NATIONAL ENVIRONMENTAL MONITORING CONFERENCE

2008 PROCEEDINGS

Section 4:
EU and EPA Chemical Regulations
Homeland Security
Nanotechnology

Washington DC
August 10 – 16, 2008

ILI INDEPENDENT LABORATORIES INSTITUTE

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NEMC

NEMC 2008
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NEMC 2008
CONFERENCE HIGHLIGHTS

The Environmental Measurement Symposium, a combined meeting of the National Environmental Monitoring Conference (NEMC) and The NELAC Institute (TNI) was held August 10 – 16, 2008 in Washington DC, just blocks from the nation's capitol. The conference was co-sponsored by the US Environmental Protection Agency, the Independent Laboratories Institute, and The NELAC Institute.

A total of 469 people attended the 2008 Forum, which was a 9% increase in attendance over 2007. The meeting included:

- 19 technical breakout sessions with 100 presentations;
- a 2-day poster program with 23 posters;
- 4 keynote presentations;
- 3 EPA general sessions with 13 presentations;
- 13 TNI committee meetings;
- an assessment forum;
- a laboratory mentoring session;
- an accreditation body forum;
- a meeting of the Environmental Laboratory Advisory Board;
- 5 training workshops; and
- a 3-day exhibit program with 43 exhibitors and sponsors.

Highlights of the week included the following keynote speakers:

- Dr. Jorg Feldman from the University of Aberdeen who spoke on elemental speciation in environmental monitoring;
- Dr. Heidelore Fielder from the UN Environmental Program who spoke on global monitoring of persistent organic pollutants;
- Dr. J. Clarence Davies from Resources for the Future who spoke on EPA and nanotechnology; and
- TNI's own Bob Wyeth who spoke on moving forward on national accreditation.

NATIONAL ENVIRONMENTAL MONITORING CONFERENCE PROCEEDINGS 2008

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EU AND EPA CHEMICAL REGULATIONS

HOMELAND SECURITY

SECTION 4 TABLE OF CONTENTS cont.

2008 NEMC Proceedings

EU and EPA CHEMICAL REGULATIONS

The Impact of Global Chemical Regulation on US Manufacturers

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ABSTRACT

This presentation will provide an update on the continuing impact of EU and other global regulation that is impacting manufacturing supply chains and design of products. Following on ELV (End of Life Vehicle Regulation), WEEE (Waste Electrical and Electronic Equipment), and RoHS (Restriction of Hazardous Substances), the new EU REACH directive (Registration, Evaluation and Authorization of Chemical materials) is having major impact on US and global manufacturing companies. These waste regulations do not exclude articles and are forcing manufacturing supply chain to deal with information transfer never before required. Additionally, these regulations force de-selection of materials in the design process with little lead time. In addition to the above, the EU's EuP (Energy using Products) and the UN's GHS (Globally Harmonized System for Classification and Labeling of Materials) will have more impact on manufacturers and chemical suppliers. It would appear that regulation and directives dealing with waste and energy are far from over and it is incumbent that the US break out of its "silos" to more effectively deal with global regulation and emerging chemical issues. Processes that more effectively link scientists with policy, standards, design engineers and HSE (Health, Safety and Environmental) experts are needed for a proactive US strategy.

The Impact of Global Chemical Regulation on US Manufacturers

NEMC 2008

Mike Taubitz, GM

Representing AIAG and ANSI Company Member Forum

Background / Key Points

- Several year journey beginning in 2004 with automotive awareness that manufacturers must be more proactive
- We're neither fighting nor complaining about recent regulation
  - The goal is compliance without unnecessary cost and moving to the next step….
- **world leadership in green chemistry and design of manufactured goods**
  - **This goal requires science and processes that do not now exist**

ANSI – NAM Collaborative Network Created October, 2007

Organizations represented

- Corporations (automotive, computer hardware and software, chemical, electrical components, manufacturers and more)
- Government agencies
- Academia
- Industry associations
- Professional organizations
- Policy / advocacy firms
- Standards developers
- Third party certification bodies

Titles / Positions represented

- EHS Professionals
- Scientists
- Policy
- Standards
- Journalists

Nearly 300 stakeholders from the private and public sectors

Purpose

To address the impact of domestic and foreign chemical controls and government regulatory programs such as REACH, RoHS, WEEE and GHS on U.S. industry and global manufacturers.

To explore how the standards and conformity assessment community can help to balance the social and economic impact of these regulations.

Problem Statement

U.S. manufacturing and supply chain is reacting to numerous emerging **foreign** chemical regulations adversely impacting innovation and competitiveness....

- **ELV**: End of Life Vehicle
- **WEEE**: Waste Electrical and Electronic Equipment
- **RoHS**: Restriction of Hazardous Substances
- **REACH**: Registration, Evaluation and Authorization of Chemicals
- **GHS**: Globally Harmonized System of Classification and Labeling
- **EuP**: Energy using Products
- **SAICM**: Strategic Approach Integrated Chemicals Management
- **WHN**: What the Heck is Next ???

The cost of dealing with multiple chemical regulation and control requirements in different markets goes far beyond the chemical industry itself.

– Dr. Nina McClelland
Program Chair

16%

Chemicals: 16% of the value of materials in the **automotive sector**

30%

30% of the value of **medical supplies**

33%

33% of the value of **semiconductor materials**

Issues for US Industry

- **U.S. manufacturers are reacting** to regulation rather than being *proactive. The US must create processes that*
  - Cut through the "silos" of industry sectors for a US approach
  - Develop "common" methods and systems for the manufacturing supply chain
- **Varying definitions** of key terms (e.g., "toxic") are causing confusion across sectors
- **U.S. manufacturers and their supply chain partners need systems** to gather and verify data that has not been required in the past.
  - Development of such systems is beyond the capability of the private sector
- **Standards and testing methods either do not exist** or are not being used to support regulatory compliance

Issues for US Industry (continued)

- **Different countries / regions are defining different environmental regulations** and expectations around common issues. US manufacturers need the systems described earlier to
  - Maintain product quality and ability to ship product
    - Determine suitable alternatives when regulation forces "de selection" of materials
  - Avoid unnecessary costs for compliance with regulation
- **Industry sectors are wrestling with how to verify compliance for REACH / other regulations**
- **Better interaction and collaboration** is needed between industry, government, standards developers, professional / scientific and other concerned organizations
- **Communication** between industry, regulators and consumers
- **Early identification of issues and engagement** of both policy and scientific community is needed
  - We need to do a better job of linking stakeholder scientists in the very early stages of deliberation on emerging chemical issues preceding regulation

ANSI – NAM Network has charged itself with…….

- Addressing current REACH and chemical-related regulations and controls,
- Identifying existing and new chemical issues which could potentially have negative impacts uniformly across industries, and
- Developing strategic and tactical solutions to proactively address and/or prevent those issues from becoming matters that could force regulations.
- **We're not fighting regulation (the "what")…. only trying to find out the "how"**

Results since October 2007

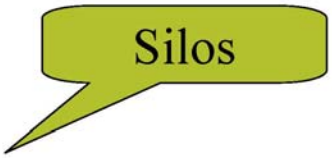
- Positioned the Network on Chemical Regulation as a proactive mechanism to better manage and prepare US industry for emerging chemical issues with the formation of the Network Work
- Launched a dedicated website and document library for the Network on Chemical Regulation.
  - Library houses materials pertaining to chemical regulations, (including, but not limited to REACH Implementation).
- Created a Chemicals Events Calendar that is populated by all Network participants.
  - Available for general viewing on ANSI's public document library.

Much is being done, but……

- Apart from ANSI donating staff and resources, the US strategic approach does not have the necessary structure and resources to be truly proactive
- US stakeholders concur that an institutionalized process is necessary for stakeholder groups to come together and develop US strategic action with commensurate tactical initiatives

Private Sector Stakeholders

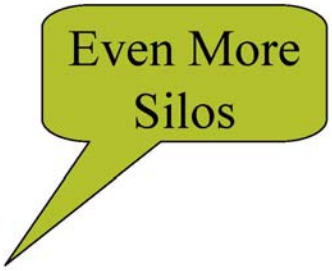
- Aerospace
- Agriculture
- Automotive
- Business and computer services
- Chemicals
- Communications manufacturing
- Construction and engineering
- Consumer goods
- Energy and utilities
- Industrial manufacturing
- Metals and mining
- Pharmaceutical
- Other



Government Stakeholders

- Department of Commerce
  - ITA (International Trade Administration)
  - NIST (National Institute of Standards and Technology)
- Department of Defense
- Department of Energy
- Department of Homeland Security
- Department of Interior
- Office of the United States Trade Representative
- United States Environmental Protection Agency
- Office of Science and Technology Policy
- States

Industry Associations, SDO's and Business Organization Stakeholders



- Aerospace Industries Association
- American Chemistry Council
- Association of Equipment Manufacturers
- Association for Manufacturing Technology
- ASTM International
- Automotive Industry Action Group
- Bureau of National Affairs
- The Business Roundtable
- Consumer Electronics Association
- Consumer Specialty Products Association
- Gas Appliance Manufacturers Association
- International Safety Equipment Association
- IPC - Association Connecting Electronics Industries
- National Association of Manufacturers
- National Electrical Manufacturers Association
- National Mining Association
- National Petrochemical & Refiners Association
- NSF, International
- Rubber Manufacturers Association
- The Soap and Detergent Association
- Society of Automobile Engineers (SAE)
- The Society of Plastics Industry
- Synthetic Organic Chemicals Manufacturers Association (SOCMA)
- United States Chamber of Commerce
- United States Council for International Business

Observations: Lessons Learned

- US manufacturing continues to react
  - Organized in silos
- Silos
  - Impose massive cost on the supply chain due to non-common approaches
  - Do not allow the US to come together for proactive approaches
- Other nations seem to have a more collaborative approach to regulation (Asia Pacific region)
  - Regulators work with industry years in advance of a regulation effective date – "WHAT" to do
  - Allows industry and scientists time to prepare standards and other necessary tools / process for the "HOW"

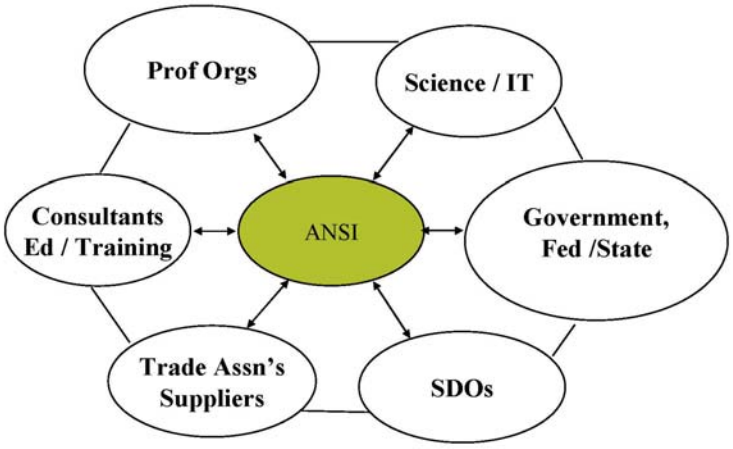
Proposed Structure: National Alliance for Global Regulatory Issues / Chemicals

