employers (the public) that they were being over delivered, and he would be compelled to correct that by reducing the over-delivered amount so that it complied with the Petroleum Measurement Tables.

We repeat, ATC will correct that inequity, because the temperature is constantly being taken while the gasoline is being measured, through the meter.

That may not fly well in U. S. jurisdictions, bordering Canada, however there was a relatively short lived, not overly serious conversation when the Government voluntary permitted the adoption of ATC at retail.

We understand there was the usual grumping by a select few but the transition went fairly well when it was explained to the public. There were some, we understand, unquestionably in the minority, who raised the question, "What took you so long?"

Again, we repeat ATC will correct that inequity, because the temperature is constantly taken while the gasoline is being measured, through the meter.

In California, there are retailers, who have been under yearly contract to receive the expanded or contracted volume of gasoline corrected to 60° F, but the rub is they have no way to pass it on, or hold it back. ATC will correct that inequity, because the temperature is constantly monitored while the gasoline is being measured, through the meter.

Remember two simple facts, without ATC, hot gasoline (over 60° F,) will short deliver the retailer and the retailers customers. Cold gasoline (under 60° F,) will over deliver the retailer, and the retailers customers. Neither is acceptable, neither is right.

As stated, ATC will correct that inequity, because the temperature is constantly taken while the gasoline is being measured, through the meter.

Succinctly put, there is no substitute for correct, accurate measure and ATC, throughout the whole distribution hierarchy is the only way to assure equity, in the distribution of automotive gasoline.

When the NCWM's Chaplain, who was also a consultant to the American Petroleum Institute, expressed the alleged API position on Automatic Temperature Compensation, in an interview published August 28, 2006, wherein the Kansas City Star's exemplary reporter, Steve Everly, reported the NCWM Chaplin as saying, ***"We never supported it for retail, in the United States."***

We were both amazed and dismayed at those comments. Are we to understand him to mean that ATC in Canada is supported by the API, for retail, but not in the United States? We don't think so, The API's Standard 2540 (which is also ASTM D1250-80) in the "Foreward" of each of its several volumes of "Petroleum Measurement Tables," we read:

> "The overall objective of this effort was to meet the worldwide need for a uniform and authoritative publication based on the most accurate information available."

Is the Chaplain suggesting that less than the most accurate information is acceptable in the United States, but not in Canada? They are using ATC, on a voluntary basis, because the enhanced accuracy incident to the use of ATC is the most accurate information available. Canada is right, and while the consumer looses his over-delivery of cold gasoline, the retailer who is now receiving ATC gasoline, he is also delivering ATC gasoline to his customers.

We should probably leave that one alone, and get on trying to assure that the (NCWM) concerns itself with recognizing that the technology to provide accurate, equitable measurement of gasoline, to the motoring public, down-stream of bulk measurements, has been available since the late 1970s, its application at retail is long overdue.

The recent NIST study (2002 - 2004) established the fact that the overall average temperature of motor fuel (gasoline) was inflated, no doubt unintentionally, through the petroleum industry spokesperson's presentation to the 1974 National Conference on Weights and

Measures, when it was claimed to be 56.2° F. The more recent NIST study established the overall average temperature at 64.7° F, or 8.5° F, higher than represented by the petroleum industries spokesperson, back in 1974.

The figure of (56.2° F,) was used to support the allegation that being colder than the standard temperature of 60° F, "...provides an advantage to the overall American consumer of some 228 million gallons annually."

The reality of the situation is rapidly reversed when it is recognized that instead of receiving "cold" over-delivered (56.2° F) gasoline, they were in all probability receiving "hot" under-delivered (64.7° F) gasoline, which totally destroys the suggestion that the overall American consumer enjoyed an annual over-delivery of 228,000,000 gallons. The probable truth is that the overall American consumer suffered a nominal loss of at least 262,000,000 gallons, annually, since 1974, and both the price and consumption have escalated considerably since then.

Cited, early-on, was the 1915 attempt by NBS to induce the Congress to vest the power, in the NBS, to require the pre-sale approval of all commercial weighing and measuring devices manufactured or sold in the United States. That very concept was rejected!

