

## **SOLUTION MINING RESEARCH INSTITUTE (SMRI) – ISSUES AND IMPACT FOR THE MINING AND STORAGE CAVERN INDUSTRY**

Authors: Voigt, John 1; Crotogino, Fritz 1; Durup, Gérard 1; Ratigan, Joe 2; and von Tryller, Hartmut 3.

1 = SMRI,

2= PB Energy Storage Services, Inc.,

3= SOCON Sonar Control Kavernenvermessung GmbH

### **ABSTRACT:**

This paper serves as an introduction to the Solution Mining Research Institute, (SMRI) and describes objectives and activities of the organization. Starting with a brief history of SMRI, the paper describes the organization's research and educational objectives and the methods used to successfully achieve the research goals determined by SMRI members from around the world. Since the 8<sup>th</sup> Salt Symposium in The Hague in 2000, the SMRI international membership has grown, and interest in solution mining of salt, potash, and trona has been driven by economic growth. The world's energy interests have become focused on storage in solution-mined caverns as an adaptable tool capable of helping meet peak or seasonal energy demands. The SMRI's most active research subject areas are determined by member and industry surveys. The Research Coordinator and Research Committee prioritize subjects and determine the most practical topics addressing research needs, then issue public 'requests for proposals', (RFPs) which solicit proposals for new research. Proposals are carefully scored and compared, then recommendations are presented to and voted on by the SMRI membership. Research projects completed since the 8<sup>th</sup> Salt Symposium are listed in the paper, and active projects are briefly described. Several technologies are being emphasized for the SMRI to provide unique and added value to its members and the public, and they will also be discussed including: web based communications, industry specific software, and expanded on-line references.

### **Contact:** John Voigt

SMRI Executive Director

105 Apple Valley Circle, Clarks Summit, PA USA

jvoigt@solutionmining.org

phone +1 570 585-8092

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### **China and SMRI, the road ahead:**

It is quite appropriate that this 9th World Symposium on Salt takes place in Beijing,

China. The salt industry has come full circle, and our industry leaders now begin this Symposium in the country where salt solution

mining is thought to have started about 250 B.C. (Kostick [2009]). Those thousands of years ago, bamboo pipe was pushed into China's ground and used to recover brine - the first known successful effort of salt solution mining.

Solution mining of salt has since become routine, is quite active in China, and has grown more economically important as energy storage in salt caverns is a preferred method of meeting energy needs. It is believed that no country produces more salt by solution mining as does the 2009 World Salt host country China. According to U.S. Geological Survey (USGS) estimates, China passed the United States in 2006 to become the world's largest salt producer, and as evidenced by salt imports, is surely the largest user of salt. While reliable production statistics were not available about tonnage by method of salt production, solution mining is thought to produce most of China's salt. (see figure 1, Salt Exploitation in China, from SMRI RR 2006-2)

Technology available to China's salt miners may lag other major salt producing countries, but their salt producers have been increasing production at unprecedented rates to meet the country's fast growing industrial demand. China's salt production has rapidly grown to nearly ¼ of the world total, as estimated by USGS:

1979	22,300,000 metric tons	(5th Salt Symposium, Hamburg, Germany)
1993	29,530,000	
	(one year after 7th Salt Symposium, Kyoto, Japan)	
2003	32,424,000	
2006	54,030,000	became world's largest salt producer
2008	60,000,000	increased production by 28 million tons in 5 years!

SMRI is pleased to maintain a tradition of co-sponsoring Salt Symposia, now including this historic 9th Salt Symposium. The SMRI

members and organization have supported the Salt Symposia since Don Richnor served as program chairman for Salt 2 in Cleveland in 1965, and SMRI has co-sponsored each symposium starting with Salt 3 held in Cleveland in 1969.

Presently, 3 members of SMRI are based in China, and are making use of SMRI information and research to improve safety, design, production, and environmental conditions at their facilities. One of the Symposium field trips will visit SMRI member China Salt Jintan Salt Co. LTD's operation near Jintan City, (their SMRI representative is Mr. Guan Guoxing). Petrochina West-East Gas Pipeline Company is developing solution-mined gas storage caverns, (with help of SMRI member representative Mr. Qu Danan in Jintan City). SMRI's newest China member is the Research Institute of Drilling Engineering, CNPC, (with their representative to SMRI located here in Beijing, Mr. Shen Ruichen). It is the hope of SMRI's members that other mining companies, universities, etc. that are active in either solution mining or cavern storage will also join SMRI to help sponsor research that will benefit the whole industry and the public interest. It is possible to imagine that SMRI may someday need an "Asian Coordinator" to assist with growth of the membership and industry activity here, as was the SMRI's successful action to support European members in 1993. Perhaps by increasing use of SMRI's library, and from information learned by actually meeting industry experts at SMRI conferences and World Salt Symposia like the 2009 symposium, China's solution miners and cavern storage people will avoid mistakes that have already been made and studied, thereby being as efficient, safe, and environmentally sound as possible. To the 2009 World Salt Chinese hosts, we appreciate the SMRI's 3 members from China who support SMRI, the research, and the conferences, and invite more of your country's organizations to join as these leaders in your industry have.