We must first cut through the silos……

- ***A true public – private partnership is needed***
- Government needs to provide seed money that provides the underlying foundation for needed collaborative efforts
- We envision the Alliance being funded through a mix of private and public sector support. In addition to government funding, interested stakeholders can choose different levels of participation

Vision: National Alliance for Global Regulatory Issues / Chemicals

Marry Policy & Science



Scientific / Technical Challenges

- Define and close the gap of the EU Precautionary Principle with the US risk based approach?
- Life cycle assessment tools & processes to include
  - energy use
  - eco-tox
  - health & safety
  - etc.…

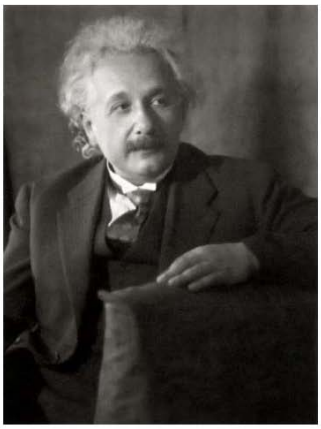
  } **Across entire life cycle**
- Integrate above knowledge with existing systems, e.g
  - CAS numbers
- Develop new concept of "self declaration with validation"
  - Must have blind testing / means of verification

Long Term Actions

- Identify and act on opportunities for ongoing coordination, harmonization and partnering
- Build upon existing linkages with bilateral, regional and international standards and compliance organizations to address chemical controls on a global scale
- Promote migration from "list-based" regulations towards a "risk-based" approach to life cycle assessment
- Promote the use of voluntary standards and compliance programs as solutions to regulatory controls
- Develop a materials selection process that encompasses EHS impacts of finished products
- Develop a strategy to proactively inject science and technology into policy deliberations at the federal and state regulatory levels, and in bilateral and regional forums, while ensuring a proper balance between business needs and EHS concerns

Summary

- There is no one-size-fits-all approach to managing chemical issues
- There is a need for
  - An institutionalized collaborative network that functions across sectors and national borders
  - Cross-industry communication
  - Communication up and down the supply chain
  - Enhanced private and public-sector collaboration
  - The development of proactive approaches to addressing immediate (e.g., REACH implementation) and long-term concerns (e.g., future product life cycle and supply chain restrictions)



Conclusion

The significant problems we face cannot be solved at the same level of thinking we were at when we created them.

— Albert Einstein

We need a mindset change. We must work together to inject science into policy.

REACH Compliance for North American-Based Manufacturers: What is a "Proportionate" Response?

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ABSTRACT

The REACH regulation imposes legal obligations on EU-based companies, with no such requirements for non-EU companies. However, the complexities of global supply chains mean that legal requirements on EU customers translate into market-based obligations on their non-EU suppliers.

Many EU customers are asking their non-EU suppliers to perform REACH registrations for them, via the use of an Only Representative. In addition, customers throughout the world are requiring their suppliers to report the presence of REACH Candidate List substances (a.k.a. SVHCs) in the products that they sell to their customers.

What is an appropriate response for a non-EU manufacturer when faced with the new realities of REACH? Ignoring customer requests for support on REACH compliance is not an option; action is imperative for any supplier who wishes to participate in global commerce. But what actions are necessary? Is it overkill to survey the entire supply chain and require material content disclosure from everyone? How about implementing a testing program for all products? Can you get by just quickly surveying your supply chain and leaving the heavy lifting up to your EU-based customers?

This talk will discuss the merits of different approaches and strategies for addressing REACH for North American-based manufacturers.

REACH Compliance for North American-based Manufacturers

NEMC
August 2008

Arnold J. Guikema
Tetra Tech
reach@tetratech.com

TETRA TECH

Agenda

- REACH Legal Requirements
  - REACH Requirements – A laundry list
  - REACH Requirements for Substances and Preparations
  - REACH Requirements for Articles
- REACH Market Requirements
  - REACH-ing outside of the EU
  - Selling into a supply chain
  - Buying out of a supply chain
- Case study: End of Life Vehicles Directive

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REACH Requirements - A Laundry List

- REGISTRATION
- NOTIFICATION
- AUTHORIZATION
- RESTRICTION
- CLASSIFICATION & LABELING
- SAFETY DATA SHEETS
- CHEMICAL SAFETY REPORTS
- COMMUNICATION
- RISK MANAGEMENT MEASURES

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REACH Requirements for Substances and Preparations

REGISTRATION

- For a substance or preparation:

  IF the substance or substance in a preparation is imported or manufactured in the EU,

  - AND the substance (note: **substance does not need to be an SVHC**, this applies to any non-exempt substance) amounts to greater than 1 metric ton per year
  - AND there are no applicable exemptions that can be applied

  THEN the substance must be registered with the EU Chemicals Agency.

Ref: Article 7.1 of the REACH Regulation

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REACH Requirements for Articles

REGISTRATION

- For a substance in an Article:

  IF the article is imported or produced in the EU,

  - AND the substance (note: **substance does not need to be an SVHC**, this applies to any non-exempt substance) amounts to greater than 1 metric ton per year
  - AND the substance is intentionally released under normal or reasonably foreseeable conditions of use
  - AND there are no applicable exemptions that can be applied

  THEN the substance must be registered with the EU Chemicals Agency.

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Ref: Article 7.1 of the REACH Regulation

REACH Requirements for Articles (cont'd)

NOTIFICATION

- For a substance in an Article:

  IF the article is imported or produced in the EU,

  - AND the substance is a SVHC (substance of very high concern)
  - AND the substance is present in a wt/wt concentration in the article at greater than 0.1%
  - AND the substance amounts to greater than 1 metric ton per year
  - AND exposure to humans or to the environment cannot be excluded

  THEN the substance must be notified to the EU Chemicals Agency.

  .

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Ref: Article 7.2 of the REACH Regulation

REACH Requirements for Articles (cont'd)

COMMUNICATION

- For a substance in an Article:

  IF the article is imported or produced in the EU,

  - AND the substance is a SVHC (substance of very high concern)
  - AND the substance is present in a wt/wt concentration in the article at greater than 0.1%

  THEN the substance must be communicated to recipients and consumers.

Recommendation: Need to, at a minimum, know presence of all SVHC's, and know amounts if above 0.1% per article.
For RoHS and for substance vulnerability matters, should know SVHC regardless of threshold.
To ensure suppliers are meeting REACH obligations, may be useful to get full disclosure

Ref: Article 33.1-2 of the REACH Regulation

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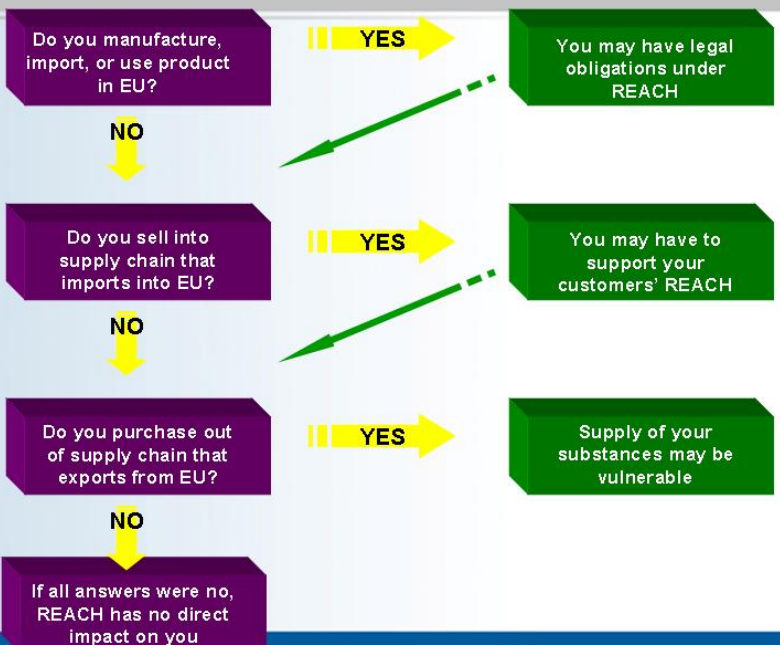
REACH-ing Outside of the EU