Rightly or wrongly NCWM was founded to assist in encouraging the achievement of national uniformity in Weights and Measures laws and regulations, rather than by interdicting design criteria developed by industry "engineers" as opposed to those conceived by "government engineers."

Please do not misunderstand that opinion, there are, and have been, some of this Nations greatest scientists and engineers associated with the National Bureau of Standards and some of this nations, great developments have originated within the confines of that organization.

There are, however, frequently different "ends" being pursued by government research scientists and engineers that may entail proving or disproving a concept, the research for which may take several

years, or even the specific feasibility of a given approach; whereas the industry engineer is more frequently involved with a desired end, including positive findings, with supporting favorable economics of marketing their findings, and are they more readily designed to be mass produced, than those which may have been the offspring of research alone.

Conceptually, the former President of the Exact Weight Scale Company, Columbus, Ohio, Mr. William "Bill" Scheurer, commenting on government "oversight" of weights and measures, once suggested that it should be limited to performance requirements, that is uniformity in "specifications and tolerances," but leave the getting there to the people who have to mass produce the device and still show a profit."

"But," he continued, "There should be no proscription against progression. The National Bureau of Standards should limit their involvement to performance, and how it is reasonably obtained. If the damned thing is made out of green cheese, and it meets the specifications and tolerances, established by NBS/OWM, stipulated in their Specifications and Tolerances, and there is little to no possibility for fraudulent use, it should be allowed."

"Specifications and tolerances" have long existed for non-ATC retail gasoline dispensers. This is a paradox, inasmuch as the sparse existing data indicates that ATC will hold its deliveries of standard Petroleum Gallons to accuracies nearly unobtainable on non-ATC dispensers. That is a test where both dispensers are charged with delivering National Standard Petroleum Gallons, of 231 cubic inches of gasoline at 60° F. or the expanded or contracted equivalent thereto at any other temperature.

Hands down, the ATC dispenser will win! Accordingly maybe we should conduct tests to determine whether present non-ATC dispensers are even close to meeting the 231 cubic inch at 60° F, definition, or the expanded or contracted equivalent thereto at any other temperature. The non-ATC dispenser will only be close when the gasoline temperature is 60° F. At all other temperatures the deliveries of non-ATC measured gasoline deliveries do not comply with the NBS/API/ASTM/IP definition of a Standard Petroleum Gallon

of 231 cubic inches at 60° F, or the expanded or contracted equivalent thereto at any other temperature.

It is incredulous that such a huge, costly, and long continuing, double standard has been tolerated. The delivery of 231 cubic inches of gasoline at any temperature, not 60° F, either above or below, is in non-compliance with the "National Standard Petroleum Oil Tables," or its successors, D 1250 and D 1250-80, titled, "Petroleum Measurement Tables," as published by ASTM.

It was, and so far as we know still is, difficult to impossible, for a manufacturer to submit an ATC prototype to NTEP, for National Type Evaluation and conformance testing, since there have been no "specifications and tolerances" established against which an ATC prototype may be tested.

California, with its certified Metrology laboratory, is of course qualified to investigate the capabilities of non-certified weighing and measuring devices, and with their engineering acumen perhaps determine attributes not yet identified by NTEP.

The failure in the system manifest itself in the almost legislative-like-veto the NCWM has, on the commercial use of all commercial weighing and measuring devices.

The NCWM, through the simple medium of not establishing "Specifications and Tolerances," for the certifying process invoked through the "National Type Evaluation Program," preclude the obtaining of a "Certificate of Compliance,"---without which, no one can buy, sell, install, or use a commercial weighing or measuring device, not so approved, in this country, and that includes ATC.

The contemporary non-ATC dispensers installed in the retail Gasoline and Diesel fuel stations throughout the United States are temperature insensitive. They will deliver 231 cubic inches (more or less) of gasoline, at any and every, product temperature, without ever being aware that the delivered volume of gasoline was never equivalent to the Standard Petroleum Gallon of 231 cubic inches at 60° F.