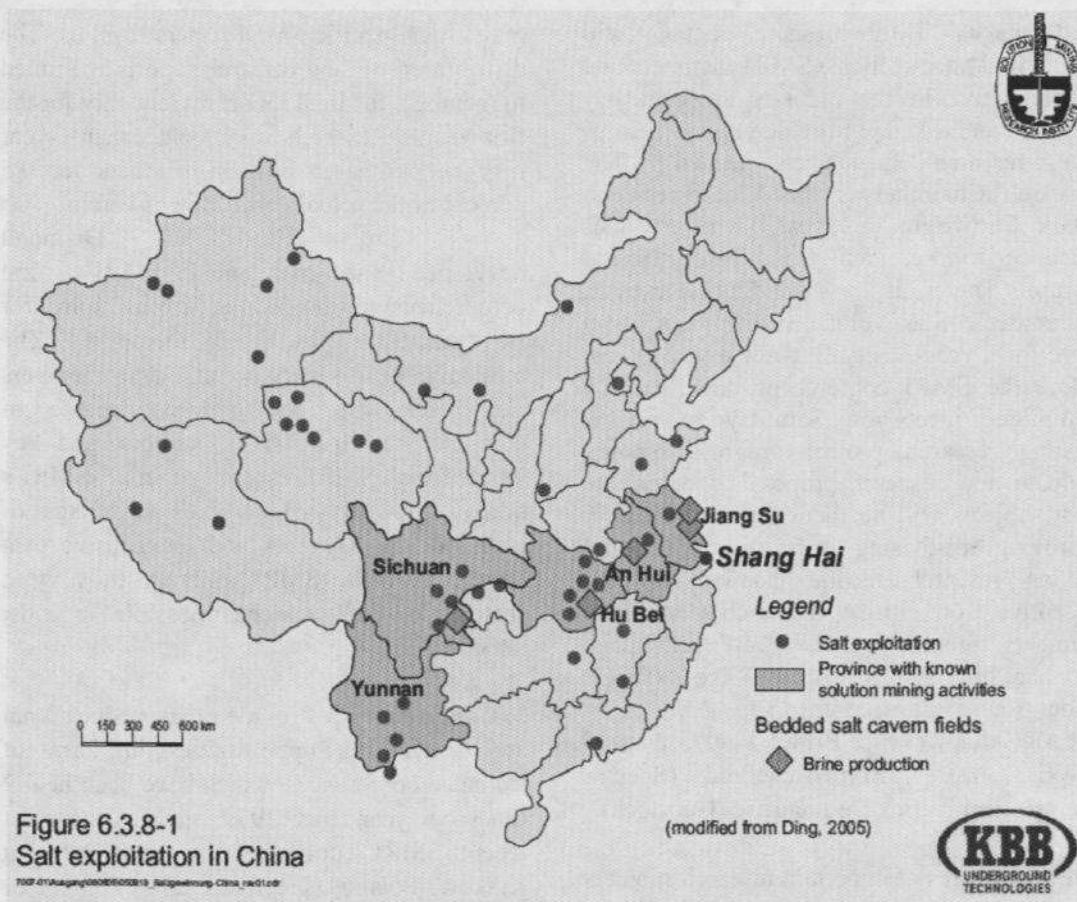


figure 1, Salt Exploitation in China, (from SMRI RR 2006-2)

#### What is SMRI?

The Brine Cavern Research Group (BCRG) was formed in 1961 by 11 companies interested mainly in bedded salt cavern design and development. BCRG was beginning to research some of the subjects still facing the solution mining industry, but lasted only a few years as interest grew in domal salt caverns, potash, and cavern use; along with legal or antitrust aspects that required change. BCRG was 'dissolved' in 1965, and the group reorganized as Solution Mining Research Institute, incorporated 5 February 1965 in Cook County, (Chicago) Illinois, as a 'not for profit' corporation. Eight of the original 14 SMRI member companies are still active members today: Solvay, Dow, Sifto Salt, Morton Salt, Canadian Salt, Olin, and PPG. Original member International Salt Co. operations became part of SMRI member Cargill in 1997. PennSalt Chemicals became present day member Arkema. SMRI operates today as a not-for-profit, 501-C corporation based in the USA. The organization continues to become stronger

over time, as it has grown to 161 member organizations. SMRI's success simply is a result of corporate support of members, passion of the staff, and dedication of the voluntary officers, as well as very capable committee members, technical authors, and researchers- all working together. SMRI staff, leadership, and members take great pride in SMRI's high ethical standards, and by the examples set by previous leaders of this organization.

**SMRI Goals and Objectives:** Please note that SMRI's objectives are foremost research and educational, and to maintain non-profit status, SMRI does not offer any commercial services. The SMRI is also careful to comply with regulations regarding anti-competitive business discussions or activity. SMRI's corporate membership list is available on the website, and a listing of services provided by some members is available to those looking for specific services.

**1. Research-** (More research details will follow in a later section.) SMRI members and people active in the industry are regularly surveyed and asked to provide input to help us focus research on subjects needed. The Research Chairman is the Vice President, (Mark Cartwright this year,) who provides guidance to Research Coordinator Gérard Durup. There is a standing Research Committee of 6 volunteer members, who serve for 3 years, meeting twice a year. Just before the SMRI conferences, the Research Committee meets on Saturday to review existing research project progress reports, evaluate new research proposals, determine what subjects will be focus of new research, approving or advising on research plans, and making research recommendations to the Executive Committee. Research Committee Members presently are: Jeff Langinai, (ConocoPhillips); Fritz Wilke (DEEP Underground Engineering); Jeff McCartney (Texas Brine); Paul Grönefeld (EWE Netz); Ron Benefield (Spectra Energy); and Patrick De Laguerie (Géostock)

A few examples of important research subjects are: salt exploration techniques, geophysics, drilling, mechanical integrity testing of wells and caverns, casing corrosion, subsidence and sinkholes, dissolution theory and cavern development simulation software, cavern storage and utilization, brine impurities, cavern abandonment, etc.

**2. Reference library-** Documents are mainly for member use, but are in the public domain. Members have access to essentially SMRI's entire library of meeting papers, research reports, and Salt Symposium publications. SMRI's existing and previous websites had limited ability to store library documents, so the new website has been designed to link with PTFS, an outside service specializing in library search and services. As of the date this paper was completed for publication in 2009, the existing website has about 6 years of meeting papers and research reports available for limited search and download by members. The new website will have 30 years of SMRI papers and reports, and will add all Salt Symposia papers, with the entire library open to powerful search capabilities. Actual document access will be limited to SMRI members, but public users

may order specific SMRI papers from us. The distribution of new research reports is limited to members for final report review only for the first year. Research reports older than 1-year may be purchased by non-members for 0.5 percent of the actual cost of the research.