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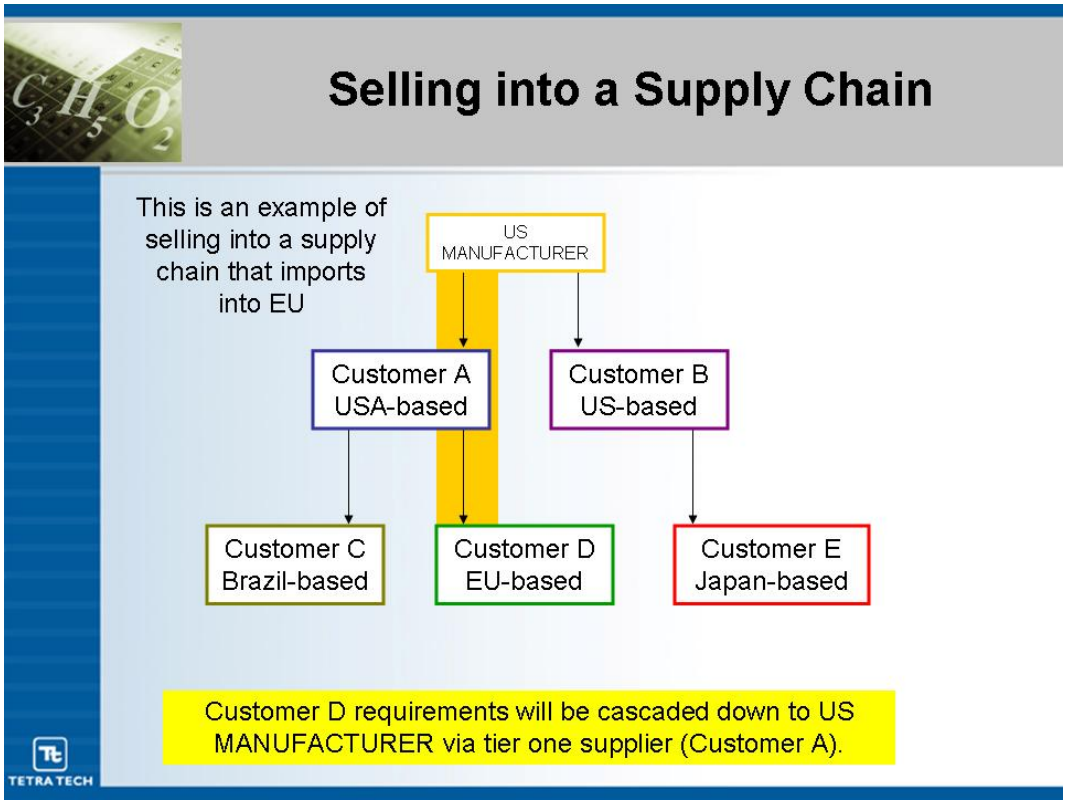
Selling into a Supply Chain
This is an example of selling into a supply chain that imports into EU
US MANUFACTURER
Customer A USA-based
Customer B US-based
Customer C Brazil-based
Customer D EU-based
Customer E Japan-based
Customer D requirements will be cascaded down to US MANUFACTURER via tier one supplier (Customer A).
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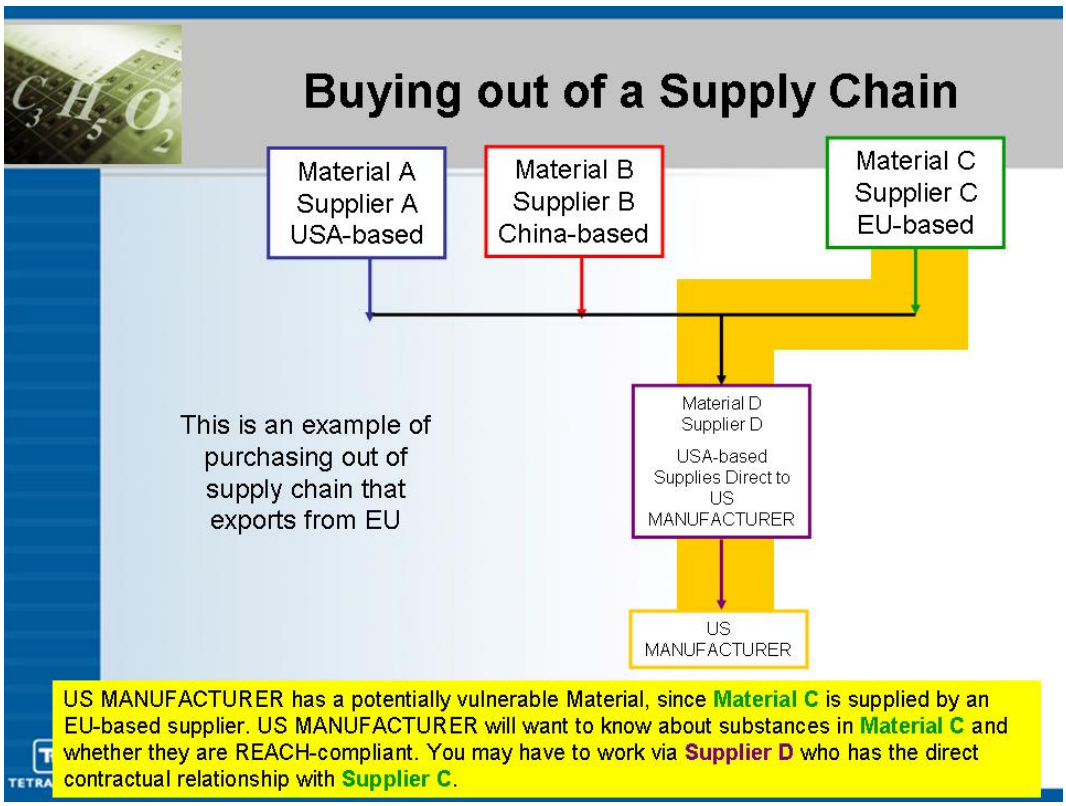
Buying out of a Supply Chain
Material A Supplier A USA-based
Material B Supplier B China-based
Material C Supplier C EU-based
This is an example of purchasing out of supply chain that exports from EU
Material D Supplier D
USA-based Supplies Direct to US MANUFACTURER
US MANUFACTURER
US MANUFACTURER has a potentially vulnerable Material, since Material C is supplied by an EU-based supplier. US MANUFACTURER will want to know about substances in Material C and whether they are REACH-compliant. You may have to work via Supplier D who has the direct contractual relationship with Supplier C.

Case study: End of Life Vehicles Directive

- 2000:
  - "ELV only applies to 9 automotive OEMs"
  - "ELV is only an EU issue"
  - "ELV only involves 4 chemicals"
- 2008
  - 120,000 users reporting material content for tens of thousands of companies
  - 100% condition for doing business anywhere in the world for the automotive industry
  - Several thousand chemicals require reporting

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Conclusions

- Ignore the myths
  - REACH is an EU issue
  - REACH is just for chemicals companies
- "Volunteer" a REACH Champion
  - To provide internal competence
  - To coordinate cross-functional compliance efforts
  - To brief management
- Inventory your SVHCs
  - Survey suppliers (both for SVHCs and for registration intent)
  - Educate suppliers
  - Revise terms and conditions
  - Track SVHCs in database
  - Prepare for re-design

TETRA TECH

REACHing Asia: Recent Trends in Chemical Regulations of China, Japan and Korea

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ABSTRACT

Will EU REACH (Registration, Evaluation, Authorisation and Restriction of Chemical substances) influence and change the chemical regulatory systems of Asia, as EU RoHS has done in China, Japan and Korea? The answer is YES. China, Japan and Korea are (or will be) filling the regulatory gap they see between REACH and their chemical regulatory systems. With its advanced chemical regulatory system under the Law on the Control of Examination and Manufacture of Chemical Substances, Japan has established a sound chemical control system. In order to better control existing chemicals, Japan operates the Japan Challenge Program, which is a risk assessment program for high production volume (HPV) chemicals, together with 47 companies and 2 associations since October 2005. Korea is quickly incorporating REACH-like aspects in the Toxic Chemicals Control Act. Pursuant to the proposed Enforcement Ordinance of 26 February 2008, the Ministry of the Environment would require 9 toxicity studies of new chemicals by the end of 2008 and 13 toxicity studies by 2011. Some existing chemicals (e.g. chemicals manufactured over 100 tons per year) would be required to submit data for the hazard review.

Since the enactment of the Measures on the Environmental Management of New Chemical Substances on 12 September 2003, China has worked hard by issuing series of implementing measures, e.g. Technical Rules on Toxicity Testing of Chemicals of 11 July 2005, Guideline on Good Laboratory Practices for Chemical Testing of 1 June 2004, Guideline for Chemical Testing (HJ/T153-2004). However the chemical control system in still at its initial stage.

This presentation will describe the current chemical regulatory systems of EU, China, Japan and Korea, analyze how Asian countries deal with the regulatory gap between REACH and their systems, and discuss how businesses will be forced to deal with this foreseen trend in Asia.

REACHing Asia

Recent Trends in Chemical Regulations of China, Japan and Korea

NEMC 2008

Washington, DC, 14 August 2008

Paul Cullen Beatley
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 Slide 1

Towards a more comprehensive approach to managing chemical risks in Asia-Pacific

1. Influence of EU environmental legislation on the Asia-Pacific region
2. Current chemical control systems in:

3. Is there REACH in Asia's future?

 Slide 2

EU WEEE & RoHS Directives spurred similar moves in North Asia

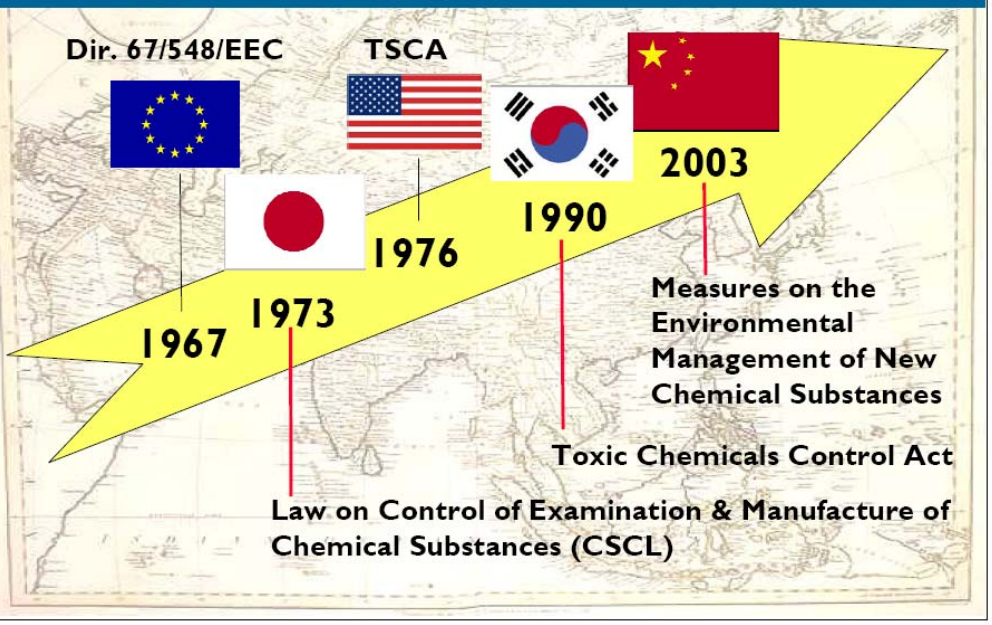
- **Primary motivation to protect trade**
  - Japan, however, pursuing recovery & recycling since early '90s
  - China aiming for leadership role – will not merely dance to a European tune
- **Key objective: set internationally applicable standards for hazardous substances in EEE**

China wants "…to positively put forward the certification of international environmental management systems and **environmental labeling of products** ***for the sake of developing foreign trade.***"

- Jiang Zemin

 Slide 3

Development of Chemicals Control Legislation in North Asia



 Slide 4

Common elements of chemical control legislation and regulation

- New & existing chemicals risk assessments & control measures
- Pollutant release & transfer (PRTR) requirements
- Chemical packaging & labeling
- Use and marketing restrictions
- Chemical import & export restrictions
- Safety data sheets
- Occupational exposure limits & worker protection

 Slide 5

Management of risks from new and existing chemicals

CSCL established system of chemicals classification in 1973

- Hazard-based evaluation of new chemicals & restrictions on manufacture, import and use of PBTs
- 1986 amend: risk-based regulation for persistent substances with long-term toxicity
- 2003 amend: evaluation & regulation of adverse effects on living organisms
- Voluntary HPV assessments under Japan Challenge Program (JCP)

TCCL regulates chemical manufacture and import/ export

- Requires new chemical notification
- New chemicals must pass Toxicity Review by MOE

MEMNCS requires new substance toxicity testing and registration

- Additional legislation to identify & control hazards proposed

 Slide 6

Reporting pollutant releases

- **TCCL requires PRTR reporting**
  - **36 industrial categories, >50 tpa for 388 substances by 30 Apr**
  - **Industrial categories include: chemicals, rubber and plastic, electronics, computers and office appliances, etc.**

- **Chemical substance releases to environment and transferred as waste must be reported under LRRSCS**
  - **23 industrial categories (e.g. metal mining, chemical and allied products, product testing industries, etc) by 30 June**
    - **employing 21 or more full-time workers and**
    - **handling 1 ton or more of class-1 chemicals per year**
  - **Reports to Ministry of Health, Labor and Welfare, Ministry of Environment or the Ministry of Economy, Trade and Industry**

- **China has no PRTR as yet**
  - **17 May 2007 Circular on First Pollution Source Survey Plan provides for government to collect information on pollutant discharges**

 Slide 7

Chemical packaging and labeling requirements

All three countries are moving forward with adopting GHS

KR: Standards on Labeling of Chemicals based on GHS (KS M 1609:2006) – but no regulatory reference!

