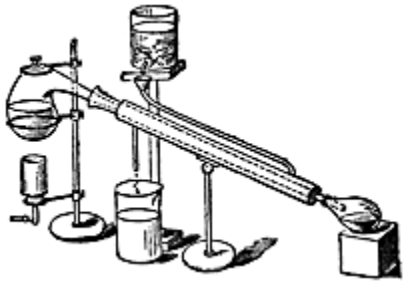
SOUTHWEST RETORT



SIXTY-FOURTH YEAR **October 2011**

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Analyses of Alternative Energy Strategies: Wind, Solar, Tide **Part 1.....p. 6**

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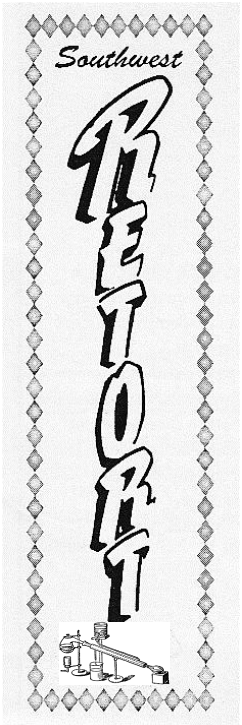

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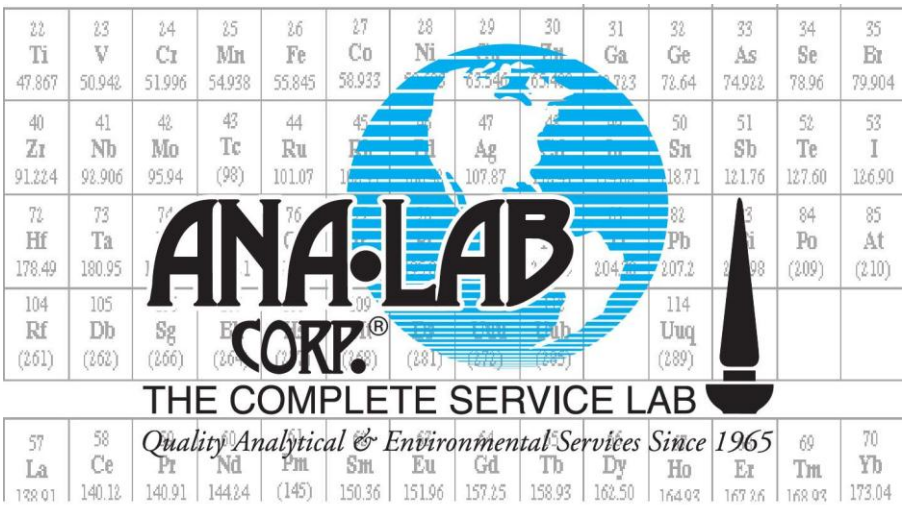
FIFTY YEARS AGO IN *THE RETORT*

The tour speaker for October is **Dr. George B. Butler** of the University of Florida. He will be speaking on either one of two topics: "The Current Revolution in Macromolecular Chemistry" or "Recent Advances in Polymerization by an Alternating Intra-Molecular Mechanism.

The Southwest and the Southeast ACS Regions will hold a combined regional meeting in New Orleans Dec. 7-9.

At the University of Texas (*now UT-Austin*) Department Chair **Dr. Norman Hackerman** has relinquished his position to become Vice President and Provost of the University. Four new faculty members have joined the department. They are **Drs. Nathan A. Bauld, Michael I. Davis, Brian N. Figgis,** and **Daniel M. Ziegler**. **Drs. L. F. Hatch** and **F. A. Matsen** have returned from leaves of absence. **Dr. James E. Boggs** attended the Symposium on Molecular Struc-ture and Spectroscopy held in Columbus, OH, in June.