Carolyn and Bill Diamond developed and maintained SMRI's first comprehensive, functional, bibliography for PC computer use by members. The bibliography was very popular with members and researchers, for it was capable of computer search of titles, authors, and key words for all SMRI research papers. SMRI's new web-based system takes advantage of technological advances and inexpensive data storage to make SMRI's library fully word searchable, with searches possible in most major languages.

**3. Conferences-** Provide regular educational and networking opportunities in form of technical conferences, which have been held 2 times per year since 1979, such as the most recent SMRI conference in April 2009 at Krakow, Poland, (see figure 2). Tom Piper noted at Salt Symposium 5 that SMRI conferences allow important contact with speakers, and now offer the advantage of informally meeting other attendees over casual breakfast, lunches, and breaks. The locations of conferences are selected based on many factors. Some location considerations are: solution mining/cavern field trip sites in vicinity, member (or potential member) facilities in the region, conference hotel space and costs, ease of travel access, and expected attendance. For ease of planning and scheduling, plus a tradition that favors conferences with a familiar format, SMRI runs 2 conferences a year, one in North America, and one outside North America (most often in Europe), designed to give the largest number of members an opportunity to attend at least one conference per year. Since memberships include all employees of every member organization, some members send as many as 6 or 8 people to the SMRI conferences since base registration fees are part of their dues benefit. It is common for members to send new engineers or technical staff to the conferences to introduce them to the industry and provide them with an opportunity to meet experts in their field of interest. Conference



costs are very closely watched so they provide good value to those in the industry.

The standard format of SMRI conferences is: Sunday- technical class, optional, (next class will be on subsidence and SMRI's SUBSID software; most popular subjects are repeated periodically).

Sunday evening- informal welcome reception for all attendees.

Monday morning, early- SMRI business meeting (for members only)

Monday and Tuesday- technical sessions for paper presentations

Wednesday- optional field trip, typically to local mine, storage, or geology sites

Spouses and friends are always welcome at SMRI conferences, and optional activities are normally scheduled for them.



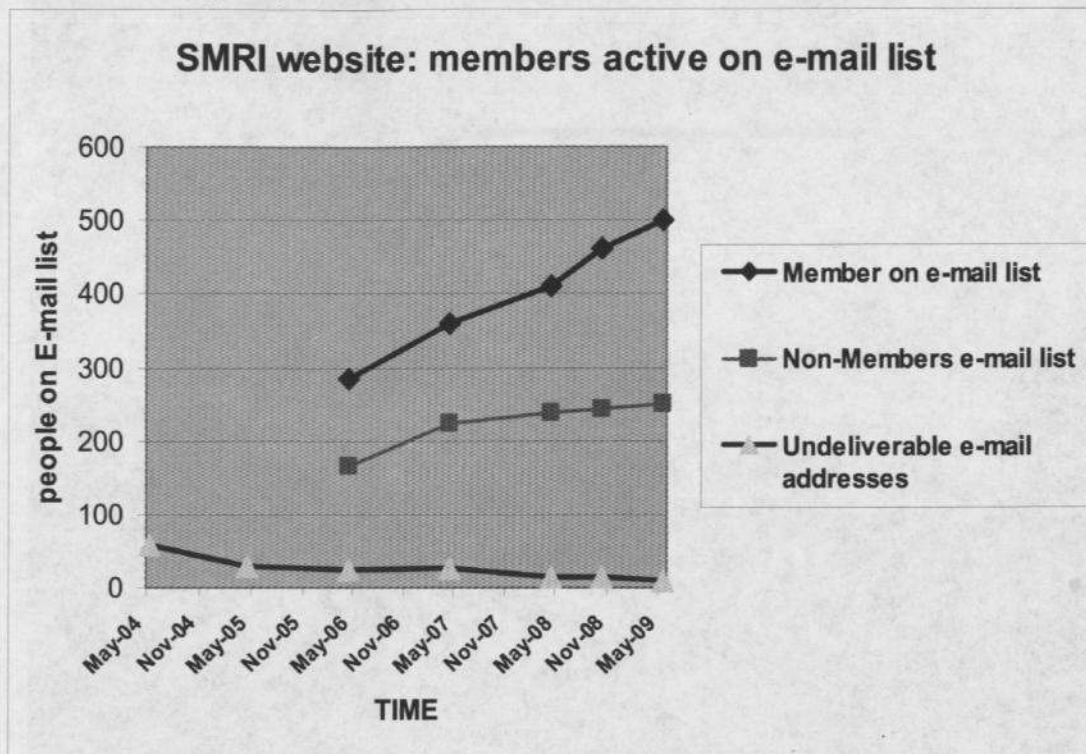
**Fig 2. SMRI group visit at Wieliczka salt mine in Poland, April 2009. (photo Detlef Edler)**

**4. Classes-** Starting 10 years ago, in 1999, SMRI began offering an optional, one day technical class, on varying subjects based on member feedback, now a popular part of each conference. To raise student awareness of solution mining and cavern storage, and to encourage student participation in SMRI conferences, student conference fees are waived for those studying fields related to the industry. Some SMRI members have offered to assist students with travel expenses. Before the spring 2009 conference, SMRI member Chemkop, located in the host city of Krakow, was asked to help put SMRI in contact with any local universities offering mining, geology, or petroleum majors. This method was the most successful reaching students of any efforts made to date, so we

plan to continue the same approach. At the Krakow conference, 5 students and a professor from a local university (AGH University of Science and Technology) participated in the conference and evening events as guests of SMRI. Dr. Katarzyna Poborska-Młynarska of AGH University helped attract interested students who were glad to be invited, and she also presented a paper on the subject of the technical mine tour of Wieliczka. Before future conferences, we plan use that same method of contacting local SMRI members to establish communication with faculty of local universities, who may be willing to help us invite limited numbers of interested students. Interested universities or professors are welcome to contact SMRI for details.