JP: several instruments implement GHS

- Circular on Labeling of Class-2 Specific Chemicals of the CSCL in accordance with Globally Harmonized System, 12 January 2007
- Japanese Industrial Standards on the Labeling of Chemicals based on the Globally Harmonized System (JIS Z 7251:2006)
- Public Notice on Marking in accordance with Article 57, Section 1, Paragraph 2 of Industrial Safety and Health Law of 20 October 2006

CN: 26 Standards on Classification, Precautionary Labeling and Precautionary Statements of Chemicals in force from 1 January 2008

 Slide 8

Proposed labels for new GHS health hazard symbol (2002)

 Slide 9

Chemical use and marketing, import/export restrictions

In China, imports/exports of banned or strictly restricted chemicals require registration certificate and clearance notification

- Manufacturing and use of Class 1 & 2 substances in Japan requires permits and notifications respectively

Korean Entities producing, importing, selling, transporting or using severely restricted or banned substances must have a permit

- All three countries:
  - Have banned or restrict PCBs, asbestos, etc.
  - Have signed the Chemical Weapon Convention (CWC)
  - Operate PIC for chemical exports
  - Have ratified Stockholm Convention on POPs

 Slide 10

Safety Data Sheets

- SDSs in all three countries adopt 16 heading format of GHS

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information.

- SDSs must be provided to customers, workers using hazardous substances

 Slide 11

Occupational exposure limits and protection

- Korea's ISHA sets exposure limits on:
  - 704 chemical substances, mixtures,
  - carcinogens (12 identified, 27 candidates, 17 without exposure limits),
  - As well as dusts, noise and high temperatures
- Japan's ISHL requires:
  - Exposure prevention reports for specified substances
  - Biannual workplace assessments where solvents are used
  - Guidance for manufacturing or handling carcinogens to take appropriate measures for the prevention of health hazards to workers
- China's Standards on Occupational Exposure Limit for Hazardous Agents in the Workplace - Chemical Hazardous Agents (GBZ 2.1-2007) stipulate exposure limits for
  - 339 hazardous substances
  - 47 dusts
  - 2 biological agents
  - prescribes the preventive or protective measures

 Slide 12

REACH is having an impact on Asia

- Current focus is to prevent trade disruptions to chemicals and products
- Some tentative moves to implement REACH-like measures
  - Japan's *Kashinho* Working Group influenced by REACH ideas
  - Korea to require 9 toxicity studies of new chemicals by end 2008 and 13 by 2011; other new tests being implemented for new chemicals
  - Some existing chemicals (HPV >100 tpa) will require data submittals for hazard reviews
  - New Environmental Health Act (21 Mar 08) introduces:
    - Risk assessment for control of environmental pollutants
    - Health impact assessments
    - Ban on use of hazardous substances in toys
    - Evaluation of risk of new technologies and materials
- China least well-equipped to implement REACH-like measures, but experience with RoHS might be instructive…

 Slide 13

For further information…

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Thank You!

 Slide 14

REACH: Reconciling Regulation and Science: Toxicological Endpoints, Annex VII-X: "Information Requirements" versus Adaptations and Test Methods

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ABSTRACT

One of the many challenges REACH presents remains in the marriage of regulation and science. With the bulk of "information requirements" and the lack of congruent terms between the regulatory text, IUCLID5, and the draft guidance on how to satisfy substance dataset requirements, understanding which test methods to apply and how to determine where appropriate adaptations may be made can be quite a daunting task. For toxicological endpoints in particular, there is an additional overlap in the use of substance dataset information in the chemical safety assessment and in how this data should be applied to "classification and labeling". Further complicating the challenge of compliance to the standard information requirements for Registration is the weighting of the value of test studies in terms of their compliance to internationally recognized methods. In order to reconcile these nebulous hurdles and somewhat disparate topics to REACH compliance, a synthesis of the regulation and its implementation will be explored taking into consideration the allowable adaptations to the information requirements and acceptable test methods.

This discussion, while limited to toxicological properties, will enable a more focused understanding of how data may be used and applied across the spectrum of REACH requirements in addition to outlining the appropriate methods from which this data should be derived.

Software Solutions for Environmental Compliance (RoHS, WEEE, REACH, ELV)

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ABSTRACT

Regulations like RoHS and REACH, which restrict the use of certain substances in products, present an enormous data management challenge for global manufacturers, particularly those with complex products and supply chains. As regulations and restricted substance lists proliferate, these manufacturers must now understand and manage the chemical makeup of their products, and in turn the chemical makeup of all the supplier parts and materials they purchase. Leading manufacturers have adopted systematic approaches to collecting and managing this chemical data - both the data provided by their suppliers in the form of a chemical specification and the supporting test data. Their approaches help determine what components and materials get tested, how often, and what tests are required. This presentation will examine these approaches, the business goals that drive them and their implications for the supply chain.

Synapsis
TECHNOLOGY, INC.

Meeting the Testing and Data Management Challenges of EU Chemical Regulations (RoHS, WEEE, ELV, REACH)

John Fox
Synapsis Technology
jfox@synapsistech.com

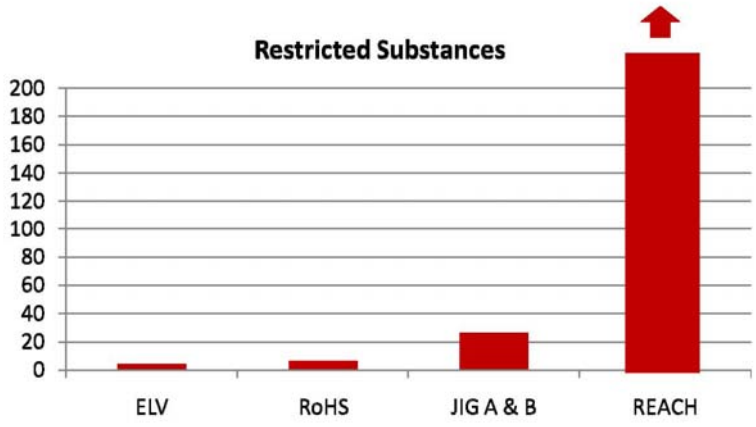
Environmental Measurement Symposium | Washington, DC | August 14, 2008

Recent Headlines

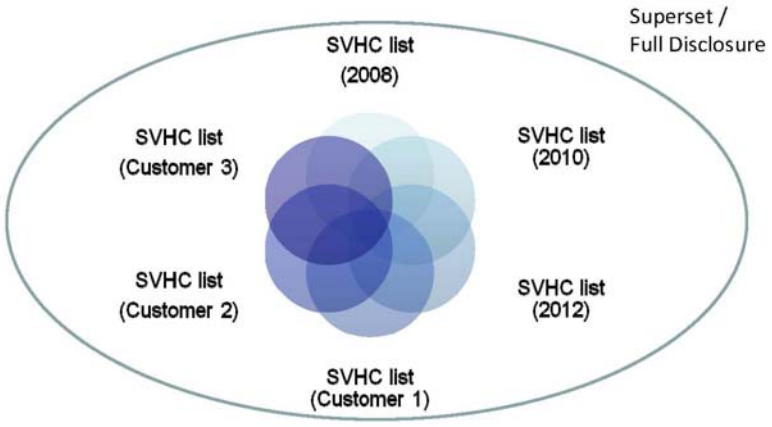
- **"Vendor admits to RoHS misconduct"**
  - EE Times
- **"Lead Paint Prompts Mattel to Recall 967,000 Toys"**
  - New York Times
- **"Jobs Announces a 'Greener Apple'"**
  - Wired Magazine
- **"Reebok paying record $1M fine for recalled lead bracelets"**
  - USA Today
- **"Greenpeace confirms hazardous materials in game consoles"**
  - TGDaily
- **"Wal-mart Raises Bar on Toy-Safety Standards"**
  - Wall Street Journal

More regulations = More complexity

Trend: More substances in scope

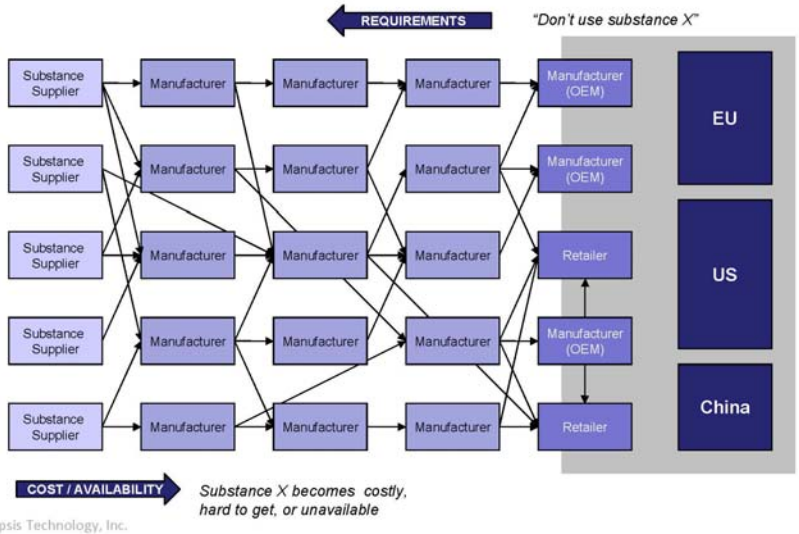


The Challenge of REACH SVHCs



What's in your product?