From the D-FW section we learn that Tarleton State instructors **E. R. Henningsen** and **Richard Poe** have been promoted to Assistant Professors. The $64,000 Science Lecture Room, which seats 170 students, has been completed and is now in use. Richard Poe has been granted a year's leave of absence for the 61-62 academic year to work on a Ph.D. degree at Texas A&M. **Dr. William Glaze** has joined North Texas State University (*now UNT*) as an assistant professor. **Dr. Price Truitt** has received a $10,500 continuance of his NIH grant. **Dr. C. W. Schimelpfenig** has received an $18,000 Welch grant, while **Dr. R. J. Thompson** has received a $36,000 Welch grant. **Dr. Calvin VanderWerf** of the University of Kansas visit-ed Arlington State College (*now UT-Arlington*) to visit classes and have discussions. **Mr. Carl Scharf** attended a six week NSF Chemistry Institute this past sum-mer. At Texas Woman's Univer-sity new faculty are **Drs. Lyman R. Caswell** and **Anne Ayres Terry**. **Dr. Helen Ludeman** attended the Institute of Isotope Technol-ogy held at Oak Ridge this last summer. At TCU **Dr. W. H. Watson** attended a Conference on Organic Semiconductors held in Chicago and the NSF Conference on Nuclear and Electron Spin Resonance held at the University of Florida. The department awarded eight new graduate teaching and research assistant-ships.



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Analyses of Alternative Energy Strategies, Wind, Solar, Tide. Part 1.

by **John E. Spessard, P.E.**

This paper discusses the feasibility of obtaining electricity from wind, solar and tidal energy. The feasibility is on the basis of the technologies functioning profitably without government subsidies and tax breaks. The technology is required to provide significant portions of our electricity needs and pay normal local, state and federal taxes and fees.

Implementing New Technology is a Challenge

A friend who is a fine engineer expressed it this way: You can take any plant or process and reduce it to some number of squares on a flow sheet. Each square represents a major process step or piece of equipment. If every square is proven technology, with proven meaning it has been done before on this scale and in this country, you will have an easy startup. One square of problems, you will have problems, but they can be handled. Two squares of unproven technology, the first Plant Manager will be fired. I have checked it through the years and it works.

Startup is defined as being the period between when you first try to operate the plant and you are consistently producing specification product at the design production rate. A change of scale changes surface to volume ratios. This leads to complications involving pumps, valves, piping, fittings, etc. TXI licensed German technology to build a new cement plant. These plants were operating successfully in Germany. The kiln is hot enough that the coal fuel melts. The liquid characteristics of German and American coal were different enough to cause problems. These problems were resolved. The plant in Beulah, North Dakota that makes synthetic natural gas from coal was enough aware of the potential problems that they sent a boat load of North Dakota lignite to South Africa to be tested in the Salsol gasifiers. This was a very well managed project. It was completed on time and on budget. (That it was an economic disaster is a story for another day.) DuPont has a well-deserved reputation for technical excellence. DuPont built a plant to make titanium dioxide pigments by reacting titanium dioxide ore with chlorine. The plant produced titanium tetrachloride which was

re-oxidized to provide pigment grade titanium dioxide. The plant had a three year startup. The plant dealt with the very corrosive environment of titanium dioxide (fine abrasive powder), titanium tetrachloride, ferric chloride, chlorine and oxygen, all at high temperature. DuPont built a second plant using mostly the same technology. It had a nine month startup.

How Much is Two Plus Two?

There is a joke where various professions are asked "How much is two plus two? The accountant's answer was "What do you want it to be?" This very much applies to innovative technology cost estimates. When coming from advocates of a technology, these estimates are optimistic to the point of absurdity. This is particularly true for yet to be implemented technology. Also, which set of books are you looking at? General Electric provided one financial is that the customer demands a lot of innovative never-been-done before technology. To make it even worse, additional innovative technology is demanded over the course of the project.

Therefore the only cost estimates for innovative technology implementation that I have any faith in are historical costs. statement to their stockholders that showed GE making a profit. GE provided a financial statement to the IRS that showed they had lost money and did not have to pay taxes. This is routine. A big factor in how you run a business is to reduce taxes. This may not be optimum efficiency but it makes business sense. Certainly, tax breaks go a long way toward making alternate energy technologies feasible.