**5. Communication and News-** SMRI uses e-mail and the SMRI website as the primary means of communication, which seems to work efficiently. The SMRI June 2009 e-mail list has 499 members and 249 non-members actively receiving the SMRI e-mail, (see figure 3). Individual contact information is not made available except by approval of requested person. E-mails from SMRI are sent regularly to inform members

about conferences, requests for research proposals, openings for SMRI staff and leadership positions, completed research projects, and if unusual industry news breaks. Since members are busy, SMRI recognizes their time is valuable, so we keep e-mails to a minimum. Members or non-members may contact SMRI with any questions, and members receive priority response.



**Figure 3.** chart shows more individuals receiving SMRI e-mail communications.

**6. Support Safety and Environmental efforts of the Industry-** This topic has not been stated as a forefront of SMRI's objectives, perhaps because it has been assumed by the SMRI members to be an integral part of technological leadership in solution mining and cavern storage. Members have always taken action to address safety and environment, which are inseparable from the business. From SMRI's inception, research was conducted to study subsidence, prevent and detect sinkholes, and on advanced cavern design. Members have been willing to cut through legal red-tape to present new information at conferences to help others. A recent example described a successful response to a wellhead fire.

To support government regulators who make and enforce safety and environmental rules for our industry, SMRI made membership less expensive, and waived most conference fees for the regulators. Recognizing that cost constraints still prevent too many interested government regulators from attending SMRI conferences and therefore missing learning opportunities, SMRI members voted overwhelmingly at the April 2009 business meeting in Krakow to create a new class of membership for regulators which will make SMRI's new, online library available to them without cost. This will require a change of SMRI By-Laws subject to member approval vote expected this fall.



There have been several instances in recent years when SMRI worked to provide information and support to government agencies facing with emergency situations involving either collapse of solution mined caverns or leakage from storage caverns. H.W. "Bill" Diamond, Jr., (Executive Director of SMRI from 1995 to 2003) and Joe Ratigan led SMRI efforts to support the Kansas KDHE following a gas leak and explosions in Hutchinson in 2001. SMRI also became aware of a potential cavern collapse at Romania's solution mining site Ocnele Mari, and attempted to help reduce risk to people, and avoid environmental damage. The latest assistance was provided to the State of New Mexico, (USA) Energy, Minerals & Natural Resources Dept. as they dealt with two brine well collapses in 2008. SMRI assisted by putting EMNRD officials in immediate contact with both regulators of other states with similar industry, and with industry experts, most of whom are SMRI members. EMNRD then assembled a working group of experts to advise the State how to best deal with their actual conditions, and SMRI was never officially involved.

#### **Organization structure and membership:**

The Executive Committee's 3 volunteer officers, (for 2009, President Hartmut von Tryller, Vice-President Mark Cartwright, and Secretary-Treasurer Pierre Bérest,) guide the organization. The SMRI's By - Laws control the operations and procedures to be followed, and the Executive Director performs day-to-day business as directed by the Executive Committee. Other part-time staff are Assistant Executive Director Dawn Langlinais, European Coordinator Fritz Crotofino, European Meeting Planner Ingrid Crotofino, and Research Coordinator Gérard Durup. Two additional volunteer positions are necessary to support the conference technical programs- a Program Chairman (Joe Ratigan) and Assistant Program Chairman (Detlef Edler). The 5 volunteer officers and program chairmen rotate each year through those leadership positions, (subject to member approval) and finish as President in their 5<sup>th</sup> year of service.

Membership classes are of 5 types, Classes A through E, depending on the business and size

of the member, for example, the largest companies that own or operate caverns are Class A at highest dues rate, while the smallest consulting, university, or government regulatory agencies are Class C at lowest dues rate. Class D members are non-voting subsidiaries of member companies, and Class E are honorary members who have offered outstanding service to SMRI, such as the SMRI retired past presidents.

Member support through annual dues forms the basis of SMRI's budget every year, as dues income funds the research projects and operating expenses. The organization has always been rather lean, using part time staff and dedicated volunteers, so more money is directed to research. For the last several years, SMRI has been offering conference sponsorships to offset growing conference costs, a very successful arrangement initiated by Nancy Bulzoni. Sponsorships enable the group to hold down costs of conference related expenses such as the welcome reception, evening events, and field trips- each offering great networking chances for attendees.

Members receive benefits such as progress reports on active research, are involved in decisions to approve research proposals, and have access to SMRI's library. They may also participate on committees or as Executive Committee members if so desired and selected. Members also receive special registration rates for Conferences, and have an advantage of advance field trip registration before the public.

SMRI Members today represent all aspects of solution mining and cavern utilization business: government regulation, research, safety, environmental, finance, education, producers, service companies, consultants, etc. so it has been quite a change from the small BCRG group that was interested only in bedded salt caverns.

The SMRI began with 14 member companies, and in 2009 there are 147 dues-paying members, with about 500 individuals in those member organizations world-wide, speaking some 12 languages, (for member growth, see figure 4).



Figure 4. SMRI member organization growth.