Beyond "compliance" - Supply chain ripple effects



Caught in the middle

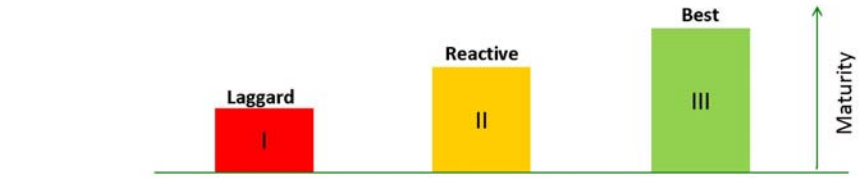
Indirect Impacts
- Supply chain ripple effects

Direct Impacts
- Customer requirements
- Regulatory requirements

Key data management capabilities of best-in-class manufacturers

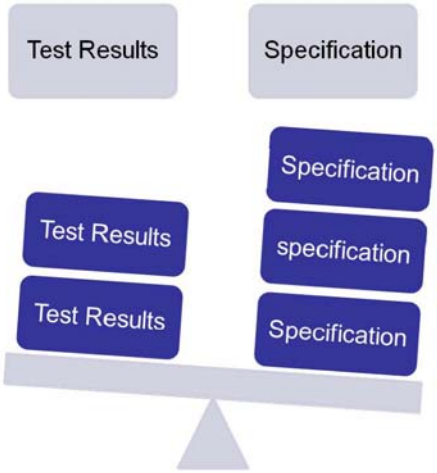
Get the data (from your suppliers)	Manage the data (analysis and action)	Share the data (internally & externally)
• Avoid duplication of effort • Use industry standard collection forms/formats • Request data that will fulfill long term goals (i.e. full disclosure) • Enable systematic testing and supplier audits	• Store and master data centrally • Relate data to products (e.g. amount used, concentrations) • Analyze dynamically (as products, parts and SVHC lists change)	• Internal - share data across functional departments • External - produce source data to fulfill all reporting requirements • External - support various discloser levels

Maturity model

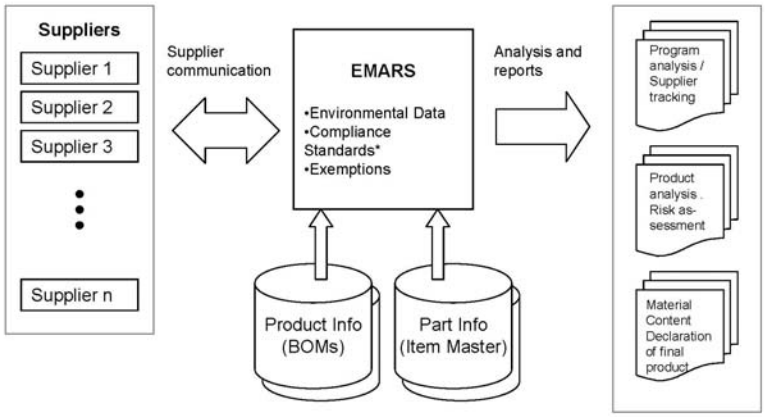


	Laggard (I)	Reactive (II)	Best (III)
Company Approach / Characteristics	▪ "We're exempt for now"	▪ One customer request at a time ▪ After-the-fact compliance ▪ Functional silos	▪ Approach addresses all customer requests ▪ Build compliance into standard BPs ▪ Chemical risk management
Supporting Data	▪ None	▪ Certificates or letters from suppliers. ▪ Yes/No data relative to fixed SVHC lists ▪ "Did you register what you need to?"	▪ Inform suppliers of key substances and intended uses ▪ Collect full material disclosure

A balanced approach

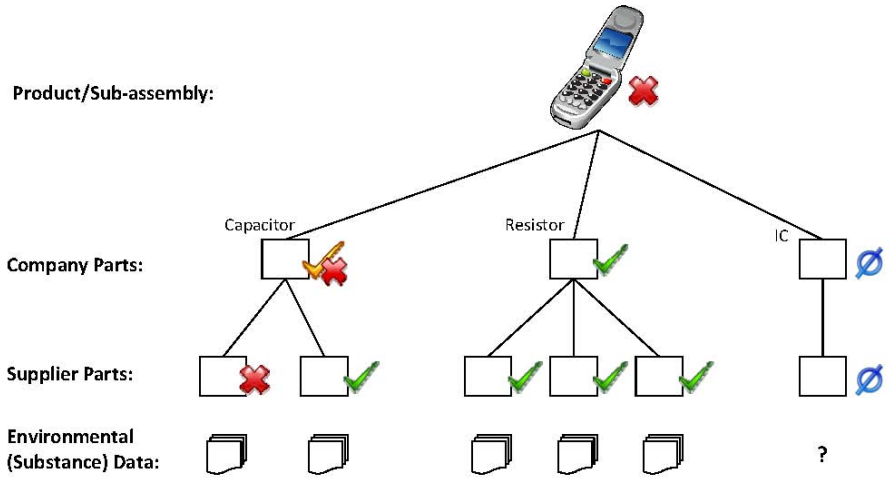


Software Solution – Synapsis Technology's EMARS™

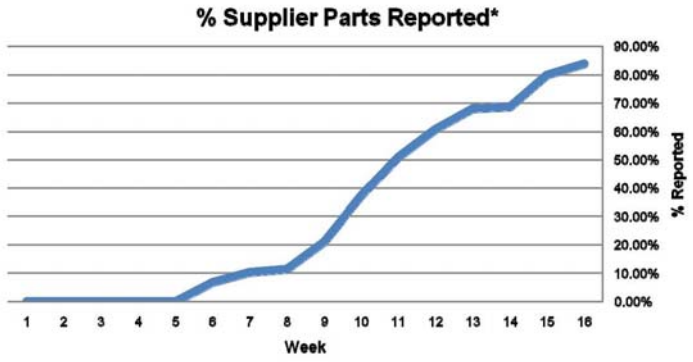


*Supported compliance standards include EU RoHS, China RoHS, WEEE, ELV, REACH and more

Data Model / Compliance Checker™



Software makes supplier data collection and validation fast and easy



*Results achieved by an EMARS customer collecting full chemical content, REACH data.

Conclusions

- Regulations and restricted substance lists are proliferating
  - Governments
  - NGOs
  - Industry reaction
- Manufacturers are under increasing pressure to better understand – and manage –the chemical makeup of their products – and all the supplier parts and materials they purchase.
- Best-in-class manufacturers use systematic approaches that enable them to
  - Manage risk associated with targeted or "black listed" substances
  - Balance declaration and testing/audit processes – and lower costs
  - Take advantage of industry standard data formats and protocols

EPA Effort to Reduce or Eliminate the Use of Mercury-Filled Non-Fever Thermometers for Test Methods and Regulations

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ABSTRACT

EPA and the Environmental Council of the States' (ECOS) Quicksilver Caucus are working together to develop a collaborative strategy to reduce the use of non-fever mercury-filled thermometers in industrial and laboratory settings. A few states became aware of this issue when taking steps to require the phase-out of the sale of these thermometers. Some of the state labs allow manufacturers to apply for an exemption. In reviewing these exemption applications, states have found many uses of thermometers by industry and laboratories are integral to American Society of Testing and Materials (ASTM) standards, and users that need to meet those standards are limited in their ability to use non-mercury alternatives. As a result, EPA is working with the States, ASTM, NIST, and other organizations to jointly determine where non-mercury measuring devices can be used instead of mercury thermometers in laboratory settings and how to promote the use of non-mercury liquid-in-glass thermometers.

ASTM is currently evaluating its more than 800 standards that refer to mercury to determine if amendments to the standards can be made to allow for the use of non-hazardous liquid-filled thermometers. EPA has undertaken a review of its own regulations for standards and test methods that may require mercury-filled thermometers. EPA believes that changes in these test methods and regulations, where possible, could reduce the demand for mercury-in-glass thermometers.

At the meeting, EPA will present information on the status of ASTM's and EPA's evaluation of standards and test methods, and the steps taken to identify barriers to the use of alternative types of thermometers used in laboratory settings.

2008 NEMC Proceedings

HOMELAND SECURITY

EPA's Water Laboratory Alliance

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ABSTRACT

The Water Laboratory Alliance (WLA) is an initiative led by EPA's Water Security Division (WSD) in response to Homeland Security Presidential Directive 9 (HSPD 9). EPA's WLA is working with the water sector to integrate existing laboratory networks (e.g., EPA's Environmental Response Laboratory Network (ERLN) and the Centers for Disease Control and Prevention's (CDC's) Laboratory Response Network (LRN)) in order to respond to drinking water emergencies.

Implementation of the WLA is being approached through a three phase process: 1) development of program, 2) initial implementation of program, and 3) final implementation of program. Phase 1 of the WLA implementation was to evaluate existing laboratory programs and develop an approach. Phase 2 of the WLA implementation is to work with the regions and establish WLA networks in each region via Regional Laboratory Response Plans. Phase 3 of the WLA implementation is to integrate the regional networks into a nationally consistent program. Phase 1 of the WLA implementation is complete and the WLA is currently in phase 2 of working with the regions to establish regional WLA networks.

The regional WLA networks are based on Regional Laboratory Response Plans (RLRPs), which are mutually agreed-upon approaches that describe how multiple laboratories may work together during a response to a drinking water incident. The RLRPs are currently under development through a four phase process: 1) development of a generic template; 2) facilitated meetings in each region among the EPA regional laboratory, state environmental and public health laboratories, and major water utility laboratories to customize the generic template into region-specific plans; 3) table top exercises to test the region-specific plans; and 4) functional exercises involving unknown sample analysis across multiple laboratories in order to test the regional networks.

The second phase of the RLRP project was completed in March 2007 and the third phase of the RLRP project was completed in August 2007. These meetings demonstrated a significant interest from the state laboratory and drinking water utility participants in the effort. Key areas of discussion at the facilitated meetings included analytical method selection, acceptable and/or necessary quality control during emergency response, and data reporting and transfer. The same groups were involved in the table top exercises that were designed to test and evaluate each Regional Laboratory Response Plan. The fourth phase is currently underway with functional exercises completed in some EPA regions.

Concurrent to the development of the regional networks, known gaps in environmental laboratory capability are being addressed through analytical method validation and implementation of methods for non-regulated contaminants of interest to the water sector.

This presentation will provide a brief WLA background and provide an update on WLA implementation activities.