Cost estimates from governmental bodies are often ludicrous. One example is the Trinity Tollway in Dallas. The City Father Advocates were less than candid about the Corps of Engineers' statement that the project was feasible. A bond issue of $243 million was voted for the project. The most recent estimate is that an additional $ one billion will be required. In 1987 when the Superconducting Collider construction began, the cost estimate presented to Congress was $4 billion. In contracts always greatly exceed the initial estimates. One reason is that to win in the competitive bidding process, the vendor needs to be optimistic. A second reason 1993 when the project was cancelled, the new estimate was $ 12 billion. (It was by no means certain that this was the end of the cost escalation.) Defense systems

That is, it has actually been done for this price. A popular ploy is to ask for more money late in the construction process. The ration-ale is we have gone this far, we only need a little more money, and it would be a shame to abandon it now.

The One Dollar Black Box

Suppose you have a black box that costs one dollar and each year, it produces five cents worth of product. Say no more! It is uneconomic. Ignoring raw materials, labor and utilities, the costs of depreciation, the dollar of capital tied up in the box, maintenance, taxes and insurance renders any hope of profitability impossible. Presently, except for a few favorable circumstances and government subsidies and tax credits, these technologies are uneconomic. The operating facilities using these technologies are located only in the locations most favorable to these technologies. Eventual profitability requires technological advances that will reduce capital costs.

Once a too high capital cost facility has been built, the capital investment can no longer be returned. It is now better (or less bad) to operate the facility to recover what you can. This is what happened in the North Dakota plant to obtain synthetic natural gas from coal. This plant was built on the expectation of nine dollar per thousand cubic feet gas.

Blowing in the Wind

Electricity from wind is the most developed of the three technologies. Independent investors are putting their own money into wind generators. Wind generates about 20% of the electricity in Denmark, 7% of the electricity in Germany and 1.5% of the electricity in the United States. However governmental subsidies are necessary to make wind power economically feasible in these most favorable locations. In the United States, there is (1) a production tax credit of 1.8 cents per kilowatt hour, (2) the investor can depreciate the equipment over a six year period and (3) utilities are required to buy the wind-generated electricity through green energy requirements. Even Advocates accept that parts of the United States, including the entire Southeast, do not have strong enough winds to make wind electricity feasible. Thus, at best wind is only a partial solution. The existing facilities are located only in the most favorable locations.

The 1.8 cents comes directly off the Federal taxes. As a comparison in Virginia it costs

between 3.5 to 4 cents per kilowatt hour to generate electricity from a conventional power plant. The cost of wind-generated electricity is about 6 to 6.5 cents a kilowatt hour. Utilities will buy the electricity to satisfy regulatory requirements for obtaining electricity from renewable energy sources. A six-year depreciation schedule using the double declining balance allows the investor to recover 55.5% of the investment in six years. (The expected tax lifetime for regular utilities is 20 years.) In Germany the generator receives 9 eurocents per kilowatt hour. That is 13 American cents per kilowatt hour paid to the generator. As a comparison, I pay TU Electric 13.5 cents per kilowatt hour for electricity delivered to my home. In the United Kingdom, land-based wind generation costs are estimated at 3 pence (4.9 cents) per kilowatt hour. (This estimate comes from advocates to be on line within ten minutes after startup and this makes them more expensive than other conventional power plants. Regular power plants run hot and will need a day or more to both startup and shutdown to avoid damaging the equipment.

The availability factor for a wind generator is about 30%. This raises the capital cost for electricity actually produced. The and should be considered optimistic.)

In Europe wind turbines are frequently located offshore in the North and Baltic Seas. These are at sea level at lower temperatures (look at the latitude compared to Amarillo.). In America, wind turbines are frequently at altitude (Lubbock is at 3241 feet above sea level and Amarillo is at 3676 feet (Rand McNally) and higher temperatures. The Texas winds will be less dense and carry less kinetic energy than the European counterparts.