**European Coordinator**, a position started in 1993 was first held by Hans Haddenhorst, after his retirement from Kavernen Bau- und Betriebs- GmbH (KBB). Hans was wonderfully enthusiastic promoting SMRI among his many European and worldwide contacts, and his efforts translated into stronger, more cohesive, and stable European membership. Following Hans, Gérard Durup of Gaz de France maintained the high standards as European Coordinator from 2000 to 2006. After Gérard's 7 very successful years of service, in 2007 Fritz Crotochino (also from KBB) became European Coordinator, the position he so ably performs today. The wide international experience of all 3 of SMRI's European Coordinators has helped greatly with providing SMRI's growing international community with personal service and pushed SMRI ahead with their forward thinking.

**The Research Coordinator** position was started formally in 2002, performed by Joe Ratigan of PB Energy Storage Services. Joe and others saw a need to formalize procedures, including how research proposals were solicited, evaluated, and carried out. He honed the 'request for proposal' RFP process to solicit competitive research proposals on specific subjects of greatest interest or to

address industry needs. The Research Committee flourished under his guidance and leadership, and the quality and relevance of research were improved accordingly. Members recognized that their research money was more competitively allocated, and fewer unsolicited proposals were approved.

#### Research

SMRI's research program is the heart of the organization, and procedures are in place to get the most out of the SMRI research funds. The efficiency of SMRI's research budget has been improved by partnering with other agencies when appropriate, such as the Gas Technology Institute, and on many projects, with companies both allowing free access to their sites for the field research, and by financial and operational contributions made to the research projects by the operator and researchers.

Cavern sealing and abandonment (CS&A) has been a long range subject of research at SMRI, and will continue. Joe Ratigan documented the program's history and objectives in SMRI Research Report 2003-3 for those interested in more details. Safe abandonment of caverns is still being studied, with consideration of complex interactions of cavern creep, pressure build-up, temperature, and geology necessary



to plan for safe cavern abandonment. Gérard Durup reports that testing in deep caverns will be still ongoing for some more years, but the testing effort on shallow caverns has been completed at Etrez, Carresse, and Stassfurt cavern sites. SMRI is considering

developing a shallow cavern report to describe data and findings to date.

About 25 research projects have been completed since 2000 and Salt Symposium 8, and the table of research reports appears below:

2000-1-SMRI	Replaced by 2001-8; (this report is not available)
2000-2-SMRI	Pfeifle, Tom W. <sup>1</sup> ; Mellegard, Kirby D. <sup>1</sup> ; Skaug, Nils T. <sup>1</sup> ; Bruno, Mike S. <sup>2</sup> . An Investigation of the Integrity of Cemented Casing Seals with Application to Salt Cavern Sealing and Abandonment, 118 pp., <sup>1</sup> RESPEC, Rapid City, South Dakota; <sup>2</sup> Terralog Technologies USA Inc., Arcadia, California
2001-1-SMRI	Tijani, S.M. <sup>1</sup> ; Jonard, A. <sup>1</sup> ; Vouille, G. <sup>2</sup> Relationship between Overbrining and Subsidence, <sup>1</sup> Géostock, Rueil-Malmaison, France; <sup>2</sup> École des Mines de Paris, France
2001-2-SMRI	Stormont, John C. Evaluation of Salt Permeability Tests, Department of Civil Engineering, University of New Mexico, Albuquerque, New Mexico
2001-3-SMRI	Behr, A. Evaluation of Salt Permeability Tests, Wilsnack & Partners (IbeWa), Freeberg/Saxony, Germany
2001-4-SMRI	Malinsky, Laurent, Evaluation of Salt Permeability Tests, G3S, Ecole Polytechnique, Palaiseau, France
2001-5-SMRI	Van Sambeek, Dr. Leo L. Review of Remediation Plans for Salrom's Ocnele Mari Mine Field in Romania, RESPEC, South Dakota
2001-6-SMRI	Golder Associates, Inc. Review of a Remediation Plan for the Potential Sinkhole Development at the Ocnele Mari Brinefield, Romania, Lakewood, CO
2001-7-SMRI	Lorenzen, Harro E. <sup>1</sup> ; Herbert, Dr. H.J. <sup>2</sup> Review of Plans for Remediating the Potential Sinkhole Development at the Ocnele Mari Brinefield, Romania, <sup>1</sup> Lorenzen Consulting, The Hague, The Netherlands; <sup>2</sup> Braunschweig, Germany
2001-8-SMRI	Berest, P. <sup>1</sup> Brouard, B. <sup>2</sup> ; DeGreef, V. <sup>1</sup> Salt Permeability Testing – The Influence of Permeability and Stress on Spherical Hollow Salt Samples, <sup>1</sup> Laboratoire de Mécanique des Solides, Ecole Polytechnique, Palaiseau, France; <sup>2</sup> Brouard Consulting 37, rue du petit-musc, Paris, France.
2002-1-SMRI	Jordan, Peter W. <sup>1</sup> ; Hare, Jennifer <sup>2</sup> . Locating Abandoned Wells: A Comprehensive Manual of Methods and Resources, <sup>1</sup> Subsurface Technology, Inc., Baton Rouge, Louisiana, USA; <sup>2</sup> Zonge Engineering & Research Organization, Inc., Tucson, Arizona, USA.
2002-2-SMRI	High Pressure Cavern Analysis, <sup>1</sup> Institut für Unterirdisches Bauen (IUB), Hannover University, Hannover, Germany; <sup>2</sup> Kavernen Bau und Betriebs GmbH, Hannover, Germany.
2002-3-SMRI	Ratigan, Joe L. Summary Report – The Solution Mining Research Institute Cavern Sealing and Abandonment Program 1996 Through 2002, SMRI CS&A Project Manager and SMRI Research Coordinator, 40 pages
2003-1-SMRI	State of the Art Review of Hydrate Potential Associated with Natural Gas Storage Operation in Salt Caverns, Michael Klafki, RWE Gas AG/ESK, Freiberg, Germany, 149 pages
2003-2-SMRI	State of the Art Review and New Techniques for Mechanical Integrity Tests of (Gas-Filled) Natural Gas Storage Caverns, Paul E. Nelson, RESPEC, Rapid City, SD
2003-3-SMRI	Summary Report – The Solution Mining Research Institute Cavern Sealing and Abandonment Program 1996 through 2002, Joe L. Ratigan, SMRI CS&A Project Manager and SMRI Research Coordinator