Features of an Active and Effective Protective Program - Real World Application

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ABSTRACT

A secure drinking water and wastewater infrastructure (water sector) is critical to protecting public health and ensuring public confidence. The U.S. Environmental Protection Agency's (EPA's) Office of Ground Water and Drinking Water (OGWDW) is promoting Active and Effective Protective Program features (basic elements) for utility owners and operators to consider as they develop all-hazard approaches for guaranteeing continuity of service and enhancing overall preparedness. The ten features of an Active and Effective Security Program capture the water sector's post Hurricane Katrina emphasis on "all-hazards" preparedness; and establish explicit alignment with the Water Sector-Specific Plan for Critical Infrastructure Protection (Water Sector SSP) prepared in response to National Infrastructure Protection Plan (NIPP) requirements. Protective activities address the physical, cyber, and human elements of prevention, detection, response to, and recovery from an all-hazard event. The key features are based on an integrated approach that incorporates a combination of public involvement and awareness, partnerships, and physical, chemical, operational, and design controls to increase overall program performance. These features serve as a framework utilities can use to design individual preparedness programs based on specific risk concerns.

The EPA OGWDW set out to document preparedness practices used by drinking water and wastewater utilities through a unique case study in the State of Washington's Seattle-King County community. Many practices illustrate the benefits of collaboration between agencies. For example, water sector collaboration with law enforcement and public safety agencies enhances local emergency response and improves the effectiveness of regional disaster preparedness exercises. These collaborative practices can also create a sense of ownership and responsibility between agencies and lead to faster response times, foster trust among local emergency responders, and create a more efficient working environment during an emergency. Ultimately, active participation by the water sector in collaborative practices enables traditional first responders to recognize water utilities as an essential team member in emergency preparedness planning and a partner in first response.

Another benefit of promoting active and effective security practices is that employees well-trained in disaster response are able to analyze their systems and recognize opportunities to improve operations on a daily basis. Preparedness training for employees also benefits the broader community because the better people understand their role in an emergency; the better able they are to handle the response. In addition, worker safety often improves when utilities update their policies to conform to new security and preparedness practices.

The EPA OGWDW is currently working on a new pilot project in Chicago, Illinois, partnering with U.S. EPA Region 5 and the Chicago Manufacturing Center's Great Lakes Partnership Program. The Chicago pilot project demonstrates how to maximize resource efficiency through a collaborative public-private partnership to ensure business continuity and water sector preparedness. Federal and state agencies can learn from the important preparedness and business resiliency practices and public-private partnerships documented in these studies.

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Features of an Active and Effective Protective Program – Real World Application

Laura Flynn
USEPA Office of Ground Water and Drinking Water
Water Security Division

National Environmental Monitoring Conference
August 11, 2008
Washington, DC

1

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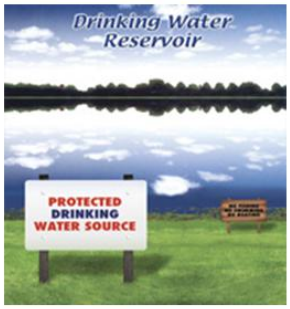
Overview

- Basic Concepts
- *10 Features of an Active and Effective Protective Program*
- Importance
- Application
- Conclusions



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Basic Concepts

- Implementing Active and Effective Protective Programs can provide multiple benefits that support:
  - Improved core water quality and emergency response programs
  - Enhanced protection of critical infrastructures/key resources (CI/KR)
- Identifying *and clearly articulating* multiple benefits can:
  - Help states and other water sector partners secure resources, and support, for improved core and protective programs
  - Prepare coordinators and managers to assist labs in creating a secure and resilient infrastructure
  - Help maximize resources and reduce redundancies

3

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10 Key Features

1. Integrate protective attitude into organizational culture, leadership, and daily operations
2. Identify and support protective program priorities, resources, and utility-specific measures
3. Employ protocols for detection of contamination
4. Assess risks and review vulnerability assessments (VAs)
5. Establish facility and information access control
6. Incorporate resiliency concepts into physical infrastructure
7. Prepare and test business continuity plans
8. Develop partnerships with first responders, managers of critical interdependent infrastructure, utilities, and response organizations
9. Develop and implement internal and external communication strategies
10. Monitor incidents and threat-level information

4

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Importance

Implementing active and effective protective programs:

- Fosters development of holistic security culture and asset management system

- Increases awareness of criticality of water infrastructure to emergency response and incident management, as well as to private sector:
  - Lab analysis
  - Manufacturing and food processing
  - Healthcare

- Improves information exchange across interdependent sectors and services
- Provides additional justification to officials to support enhancements to aging infrastructure

5

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Application

Seattle-King County, WA Case Study goals:

- Document current active and effective security, and emergency practices, related to a community's water sector
- Serve as *model* for other communities:
  - Provide information and examples
  - *Not* intended to serve as guidance

King County SEATTLE.GOV

Basic Methodology:

- Established Guidance Team of local agencies from multiple sectors
- Conducted meetings with individual utilities to collect information on water security practices
- Hosted workshop with utilities and collaborative agencies
- Met with local elected officials to strengthen support for security and preparedness
- Produced final report to document practices

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Key Findings

- Key findings:
  - Partnership is essential:
    - > Right people at the table
    - > Trust in crucial
  - Think long term:
    - > Improvements are incremental
    - > Maintain momentum
  - Secure support from leadership
    - > Educate officials and decision makers
  - Think holistically:
    - > Identify and overcome barriers
    - > Seek collaboration from other agencies
    - > Pursue collaborative programs and multiple benefits

- Example practices:
  - Mutual aid and assistance agreements
  - Conducting disaster exercises and training on security

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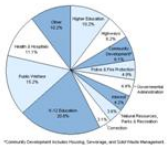
Program Benefits

- Improve business resiliency and continuity of daily operations
- Develop/use tools that enhance opportunities for cross-governmental, cross-sector:
  - Communication
  - Coordination
  - Collaboration



- Build upon existing networks of emergency management officials, private-sector and their advocacy groups, and others with an interest in infrastructure protection
- Share technology, and other resources, that facilitate better management and flow of information

8

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Examples of Available Tools

- Tools already available to support voluntary water protective programs:
  - Mutual aid and assistance agreements
  - Water/Wastewater Agency Response Networks (WARNs)
  - Response Protocol Toolboxes
  - On-line and in-person water preparedness and emergency management training and webcasts
- Other tools will be available soon:
  - Seattle-King County, WA report on best water protection practices
  - "How To" manual for communities wanting to replicate "Chicagoland" model of connecting water preparedness with business resiliency

King County

SEATTLE.GOV

9

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Conclusions

- Instituting active and effective protective programs does more than protect the water infrastructure, communities derive *many* benefits
- Programs are *voluntary* efforts by utilities, and the communities they serve, to foster a more protective environment
- Utilities and communities can choose to implement the features that best meet their individual needs and/or build upon existing efforts in the community
- Using active and effective programs to leverage "non-traditional" water sector partners, can provide better, cheaper, and faster protection of water infrastructure and other key resources

10

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For More Information

Active and Effective Protective Programs and Features

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11

Chicagoland Water and Wastewater Preparedness and Business Resiliency Pilot

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ABSTRACT

The U.S. Environmental Protection Agency's (EPA's) Office of Ground Water and Drinking Water (OGWDW) is partnering with U.S. EPA Region 5 and the Chicago Manufacturing Center's Great Lakes Partnership Program on a new water security pilot project in the Chicagoland area. Phase I of the pilot was initiated through the Chicagoland Water and Wastewater Preparedness and Business Resiliency Summit held November 28, 2007, in Chicago, Illinois.

From a national perspective, one critical output of the pilot partnership is to create a methodology ("How To" manual), available in mid-2008, for other communities to use in replicating the pilot concept on their own. The pilot supports homeland security efforts related to: critical infrastructure protection; preparedness, response, and recovery; and, communication/information sharing. Industry representatives who participated in the Summit identified connections to WaterSense and Green Suppliers Network programs. Communities need a variety of tools to enhance their state of water emergency preparedness; the pilot implemented in Chicago offers a methodology that communities can use to protect the water infrastructure.

The Chicago pilot is especially useful in raising awareness in the private sector, where most water preparedness assets are held, and offers a collaborative public-private path forward that can be tailored to the individual needs of each community. Having the opportunity to share this concept with the broad audience present at the National Environmental Monitoring Conference (NEMC) will facilitate dialogue and networking opportunities among other agencies and the regulated community to promote this methodology and proactively enhance preparedness and business resiliency across all environmental programs.

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Chicagoland Water and Wastewater Preparedness and Business Resiliency Pilot

Laura Flynn
USEPA Office of Ground Water and Drinking Water
Water Security Division

National Environmental Monitoring Conference
August 11, 2008
Washington, DC

1

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Chicagoland Pilot draws together concepts of drinking water and wastewater preparedness with business resiliency and sustainability

Long-term goal is to promote adoption of concept in other communities.

2

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Initial Concept

- Chicagoland Pilot builds off Seattle-King County Case Study partnership efforts
- Seattle was very successful…but prohibitively expensive to replicate
- Initial plan for Chicagoland Pilot was to replicate Seattle…but do things better, cheaper, faster

Instead we created a very different pilot

3

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Seattle-King County Case Study

Goals:

- Document current active and effective security and emergency practices related to a community's water sector
- Serve as *model* for other communities
  - Provide information and examples
  - *Not* intended to serve as guidance

Basic Methodology

- Established Guidance Team of local agencies from multiple sectors
- Conducted meetings with individual utilities to collect information on water security practices
- Hosted workshop with utilities and collaborative agencies
- Met with local elected officials to strengthen support for security and preparedness
- Produced final report to document best practices

4

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Chicagoland Pilot

- Builds upon Seattle-King County basic methodology, but expands to include:
  - Much stronger public-private partnership
  - Active involvement in multiple local departments including:
    - > Drinking water and wastewater utilities
    - > Emergency management
    - > Environment

- Process inverted to *begin* with a large summit on drinking water and wastewater preparedness
- Links drinking water and wastewater preparedness to business resiliency and continuity
- Places less emphasis on documenting preparedness practices than Seattle-King County, WA
- Places greater emphasis on establishing long-standing relationships and on-going dialogue between public and private sectors
- Future phases are currently under discussion and may include a community-based, water-related demonstration project or cyber-exercise

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Goals

- Promote a better understanding of public and private sector interdependencies in Chicagoland:
  - Foster fuller understanding of potential impacts of water infrastructure loss on business resiliency and continuity
  - Identify resources needed to respond, and recover from, a water emergency
- Build regional capacity by establishing a continuing water emergency preparedness network that draws upon collective public and private:
  - Knowledge
  - Resources
- Help Chicagoland prepare for future water events by using *all-hazards* approach that enables community to respond to water incidents in most effective/efficient manner possible