Estimated construction costs of wind-generated electricity range between one and two million dollars per megawatt. (This is from Advocates.) As a comparison Tampa Electric Company built five 60 megawatt natural gas fired peaking units at a cost of $237 million or 0.79 million dollars per megawatt (This is a real number). Peaking units have capacity factor is a measure of how much electricity is generated versus the theoretical maximum. The wind does not blow all of the time or at the optimum speed. Turbines begin to generate at wind speeds of 8 mph, reach full power at 30 mph and need to shut down at 55 mph to protect the equipment. As a comparison nuclear plants will have a 90 percent capacity factor and main

line coal and natural gas plants an 80 percent capacity factor. (These plants will schedule shutdowns for maintenance in the spring and fall when the demand for electricity is at a minimum.)

Failure of the turbines due to vibration is a major problem. Bearing failures are a problem. Turbines have grown from 50 kilowatts capacity to over three megawatts. (See my discussion on the problems created by different sizes.) The industry has made significant efforts to increase equipment reliability. The propeller blades have gotten larger to where some have diameters of over 100 meters. The industry has settled on the planetary gear box for turbine design.

One source identified the worst possible case for vibration problems:

*Variable speed and load

*Difficult and limited accessibility

*Complex gear boxes with planetary gear boxes being the worst

*Very low speed shafts

Voila! You have a wind farm.

If you have a 300 foot diameter blade, the turbine must be at least 300 feet above the ground to (1) catch the optimum winds and (2) provide clearance for the blades. When there is a problem with a turbine, the technician will have to climb 300 feet up and 300 feet down to diagnose the problem. Then there will be at least one more climb and decent to fix the problem. This is expensive and potentially hazardous maintenance labor. The combination of larger turbines and propeller blades exacerbates the vibration problems. Diameters have been reported up to 100 meters.

The new problems associated with wind power being a major source of electricity have been addressed. Is there enough available capacity on electric transmission lines to handle a major new electricity source? If not, new transmission lines will cost about a million dollars a mile and securing a right of way could be a political adventure. If we rely on electricity as a major source, what happens when the wind doesn't blow, there is no electricity and we need it? The policy of building peaking units such as the ones built by Tampa Electric to serve as backups have been mentioned. Having built the peaking units, where do you find the crew to run it? In a small country like Denmark getting a crew to the site quickly may not be a problem. What happens if an operating crew is needed at Springfield, Colorado on short notice? The expensive answer is that the on-

site crew has to be able to operate and maintain BOTH units.

In Denmark, wind energy provides 20% of the electricity. The propeller blades are made of carbon fibers and are not recyclable. Denmark has found that failed propeller blades are consuming undesirable amounts of landfill space. Carbon fibers have the advantage of light weight and high strength. But in Denmark, they still fail and disposal is a problem. The Denmark experience indicates that the blades do not have the projected 20 year life.

To summarize, wind power does not have the potential to become a reliable major electricity source. Equipment reliability issues with the turbines and blades are a problem. Wind is not a reliable energy enough energy source to be there when you always need it. (The entire Southeast does not have enough wind to make wind farms available.). Assuming that transmission line capacity is always available, wind is probably limited to producing about 20% of our needs. This is based on experience with wind farms in Germany and Denmark.

Sources Consulted: Part 1

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1G. Wikipedia, Superconducting Supercollider" June 8,2011. This is a good history of the project and the ever increasing cost escalations.

2. Wind

1W. John R. Sweet, "Economic Factors for Wind Energy Projects, John R. Sweet Web Site, February 19, 2005

2W. No author, "The Economics of Wind Energy," Renewable UK. The voice of wind & Marine Energy, post Autumn 2004. These are advocates.

3W. No author, "Wind Power Economics," EWEA, the voice of the wind industry, late 2010. These are equipment suppliers and advocates

4W. Jordi Pulgcorbe and Alexis deBaumont, "Wind Turbine Gearbox Reliability," Renewable Energy World, June 3, 2010. They describe the problems.