2003-4-SMRI	State of the Art Review of the Understanding, Mitigation and Monitoring of Corrosion in Brine and Water Piping, tubing and Casing at Brine Production and Hydrocarbon Storage Cavern Facilities. By L.K McDonald, K.E. Davis of Subsurface Technology, Inc. Houston, Texas; J.S. Smart, III Consulting Engineers, Houston, Texas; R.G. Taraborelli Consultants, Houston, Texas; 128 pages
2004-1 SMRI	State of the Art Review of Existing and Novel Methods for Mapping Solution Mined and Storage Caverns,. By L.K McDonald, K.E. Davis of Subsurface Technology, Inc. Houston, Texas; 141 pages
2005-1-SMRI	Improvements in Mechanical Integrity Tests for Solution-Mined Caverns Used for Mineral Production or Liquid-Production Storage, by L.L. Van Sambeek of RESPEC, Rapid City, SD; P. Bérest of École Polytechnique, Palaiseau, France; B. Brouard of Brouard Consulting, Paris, France; 142 pages
2006-1-SMRI	Salt Cavern Abandonment – Field Test, B. Brouard of Brouard Consulting, Paris, France
2006-2-SMRI	Compilation and Evaluaton of Bedded Salt Deposit and Bedded Cavern Characteristice Important to Successful Cavern Sealing and Abandonment, Axel Gillhaus, Fritz Crotogino, Daniel Albes of KBB Technologies GmbH, Hannover, Germany and L.L. Van Sambeek of RESPEC, Rapid City, SD, USA and others; 242 pages (available in 4 parts)
2006-3-SMRI	Cavern Well Abandonment Techniques Guidelines Manual, by Fritz Crotogino and Jürgen Kepplinger, KBB Technologies GmbH, Hannover, Germany; 82 pages
2007-1-SMRI	Compilation of Geological and Geotechnical Data of Worldwide Domal Salt Deposits and Domal Salt Cavern Fields, Axel Gillhaus and Peter Horvath, KBB-Uunderground Technologies GmbH, Hannover, Germany, 101 pages
RR2008-01_S MRI	Cavern Abandonment Field Tests in a Deep Cavern, (Phase I), Enterprise Products Operating L.L.C., Houston, TX, USA; PB Energy Storage Services, Inc., Houston, TX, USA; and RESPEC, Rapid City, SD, USA; 54 pages
RR2008-02_S MRI	User's Manual for SALGAS for Windows Software, Thomas Eyermann, Hill City, SD, USA, 53 pages
RR2008-03_S MRI	TOOLBOX Software- Development of a Solution Mining and Hydrocarbon Storage Toolbox, Brouard Consulting, Paris, France; and Texas Brine Company, LLC, Houston, TX, USA;
RR2009-01_S MRI	Staßfurt Shallow Cavern Abandonment Field Tests, ESK GmbH, Freiberg, Germany, 77 pages final draft in process
RR2009-02_S MRI	Salt_SUBSID Software update, RESPEC, Rapid City, SD, USA; final draft

#### SMRI Software:

Three SMRI software programs have been developed through SMRI research. A recently completed TOOLBOX is popular, and upgrades of SALGAS and SALT\_SUBSID, (both versions are in final completion,) will be available soon. It is suggested that potential SALGAS and SUBSID users start with latest Windows versions rather than using outdated and unsupported DOS versions. SMRI offered 2 technical classes on SALGAS and TOOLBOX during 2008, and just offered a class on SUBSID at the spring 2009 conference. The

next SUBSID class will be at the spring 2010 conference. The Research Committee is working on a long-term maintenance and support policy for the new/updated SMRI software.

Software is IBM PC compatible and will be available online or by web links.

Current members are granted a license to use, freely copy and distribute within their organization at no charge. In the event membership is canceled or terminated the



license is revoked and the program shall no longer be used.

Non-members may purchase a license for the following SMRI copyrighted programs:

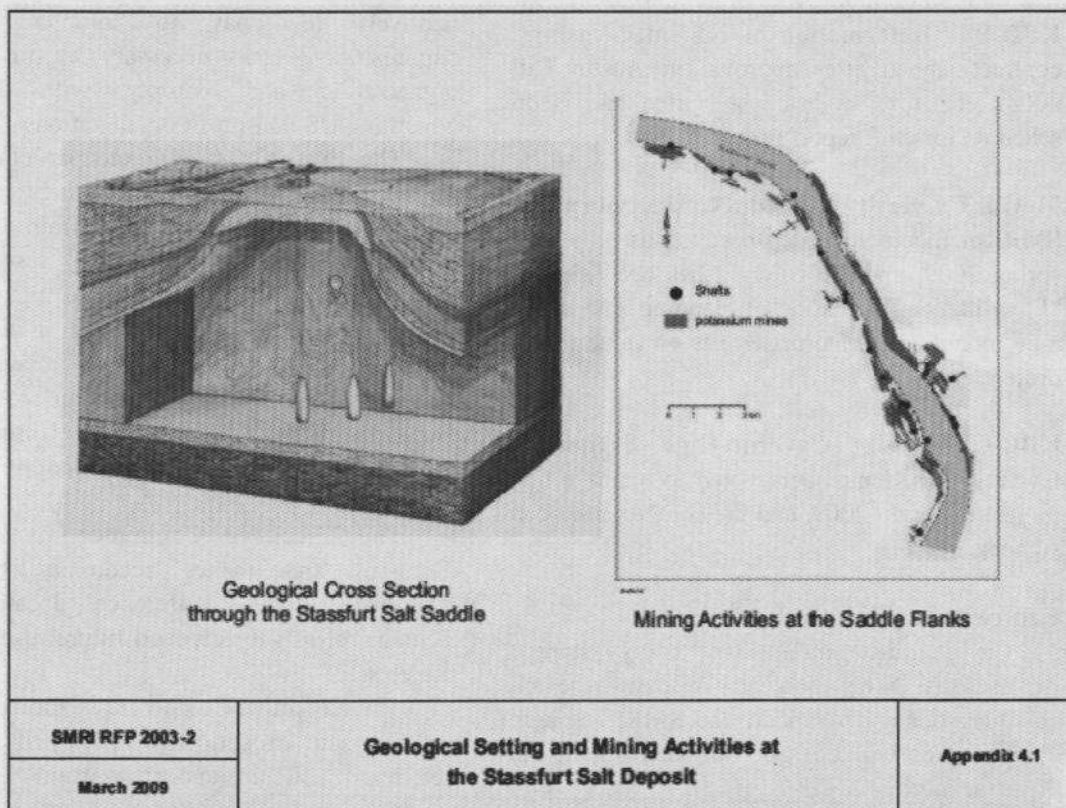
**SALGAS**, pending 2009 latest version single user license \$2500.