The issue with contemporary retail gasoline dispensers is that they are, for the most part, incapable of accurately delivering a National Standard Gallon of gasoline. The petroleum industry is mindful of this and it was among the motivating influences that caused them to become involved with more accurate measurement capabilities, including their participation in the development of the National Bureau of Standards, "National Standard Petroleum Oil Tables."

The resolution of the problem, now that it has been accomplished, seems academically apparent.

However, there was a whole new electronics industry born before that was accomplishable.

Platinum temperature sensing probes were developed with the astonishing capability to determine the temperature of the flowing product, at the time of measurement, through the meter.

This opened the door for Automatic Temperature Compensating retail gasoline dispensers.

The industry recognizes that the issue is not just the acquisition of new ATC retail dispensers, but more, much more than that---it is the admission that the measurement techniques employed were less than accurate and there could conceivably be costs attendant to the inability of the non-ATC dispenser to accurately deliver National Standard Petroleum Gallons, over all these years.

The ATC dispenser is more accurate than is the non-ATC dispenser. When required to deliver National Standard Petroleum Gallons, the non-ATC dispenser, being temperature insensitive, is totally out of its league. The ATC dispenser has no problem determining the gasoline's temperature of the fly as it is measured through the meter.

ATC retail dispensers manufactured, in the United States, are approved for commercial dispensing of gasoline, but only in Canada. Canada has approved the voluntary use, of ATC, and the Gilbarco-Veeder Root, dispenser manufactured by an American company, is a major supplier of devices that meet the specifications and tolerances of "Measurement Canada."

Something is amiss when Gilbarco-Veeder-Root, a pump and subsequent dispenser manufacturer, whose existence as Gilbert Barker Pump Company predates the American Petroleum Institute, yet it is proscribed from selling its locally manufactured ATC retail Gasoline dispenser in the United States, but can sell them for installation and use, in Canada.

The "National Conference on Weights and Measures," through its National Type Evaluation Program, a non-profit standards writing body, sitting in judgment on the engineering competence of industrial engineers and their products, have demonstrated an appalling lack of engineering acumen in continuing in use equipment totally incapable of meeting defined standards.

Wherein lays the justification for continuing in use retail gasoline dispensers that are incapable of delivering National Standard Petroleum Gallons, to the consuming public? What other industry could acknowledge the superior accuracy of Automatic Temperature Compensation intra-industry, but deny its application in measuring retail deliveries to the consumers?

As early as 1923, the NCWM was alerted to the concerns of Weights and Measures calibrating dispensers at varying product temperatures, or utilizing underground gasoline at its ambient temperature, to calibrate a retail dispenser.

The "National Type Evaluation Program," is a conception of the National Conference on Weights and Measures," that was rejected, in principal, as early as 1915. Unquestionably there must be minimum performance standards however they should be related to the definition of the Standard, not the limitations of the device's capabilities.

Enhancing capabilities should be the near-constant goal of every retail gasoline dispenser manufacturer. Exceeding NCWM recommendations for accuracy, should be encouraged, and the manufacturer should be allowed to capitalize on that superior capability, in their sales advertising. The real issue is not alone ATC but the fact that non-ATC dispensers are inherently design deficient.

Granted that when gasoline was selling for what now appears a ridiculously low price, there wasn't much concern about non-compliance with the definition of a National Standard Petroleum Gallon.

Being temperature insensitive it is impossible for non-ATC dispensers to deliver the expanded or contracted equivalent of 231 cubic inches at 60° F", when the product temperature is some temperature other than 60° F, which appears to be the national average norm.

But, for heavens sake establish the "Specifications and Tolerances," and let the manufacturer build a device to meet them. Re-awaken competition, it is good for innovation.

Essentially NCWM via NTEP, have by their very inaction deprived the consumers, of accurate retail gasoline delivery, by the simple means of doing nothing.