5W.W. Musial, S. Butterfield, and B. McNiff, "Improving Gear Box Reliability" 2007 European Wind Energy Conference, May 7-10, 2007. They concede there is a problem and predict better days ahead. Musial and Butterfield are from the Federal National Renewable Energy Laboratory. They are advocates.

6W. Jason Tranter, "Vibration Analysis of Wind Turbines," ARC World Industry Forum, late 2010. The basic design of wind turbines is a source of problems.

7W. No author, “Wind Power Performance, Economics and Integration, Renewable Energy Research Laboratory, University of Massachusetts at Amherst, no date

8W. Eon Kraftwerke, “Fluctuating Wind Output and Subsidies”, National Windwatch Inc. (Germany), March 15, 2007

9W. Jeffery Logan and Stan Mark Kaplan, “Wind Power in the United States: Technology, Economic and Policy Issues,” Congressional Research Study, June 20, 2008. This is a good detailed study.

10W. No author, “Five Key Characteristics Make Wind Farms More Profitable,” ABB Inc., no date. ABB sells equipment to the wind industry and must be considered an advocate

11W. John O’Sullivan. “Broken Wind Turbine Blades Create mountainous Waste Problem,” Climate Change Dispatch, June 12, 2011. Denmark is obtaining 20% of its electricity from wind farms. Broken wind turbine blades are crowding the Danish landfills.

12W. No author, “Tampa Electric Invests in Peaking Power Units,” TECO news release, February 14, 2008. This provides actual cost data for five new sixty megawatt peaking natural gas-fired electric generating units.

13W. No author, “Madison Peaking Units,” News release Basin Electric Power Cooperative, Madison, WI, April 2005. They built five two megawatt diesel-powered peaking electric generating units at a total cost of 5.5 million dollars.

Contributors wanted! The RETORT seeks articles on technical topics, scientific and opinion papers. Submit to retort@acsdfw.org

2011 Southwest Regional Award Winner

Sean O'Brien is the 2011 winner of the ACS Southwest Regional Award. He will be given the award next month at the regional meeting in Austin.

Austin College's Stephanie Gould Awarded ACS – PRF Grant

Dr. Stephanie Gould, Professor of Chemistry at Austin College in Sherman, Tx, was awarded a $50,000 two-year grant from the American Chemical Society Petroleum Research Fund. The grant will support Gould's research into building solid state nanogears. Like their mechanical counterparts, nanogears will have cogs that will turn and fit together. Gears that move in liquids already exist, but the gears focused by Gould's research would be the first crystal-based gears.

In addition to the research itself, the grant will allow Gould to hire three students for each of the two years to work in the research lab. Gould believes the research lab is the best place for students to apply their coursework knowledge and to develop problem-solving skills.

EPA Region 6 Hosts 21st Quality Assurance Conference

Region 6 of the U.S. Environmental Protection Agency is hosting the 21st Quality Assurance Conference during the week of October 17th through the 21st in downtown Dallas. Conference sessions and workshops will be held in the 12th floor conference center of the EPA building located at the corner of Ross Avenue and Field Street. Everyone is welcome. There are no registration fees, but those planning to attend the conference are asked to complete the registration form located on the conference website: www.epa.gov/region6/qa. The conference agendum is also posted on our conference website. Questions may be directed to Ritchey Charles by phone (214) 665-8350 or by e-mail at Ritchey.Charles@epa.gov.

Around-the-Area

East Texas

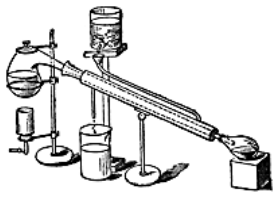
Al Hazari was the speaker at the Oct. 5th section meeting. His talk, "Periodic Fun," focused on the display of numerous periodic tables of the elements from the old (pre-Mendeleev) tables through the modern tables as well as the more unusual ones.