**SALT\_SUBSID** pending 2009 new version single user license \$1000.

**TOOLBOX** v 2008 latest version single user license \$250.

**Current research projects-** (information provided by Gérard Durup)

**ESK RWE: Shallow Cavern Abandonment Field Test** was completed in early 2009, with report in final draft approval process. "Staßfurt Shallow Cavern Abandonment Field Test". The field tests were completed on schedule in 2008. The final report has been submitted and has been reviewed by the Research Committee; modifications that have to be integrated in the final report have been transmitted to ESK/RWE. Final sonar surveys will be performed in summer 2010, but they are not expected to change the conclusions of the final report; the results of these logs will be transmitted to SMRI. See figure 5 for Staßfurt dome geology from SMRI RR 2007-1.



**Figure 5, ESK RWE, Staßfurt salt dome and caverns from SMRI Research Report 2009-1 draft**

**TOTAL: Cavern Abandonment Field Test** and reporting of pressure data. "Carresse Abandonment Field Test – Continued Monitoring". TOTAL has made available to SMRI the complete set of P tests data from the four Carresse wells SPR1, SPR2, SPR3 and SPR4 (data for every hour from April 2005 to January

2009; Tubing Pressure; Annular Pressure; Atmospheric Pressure and Temperature).

**Enterprise: Deep Cavern abandonment field test, Phase II**, "Barber's Hill Deep Cavern Abandonment Test - field tests Phase I have been completed on schedule in 2008 and the final report was submitted in early

2009. The research results of Phase I were presented by Joe Ratigan to the SMRI membership at the beginning of the Krakow Conference. Phase II started in 2008 and will monitor for a period of 4 years, until 2012.

**Sabine Storage & Operations: Standard Practice- Gas cavern,** "Standard Practices for Gas Cavern Site Characterization, Design, Maintenance and Operation". The project started in 2008 with the preparation of a Standard Practices Survey. This 11-page, detailed survey questionnaire has been issued on the SMRI website, additionally 200 questionnaires have been sent out. A draft report is expected at the Beijing Research Committee meeting and the final report is scheduled for the Grand Junction spring 2010 SMRI conference.

**KBB-UT- Deformation of cemented casings,** contract signed after approval in Austin Fall 2008. The project has just started and is on schedule for draft report in spring 2010.

**McGill University, Canada, Casing vibration,** SMRI members voted to approve this project in spring 2009, and the contract has been signed. "Flow-induced Vibration of Hanging Tubulars", may incorporate Enterprise tests of value to the project.

**KBB-UT - Gas Cavern High Frequency Cycling,** SMRI members voted to approve this project in spring 2009, and the contract has been signed.

#### **Future research**

Cavern utilization for new energy storage uses is likely subject. A new research questionnaire to update the SMRI research priorities will be sent for feedback in the near future.

#### **SMRI's future Executive Committee considerations and planning:**

Should SMRI hold one large or two (2 day) conferences per year? As long as the SMRI Program Chairmen can find enough quality papers for 2 conferences per year, the advantage is that it allows most of the SMRI members to participate in 1 conference per year without travel overseas. The plan has worked well so far.

How can SMRI increase participation in conferences, and provide better

information access by government regulators? SMRI Members want the regulators to have the best information available, so they have most reliable basis and most experience possible for them to do their jobs.

Control costs of SMRI membership dues and conference fees, provide most value to members, and to get the most out of research budget? SMRI allows conference sponsorships, but not any advertising.

The Executive Committee sets the guidelines and makes decisions to run SMRI, (a small non-profit organization) without any full-time staff, and faces the challenge of filling staff vacancies with people who understand SMRI needs and tradition, and are often required to work many hours at relatively low pay to complete the administrative tasks necessary to run the organization and comply with laws governing US non-profit organizations.

The Executive Committee participates in Research Committee meetings, and evaluates recommendations from the Research Committee regarding research proposals. The Executive Committee considers overall member and industry needs, with SMRI's financial situation before making a recommendation to the membership for a vote on every research project before it can be approved by the members.

The Executive Committee routinely discusses and makes recommendations regarding future conference locations, technical class subjects, and future research subjects.

The Executive Committee is allowed to make certain exceptions to policy if they determine circumstances warrant such action.