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Planning Partners

- In addition to the Water Security Division (WSD), USEPA Region 5, and the Chicago Manufacturing Center (CMC), other planning partners include:
  - Local:
    - > City of Chicago Departments of Water Management and Environment
    - > City of Chicago Office of Emergency Management and Communications
    - > Metropolitan Water Reclamation District of Greater Chicago
  - State:
    - > Illinois Environmental Protection Agency
  - US Department of Homeland Security:
    - > National Cyber Exercises Program
    - > Federal Emergency Management Agency Region 5
    - > Protective Security Advisors
  - US Department of Commerce, National Institute of Standards and Technology's Manufacturing Extension Partnership Program
  - James Lee Witt Associates
  - America's Second Harvest

7

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First Step…Stakeholder Summit

- Attendees:
  - 100+ senior-level officials representing:
    - > Public and private sectors
    - > Drinking water and wastewater utilities
    - > Large-scale users (e.g., manufacturers, pharmaceutical companies, banking industry)
- Panels Included:
  - State and Local Government Perspectives on Interdependencies and the Value of Water Infrastructure
  - Building a Business Case for Private Sector Involvement in Water Preparedness
- Town Hall Meeting:
  - Keynote Address by Ben Grumbles, USEPA Assistant Administrator for Water
  - Panel: Theory and Real World Practice of Water Emergency Response
- Facilitated Breakout Group Discussions:
  - Coming Full Circle – Ensuring Business Resiliency
- Joint announcement of on-going efforts

8

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Tools

- Tools already available include:
  - Mutual aid and assistance agreements
  - Regional Lab Response Protocols
  - Water Lab Alliance
  - Water Security Initiative
  - Green Suppliers Network
  - WaterSense
  - Lean and green manufacturing techniqu
  - Enhanced back-up systems
  - Supply chain management
  - Emergency communication networks

EPA WaterSense

- Tools in development:
  - "How-To" manual for replicating pilot concept
  - *Chicagoland Summit* findings and recommendations
  - *Seattle-King County, Washington Community Case Study* report

9

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Next Steps

- USEPA Region 5, Planning Partners, and WSD activities:
  - Focus on education, exercises, and redundancy
  - Target workshop for local medical community
  - Consult with local emergency planning committees
  - Integrate water sector into local community response exercises
  - Consider development of additional pilot
  - Consider development of a national meeting
  - Develop and implement outreach strategy to promote replication of pilot concept and lessons learned from previous pilots

10

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For More Information

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Methods for Extractable Nonvolatile Compounds Analyzed by Liquid Chromatography/Mass Spectrometry for Environmental Restoration Following Homeland Security Events

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ABSTRACT

The U.S. EPA needs standardized methods for qualitative and quantitative determination of target analytes of concern during environmental restoration. This presentation will demonstrate four quick and robust liquid chromatography tandem mass spectrometry (LC/MS/MS) methods for detecting and quantifying a series of extractable nonvolatile compounds, including some degradation products of chemical warfare agents. These methods focus specifically on analyzing organophosphonic acids, carbamates, ethanolamines and thiodiglycols in water samples, targeting risk levels provided by NHSRC. EPA's National Homeland Security Research Center (NHSRC) is currently validating these four draft procedures in reagent and environmental water samples. The US EPA Region 5 laboratory is concurrently developing analytical methods for the detection of these analytes in soil and wipes.

Quantification of Toxins in Drinking Water using EPA Method 6800 and ESI-TOF-MS

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ABSTRACT

Many toxins are available and transported in large quantities due to the large volumes which they are used in common industrial processes. Included among these toxins are small molecules (sodium azide and potassium cyanide) and pesticides (glyphosate and malathion). These compounds are extremely toxic and, as a result, are of great concern due to their potential for the implementation in a terrorist attack and their adverse effects on human health. These toxins are quantifiable in drinking water using isotope dilution electrospray ionization-time of flight-mass spectrometry (ID-ESI-TOF-MS) in both positive and negative mode following EPA Method 6800. Sample clean up and preconcentration methods are evaluated for further analysis of the analytes on ESI-TOF-MS. The unique quantification method for these analytes of isotope dilution mass spectrometry (IDMS) yields an instantaneous measurement using direct mathematical solutions without a calibration curve. This method makes analysis faster, quantifiable and reduces the chance for false positive and false negative data. The sample preparation along with quantification is a newly developed technique for field analysis being coordinated with the United States Air Force and Duquesne University for use in Homeland Defense. The protocols used in these analyses will be demonstrated for these toxins and general application to other toxins.

Water Sector Mutual Aid and Assistance: Utilities Helping Utilities

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ABSTRACT

The events of 9/11, Hurricanes Katrina and Rita in 2005, and severe flooding in New England and the Midwest in 2007 show the need for water and wastewater systems to share resources to overcome disasters occurring at a local or regional level. The Water Sector's professional associations, with support from U.S. Environmental Protection Agency (EPA), are working to encourage local utilities in every State to establish intrastate mutual aid and assistance agreements between both drinking water and wastewater utilities. These agreements, formally known as Water/Wastewater Agency Response Networks (WARN), embrace a utility-driven model to facilitate an effective and efficient flow of personnel and resources during an emergency.

The mission of WARN is to provide expedited access to specialized resources needed to respond to and recover from natural and human-caused events that disrupt public and private drinking water and wastewater utilities. By adopting the WARN approach to mutual aid and assistance, drinking water and wastewater utilities in each state are able to sign a single agreement covering issues such as indemnification, workers' compensation, and reimbursement. Unlike existing statewide mutual aid agreements, WARN membership is open to both public and private utilities. WARN helps utilities reduce the typical response "gap" between local agreements and activation of statewide agreements, as it does not require an emergency declaration prior to activation. Due to the outstanding support EPA and the American Water Works Association (AWWA) provided to this grassroots, utility-driven effort, the International Association of Emergency Managers (IAEM) awarded them the 2006 "Partners in Preparedness" award. The agreement implemented by WARN is recognized as a "Model Agreement" by the U.S. Department of Homeland Security/Federal Emergency Management Agency National Integration Center Incident Management Systems Division. The number of statewide agreements has more than tripled in the past year, leading to a better prepared and more resilient Water Sector.

INTRODUCTION – WHAT IS A WARN?

With increasing frequency, large scale emergencies and natural disasters are placing critical infrastructures to the test. These events have demonstrated the need for water and wastewater systems to be able to work together to overcome the impacts of the disasters. In response to these challenges, water utilities have begun to develop intrastate, mutual aid and assistance networks formally known as WARN—Water/Wastewater Agency Response Networks. By adopting the WARN approach to mutual aid and assistance, water utilities benefit from the ability of utilities to share equipment, personnel, and other resources required to respond promptly and effectively to any crisis that overwhelms local utility resources. Thus, WARN

networks fill a critical early response function before government aid or personnel become available.

The initial focus of WARN has been to create intrastate networks that enhance utility preparedness and resiliency within each state. An emerging objective of the WARN program is to promote the establishment of interstate mutual aid and assistance agreements to share resources across state lines using existing mechanisms, such as the Emergency Management Assistance Compact (EMAC) or other mechanisms. The WARN concept supports a number of emergency preparedness initiatives in the United States including:

- National Incident Management System (NIMS) (U.S. Department of Homeland Security (DHS), 2007),
- National Response Framework (NRF) (DHS, 2008),
- National Infrastructure Protection Plan (NIPP) and (DHS, 2007), and
- Water Sector-Specific Plan (DHS and EPA, 2007).

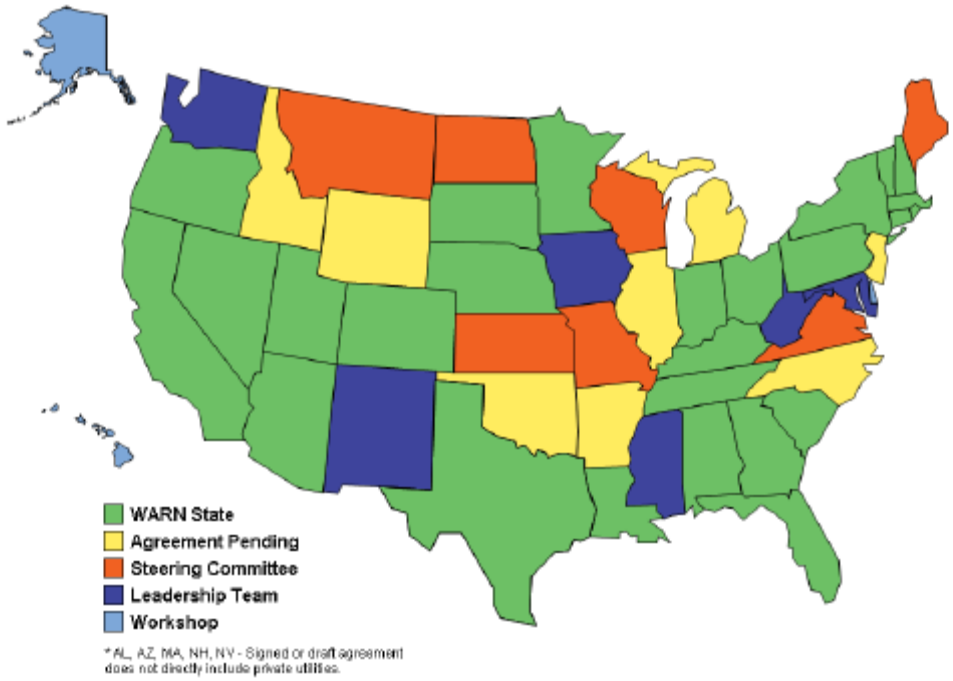
HISTORY OF THE WARN PROGRAM

The first WARN was created in the state of California in 1992. Following four hurricanes in 2004, utilities in Florida created the second WARN in 2005. Based on the experiences of these states and programs developed in similar industries, a white paper titled "Utilities Helping Utilities: An Action Plan for Mutual Aid and Assistance Networks for Water and Wastewater Utilities" was developed to provide a proven process for establishing future WARNs. The white paper outlined ten key steps to success:

- Step 1. Identify interest in starting a program.
- Step 2. Form an Initial Leadership Team (ILT).
- Step 3. Prepare a kickoff session.
- Step 4. Establish a Steering Committee.
- Step 5. Identify a mission for the program and goals for the Steering Committee.
- Step 6. Determine need to use State regions.
- Step 7. Identify mutual aid and assistance activation criteria.
- Step 8. Draft an agreement (including information on steps 4, 6, and 7).
- Step 9. Create facilitation tools.
- Step 10. Maintain the program.

Figure 1 shows the progress of the 50 states of the United States toward implementing WARN programs. As of February 2008, 21 states have fully established WARN programs while additional WARNs are expected to be in place before the end of 2008.