Dallas-Fort Worth

UT-Arlington. Dasgupta Receives Million Dollar NASA Grant. Professor Purnendu, Sandy, Dasgupta has been awarded a nearly 1.2 million dollar grant from NASA to develop an ion chromatograph for extraterrestrial explorations. The chromatograph is to test the composition of extraterrestrial soil. The project was one of eight nationwide recently funded by the Astrobiology Science and Technology for Instrument Development grant program of the NASA Astrobiology Program.

Schug, Kroll, Mandal Promoted. Drs. Kevin Schug, Peter Kroll, and Subhra Mandal were recently granted tenure and promoted to Associate Professor. Dr. Schug is an analytical chemist, Kroll a theoretical chemist, and Mandal a biochemist. In addition to his analytical research, Dr. Schug will spearhead UTA's Organizational Network for Teaching as Research Advancement and Collaboration (ON-TRAC). The goal of the organization aims to provide doctoral students with better tools to teach student in STEM fields.

UT-Dallas. Welch Chair Ray Baughman was ranked #30 on Thomas Reuters' Top Materials Scientists of the Past Decade. Professors Jung-Mo Ahn and Dean Sherry were awarded two-year Research Grants from the Welch Foundation. Professor Gregg Dieckmann received the Outstanding Teacher Award from the School of Natural Sciences and Mathematics. Professor Rocky Draper (PI) was awarded a three-year NIH Research Grant from the National Cancer Institute with co-PIs Paul Pantano and Ellen Vitetta (UT Southwestern).



METROPLEX SEMINAR SCHEDULE

Seminars are occasionally postponed or cancelled. Check departmental websites or call the department before attending.

<u>UT-Arlington</u>. Oct. 28. Prof. Mihaela C. Stefan, University of Texas at Dallas, Department of Chemistry. "*Benzodithiophene Semiconducting Polymers for Organic Electronic Applications*" **Nov. 4**. Prof. Paul F. Fitzpatrick, UT Health Science Center, San Antonio, Department of Biochemistry, "*Catalysis and regulation of the aromatic amino acid hydroxylases*" **Nov. 11**. Prof. Paul Bagus, University of North Texas, Department of Chemistry, *"Interpretation of Satellites and Multiplets in Photoemission Spectra: Implications for Materials Prop-erties"* **Nov. 18**. Prof. Uttam Tambar, UT Southwestern Medi-cal Center, *"Asymmetric Molecu-lar Rearrangements in Chemical Synthesis"* **Dec. 2**. Prof. Nicolay Tsarevsky, Southern Methodist University, Department of Chemistry, *"Controlling Molecular Architecture and Placement of Functional Groups in Polymer Synthesis: From Synthesis to Applications"* **Dec. 9**. Prof. Sung-Kun Kim, Baylor University, Department of Chemistry and Biochemistry, *"Novel Inhibitors of Metalloenzymes from Antibiotic Resistant Bacteria and ssDNA Aptamers against Anthrax Protective Antigen"* Seminars are normally at 2:30 p.m. in Room 114, Baker Chemical Research Bldg.

PUMPKIN SPECIAL for HALLOWEEN!!

http://www.youtube.com/watch?v=O2799XSIlZM

OCTOBER MEETING NOTICE

National Chemistry Week is October 16th - 22nd and DFW ACS section is teaming up with Fort Worth Museum of Science and History for a

Family ACS Meeting!!

- On October 18th - 22nd, chemistry clubs from local universities will be providing chemistry activities, demonstrations, and playshops from 10am-5pm at the museum.
- **ACS members** will serve as **Chatters Saturday Oct 22nd from 3-5pm**. **Details below about what activities and demonstrations will occur.**
- All ACS members and their families will get group pricing to the museum during that week. **Pricing details below.**
- Currently we are looking for volunteers for the ACS event on **Saturday Oct 22nd** event. We are looking for at least 10 **Chatters** from all walks of chemistry. Chatters will talk for 10-15 minutes about a topic in chemistry and demonstrations are welcome. **Those who are able to volunteer will get additional discounts.**
- For more information email Aaron Fletcher at aaronf@dbu.edu

For ACS members and families coming throughout the week group rates will be available. When you check in you will have to show your ACS card to receive the discount.