#### **Selection of Executive Committee, Research Committee and staff-**

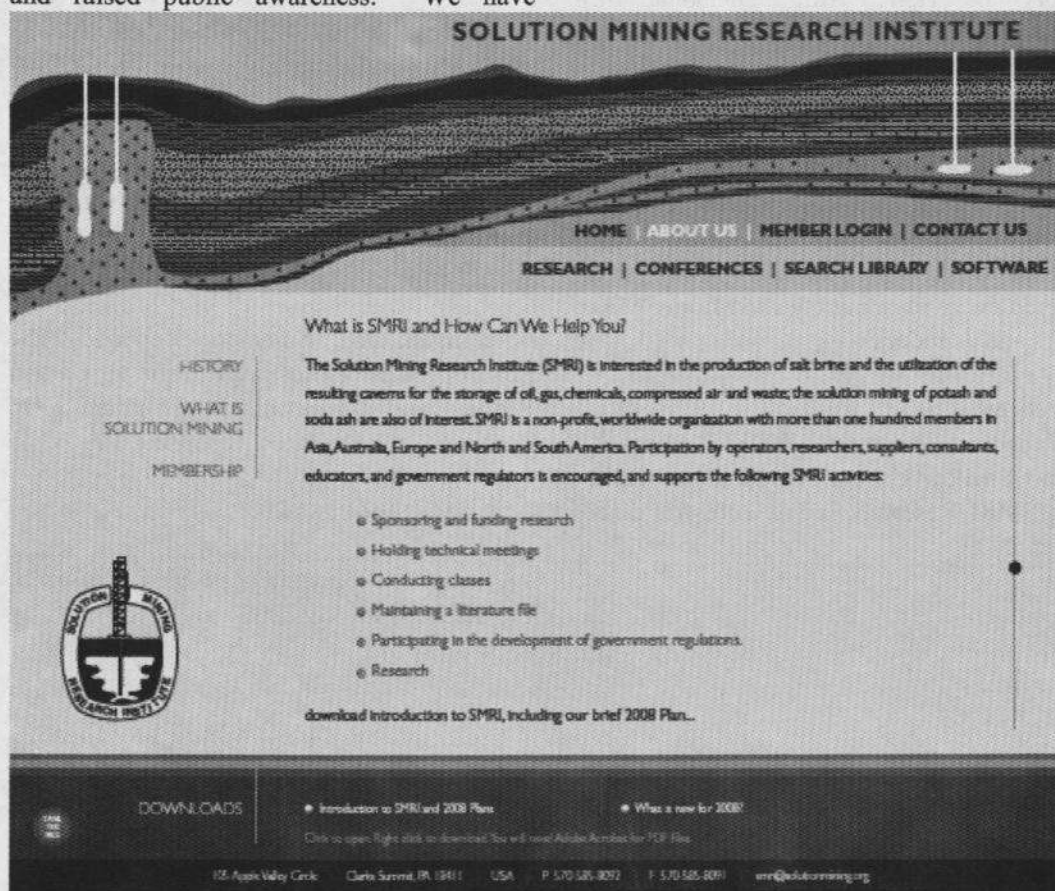
Research Committee appointments are carefully made almost every year. A new person, (normally the previous Program Chairman,) is voted by the membership to join the Executive Committee every year. Staff changes are less frequent



but each such replacement is typically a year long process. The Executive Committee attempts to balance geographic and business segment representatives for every position. It is SMRI's intent to fairly advertise and review all candidates for every opening, and selection must carefully balance between those who have already provided years of dedicated, voluntary service, with newer members interested in serving and with good qualification, perhaps just not as familiar with SMRI. It was noted that a handful of companies have been outstanding contributors of their own staff to SMRI's volunteer Executive Committee positions. Since 1972, fully half of SMRI's 38 Presidents were employees of the following 6 companies or affiliated companies: PB / KBB organizations with 5, Morton / Canadian Salt with 4, Akzo and Dow each with 3, and Sifto Salt and Texas Brine each with 2.

**The Internet** has helped SMRI grow and improved the SMRI internal communication and raised public awareness. We have

growing numbers of members who rarely are able to attend conferences, whether due to distance of travel or to job demands. Keeping such members better informed, and making the SMRI reference library available to them is a major objective of the SMRI new website. E-mail is the SMRI primary communication tool and we have been in need of an improved system. The planned website utilizes an Auctra system to better track members and non-members, provide conference information and registration, and will link to a PTFS library of the SMRI documents to make search and access easier and more thorough. The online library will be greatly expanded. In summary, the new SMRI website will be geared to member needs, and streamlining laborious staff tasks. Upon startup of the new site, non-members and the public will have full search capability, but not the document access that SMRI members will enjoy. A preview of a web page is below in figure 6:



**Figure 6.** Example of new SMRI website 'about us' page.

**Acknowledgement:** The authors wish to thank the membership of SMRI for support of this non-profit organization. We are indebted to those member companies/agencies that year after year encourage their technical and managerial staff to participate in SMRI's research and leadership on a voluntary basis. The success of SMRI is also the result of the excellent authors and speakers who contribute technical papers from their fields of expertise, and to those who perform the SMRI research. The Executive Director wishes to thank previous Assistant Executive Director Carolyn Diamond; current staff Fritz Crotogino, Gérard Durup, Ingrid Crotogino, and Dawn Langlinais; previous Research Coordinator and 2009 Program Chairman Joe Ratigan and his Assistant Program Chairman Detlef Edler; and Executive Committee members current (Hartmut von Tryller, Mark Cartwright, and Pierre Bérest) and past (Christian Hellberg, Jeff Hertzling, Kurt Staudtmeister, and Roger Blair)— as these people are the essence of SMRI. This paper is dedicated to the memory of H.W. 'Bill' Diamond, Jr. Executive Director of SMRI from 1995 to 2003, who was the consummate leader of SMRI, and a friend of all solution miners.

SMRI sincerely thanks the entire Beijing Symposium Organizing Committee: the Secretariat, and especially Ms. Linda Liang, who was always available to help, and answered every planning question from SMRI authors and attendees.

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