Having said that, it is worthy of note that "Measurement Canada," does have such "specifications and tolerances," to which Gilbarco-Veeder-Root ATC retail gasoline dispensers do comply. However, despite the "Memorandum of Reciprocal Agreement," entered into by a Past Chairman of NCWM and an Official representative of Measurement Canada, an agency of the Government of Canada, that MRA conveniently, as it turns-out, didn't include Automatic Temperature Compensating retail gasoline dispensers. One wonders, why?

To illustrate once again, a ("National Standard Petroleum Oil Gallon,") is defined as 231 cubic inches at 60° F,) while a ("Specific National Standard Petroleum Oil Gallon,) is a (National Standard Petroleum Oil Gallon, which includes the gravity as 58° API at 60° F.) (Note: we are referencing MOGAS, other petroleum product derivatives may have different API Gravities, in which case the weight per gallon would change, and the definition would carry a different API Gravity number.)

In summation,

Since the effective denial of accurate, equitable measurement of gasoline to the retail consumer, has been a function, in part, of the opposition by the petroleum industry, (See 1974 NCWM presentation by a representative of the Petroleum Industry, titled "Temperature Correction of Petroleum Products at Retail,") and of the inaction of the "National Conference on Weights and Measures, and the unofficial big brother of the NCWM, namely the Division of Weights and Measures, which is a subordinate agency to the National Bureau of Standards/National Institute for Standards and Technology, which is itself joined at the hip to the U.S. Department of Commerce, one must muse, just who is looking-out for the consumer?

There is no question that an ATC retail dispenser is more accurate than a non-ATC dispenser, which is only correct on that rare happenstance when the gasoline temperature is 60° F. (The recent two year study, (2002 – 2004) conducted by NIST, established the average year around national gasoline temperature as 64.7° F,) Which means that on average the retail consumer was under delivered "Hot" gasoline, year around.

In Hawaii, the nominal average, year around temperature of gasoline, is more or less 84.12° F. The documented range was 105° F, down to, but never lower than, 76° F. With ATC, which factually Hawaii falls short of utilizing, and instead uses a politically agreed too, fixed temperature of 80° F; which is 4.12° F short of documented reality, mainly because the individual testifying, suggested to the Hearing Officer, that it was too hard to remember 84.12° F, whereas 80° F, would be easier. (See page 55, Underground fuel temperature data.)

Comments like that make one realize that there are those who really understand the inequity of the present practice, and there are those who simply do not.

It seems that the truly repugnant transactions are continued by those who are very well versed in the inequity of the current distribution practice, and continue to disrupt efforts to eliminate that disparity by their refusal to support corrective measures that would assure correct, accurate and equitable distribution all the way through the

petroleum products distribution hierarchy, right into the consumer's gasoline tank, and, that doesn't seem too much to ask.

Should ATC become mandatory in California, or better yet, if California could lead the nation in achieving equitable measurement of gasoline nationally, then, included for the first time will be both those California retailers who receive ATC, on a yearly contractual basis now, and those previously excluded from participation in that economic benefit, and of course, included, would be the very largest state population of gasoline users in the nation the automobile driver.

The greatest inequity of all will be removed when Automatic Temperature Compensated gasoline is the only way gasoline may be sold, to the retail consumer, in California. We commend your efforts, although it remains a mystery how a law was ever enacted, that only required the supplier to correctly measure gasoline, to the National Standard of 231 cubic inches at 60°F, if and when the retailer has entered into a year long contract to accept gasoline from a specific dealer.

That certainly appears to be preferential, if not discriminatory. What If there is no contract? One retail dealer is receiving correctly measured gasoline, while the other is not! The supplier is not required to make an accurate delivery to the retailer? Wow!

Thank you for reading.