Rates and Activities cont. on next page

Group Pricing	Child (2 - 12) Senior (60+)	Adult
Exhibits Only	$8	$12
Omni (1-hour film) Only	$5	$6
Planetarium Only	$3.50	$4.50
Exhibits + Omni (1-hour film)	$13	$18
Exhibits + Planetarium	$11.50	$16.50
Exhibits + Omni (1-hour film) + Planetarium	$16.50	$22.50

For the ACS members volunteering on Saturday as chatters:
The ACS member is free and they can purchase up to 4 tickets at half price to the Exhibits, OMNI show Hubble and the Planetarium. Email Aaron Fletcher at aaronf@dbu.edu if interested in volunteering as a chatter.

SO MUCH TO DO, SO LITTLE TIME!!

ACTIVITIES	PLAYSHOPS	DEMONSTRATIONS
properties of gas/balloon	Bubbles/dry ice/colored	Liquid Nitrogen
instant snow	Glowing	Dry Ice
chemical pop gun	Gases	Oobleck
snakes and acetone	Dry Ice	Invisible Potion
Lava lamps	Fire and Ice	Balloons and gases
ice cream (rock salt)	Foodie Chemistry	Burning bubbles
liquid nitrogen ice cream	Chemistry Clinic	Dancing Dinosaurs
dip n dots	Lava Lamp	Flame/Firework Demo
baggie chemistry	Candy chemistry	Oscillating Clock
slime/ectoplasm	Green Chemistry	CO2 Bombs
bubbles	dissecting diaper	Electric Pickle
molecule construction	chromatography	Elephant Toothpaste
carbon cone (outside)		Nylon Rope
endothermic/exothermic		
test ph of saliva		
baby food testing		
magic rocks		
fire lighting		
Floam AND MORE!		

From the Editor

Last week I saw an editorial in the Dallas Morning News in which the author bewailed the loss of paper books in favor of electronic books. She used the example of a well-loved, thumbed copy of an Ursula LeGuin novel. Is that to be lost, and replaced by a sterile Kindle or Nook?

Until the advent of electronic readers, several years ago, we had no other option for books, other than the traditional paper and ink—both pre- and post-Gutenberg, that saint of the printing press. I don't know if traditionalists then bewailed the loss of *real*, handmade, handcolored books, but I wouldn't doubt it. So, like any good researcher, I googled it (by the way, does anyone regret the passing of encyclopedias?), and found that they did! Scholars would lose their jobs, the populace would learn to read and get ideas that weren't good for them, overthrow the government...etc. For more input, read this interview with Johannes Gutenberg: (http://focus2011.org/2011/05/interview-with-johannes-gutenberg-by-dr-charles-j-margerison/)

However, the paper-and-ink version is no more the real book than the school is a building, the church is a cathedral, or the government is the Capitol.

I will always treasure my battered first copy of *The Hobbit*, collections of Kathleen Norris, first editions of Mary Russell Mitford and Elizabeth von Armin. I cherish the smell of dusty paper and the feeling of all the other hands that have touched that book.

But I don't want to *own* all the books in the world…I just want to *read* all the books in the world! And how many books can one physically keep? I recently discovered, via Kindle and the Gutenberg project, the novels of Edgar Wallace, Sax Roehmer, and Rosa Nouchette Carey, just to name a few.

All this is a prelude to the advent of the electronic production of the Southwest RETORT. Digitized, it can be instantly and simultaneously transmitted to all subscribing members; individual pages or issues can be printed if wished. Back issues are searchable. So, email your comments, and send us your articles, news items, seminars, and whatever else you can think of, but certainly, enjoy the new RETORT!