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

George K. Burgess, Director

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THE BUREAU OF MINES

THE BUREAU OF STANDARDS

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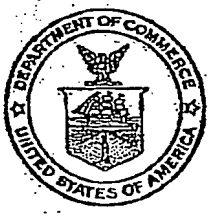

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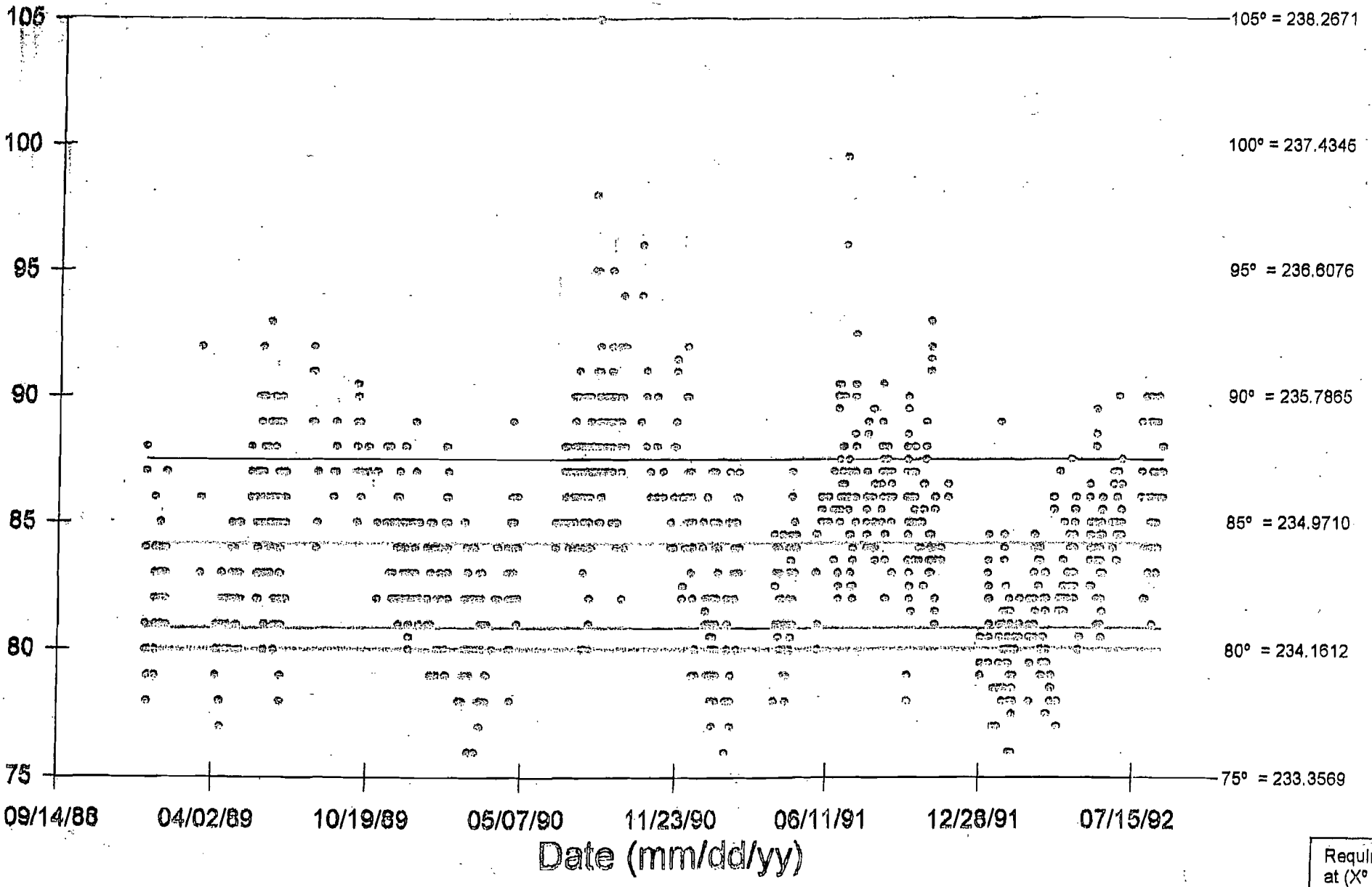
UNDERGROUND FUEL TEMPERATURE DATA

Oahu (01/06/89 - 08/20/92)



Required volume at (X° F.), to equal 231 cubic inches a 60° F.

Undrgrnd Temp — Avg Temp — Avg Temp +/- 1 SD — HI Ref Temp