Figure 1. WARN Status: June 2008



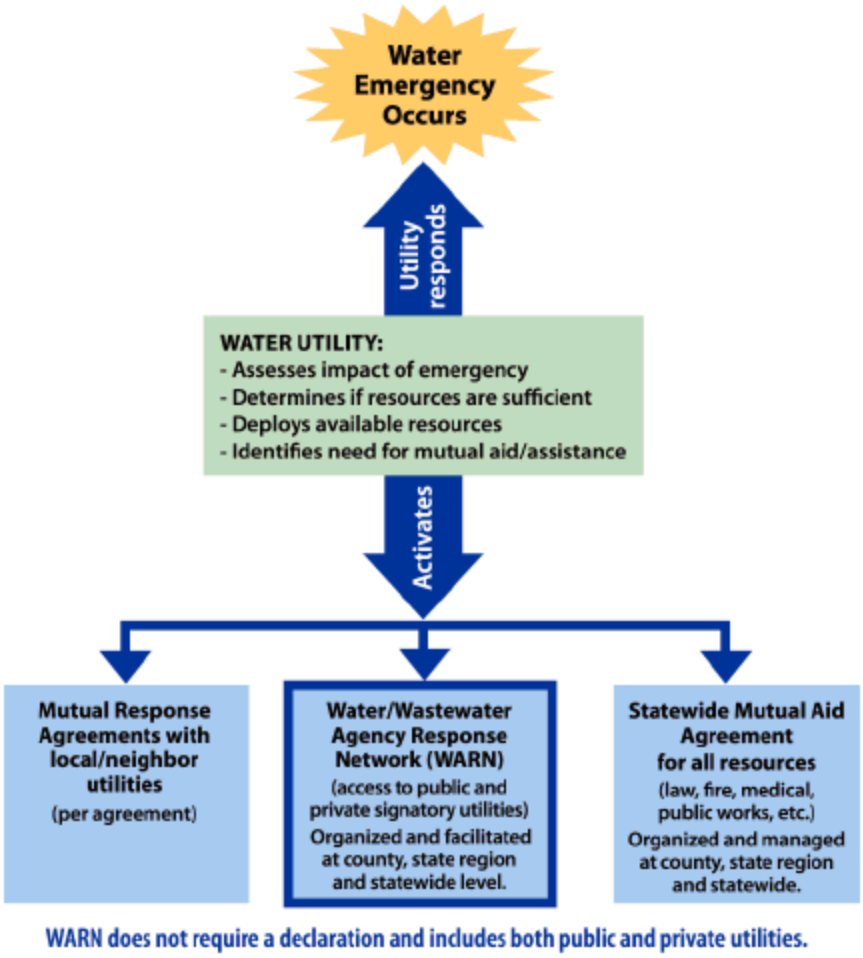
DISCUSSION

Benefits of WARN Programs

A WARN provides numerous benefits for its participating water and wastewater utilities and for the communities that they serve:

- Expedited access to specialized resources
- Improved planning and coordination
- Consistency with the National Incident Management System (NIMS)
- Operation with voluntary participation
- There is no cost to participate
- Control of resources by member utilities (they can recall/retrieve them at any time)
- Fulfillment of federal National Incident Management System (NIMS) requirements through pre-disaster agreements
- Reduced dependence on government aid
- Inclusion of legal mechanisms in the agreement that address member indemnification, workers' compensation, and reimbursement
- Activation prior to an emergency declaration (unlike traditional statewide mutual aid/assistance agreements, WARN requires no declaration of a local emergency)

Figure 2. Intrastate Water Sector Mutual Aid/Assistance Process



The WARN/Mutual Aid/Assistance Activation Process

Activation of a WARN or a similar local or state-wide mutual aid agreement is a simple process. As Figure 2 shows, upon identification of an emergency, a water utility gauges the seriousness of the event and determines if it needs to call upon outside resources. If outside support is required, the utility—after first deploying its own resources—identifies which type of mutual aid is needed, and available. The utility activates the appropriate mutual aid agreement (local/neighbor utility agreement, WARN, or a statewide mutual aid agreement).

Support and recognition for WARN

In the United States, the WARN approach has succeeded due to the widespread and continued support provided by water industry associations and federal government agencies, such as EPA.

On February 15, 2006, eight major water industry associations representing the water sector signed a Joint Policy Statement on Mutual Aid and Assistance Networks, titled *Utilities Helping Utilities*, which endorsed the associations' commitment to encourage members to establish intrastate mutual aid and assistance networks (AWWA, 2006). The signatory associations were:

- Association of Metropolitan Water Agencies (AMWA)
- American Water Works Association (AWWA)
- Association of State and Interstate Water Pollution Control Administrators (ASIWPCA)
- Association of State Drinking Water Administrators (ASDWA)
- National Association of Clean Water Agencies (NACWA)
- National Association of Water Companies (NAWC)
- National Rural Water Association (NRWA)
- Water Environment Federation (WEF)

EPA provided a grant to AWWA in which representatives from all 50 states and the District of Columbia were invited to attend workshops focused on what WARN is, how it has been used in the past, and WARN enhancements planned for the future. EPA also has provided support to individual states:

- Funding from the States and Tribal Grants (STAG) Program furthered the development of a WARN in both Florida and Pennsylvania
- EPA contractor support enabled creation of WARN Web sites for Georgia and Louisiana
- EPA facilitation support benefited WARN planning meetings in a number of states, as well as the various workshops sponsored by AWWA.

The WARN program has received recognition on the national, regional, and state level:
2006 International Association of Emergency Managers "Partners in Preparedness" Award

- 2008 EPA Region 1 Environmental Merit Award to all 6 states in New England WARN programs
- 2008 Oregon Emergency Management Award for Partnership

WARN Sample Operational Plan

EPA is developing a sample Mutual Aid/Assistance Operational Plan to help utilities develop procedures for activating and implementing formal, signed WARN agreements. The sample plan outlines critical operating procedures and provides step-by-step instructions for creating new, or improving existing procedures. The sample operational plan also provides instructions for integrating WARN member utilities into WARN operations before, during, and after a water event or emergency.

Tabletop Exercises

One of EPA's most recent WARN support initiatives is the development of tabletop exercises that enable WARN members to practice implementing the WARN agreement. The purpose of these exercises is to practice using WARN features such as activation protocols, response activities, and coordination with state and local emergency management agencies, state primacy (regulatory) agencies, and other agencies. In addition, the tabletop exercises will enable participating utilities and agencies to define more precisely and realistically their roles and responsibilities. At the most fundamental level, the exercises also provide a forum for participants to identify missions for WARN and goals for WARN steering committees.

EPA is developing the exercise content based on needs identified by current WARN member utilities. The exercises will be scenario-based, and include participant and facilitator guides. An initial exercise was conducted with Florida WARN (FlaWARN) to test out the materials. The Exercise Design Team responsible for developing the scenario was able to quickly and easily modify EPA's sample materials to develop a hurricane scenario for this exercise. Several participants commented that it was the best exercise they had ever attended in their careers. EPA plans to support additional tabletop exercises for both well-established and newly-forming WARNs once the materials are finalized.

Beyond State-Level Response: Interstate Mutual Aid/EMAC

As the WARN concept has taken hold, its design and implementation have continued to evolve. Utilities in states located in close proximity to one another geographically are interested in expanding the water utility mutual aid and assistance concept across state lines to create interstate mutual aid agreements. One option for sharing resources across state lines is EMAC—the Emergency Management Assistance Compact. Managed by the National Emergency Management Agency (NEMA), EMAC is the only mutual aid program ratified by the U.S. Congress to which all 50 states and the District of Columbia are members. Since EMAC requires a formal emergency declaration, many utilities are interested in developing WARN to WARN agreements. An understanding of state laws that govern interstate sharing of resources is currently being evaluated to determine how this concept could be implemented.

CONCLUSIONS

In response to threats from natural disasters and human-caused events, the water sector in the United States has partnered to adopt mutual aid concepts that enable effective mutual aid and assistance programs to operate within states and even across state lines. Partnering with industry associations and local, state and federal government agencies, utilities have used the WARN program to establish mutual aid networks within many states. In addition, states have begun using the WARN approach to outline the framework for interstate mutual aid programs. U.S. EPA is fully committed to the WARN concept, and is supporting the development of WARN through extensive outreach, facilitation, and technical support.

For additional information on WARN, visit the WARN information Web site (www.NationalWARN.org), or contact John Whitler of U.S. EPA (whitler.john@epa.gov).

REFERENCES

U.S. Department of Homeland Security, 2007. National Incident Management System. National Integration Center Incident Management System Integration Division, Washington DC, United States. http://www.fema.gov/emergency/nims/.

U.S. Department of Homeland Security, 2008. National Response Framework, Washington DC, United States. http://www.fema.gov/emergency/nrf/.

U.S. Department of Homeland Security, 2007. National Infrastructure Protection Plan, Washington DC, United States. http://www.dhs.gov/xprevprot/programs/editorial_0827.shtm.

U.S. Department of Homeland Security and U.S. Environmental Protection Agency, 2007. Water Sector-Specific Plan, Washington DC, United States. http://www.dhs.gov/xlibrary/assets/nipp-ssp-water.pdf.

American Water Works Association, 2006. Utilities Helping Utilities: An Action Plan for Mutual Aid and Assistance Networks for Water and Wastewater Utilities, Denver, United States. http://www.awwa.org/files/Advocacy/Govtaff/Documents/Utilities_Helping_Utilities.pdf#White paper.

Defending Drinking Water Supply Systems – An Active and Efficient Preventative System to Evade Sabotage of Drinking Water Supplies

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ABSTRACT

The world-wide toxicological threat by terrorism and criminal actions on water supplies for human consumption has several severe technical and security challenges. The perpetual threat on drinking water storage facilities constitutes a potential hazard in the free world since 9/11. As a result of terror threats and anti-terrorism actions, large efforts are being invested to prevent attacks on society.

Water resources are prone to attack using minimum resources and can result in large-scale fatalities due to toxification. Moreover, the possibility of contaminating and damaging drinking water supplies using semi-toxic agents (that do not result in large fatalities) and inflicting human casualties by anti-government activists as part of a fanatical objection should also be taken into account.

As a consequence of the wide distribution of water storage facilities their protection by security organizations responsible for drinking water safety is an arduous task. Because the number and spectrum of toxicological agents are very large and time is a crucial factor, preventative monitoring of drinking water supplies using chemical, bio and physical sensors is a very large undertaking requiring huge financial and human resources. Accordingly, the successful achievement of this undertaking using "analytical" strategies is a matter of prediction.

In this presentation we will describe active approaches featuring fool-proof innovated devices and versatile customized sensor and alerting systems guaranteeing water storage facility safety. RAVEN-PROTACT and RAVEN-OREN water defense strategies eliminate the need to monitor water quality on line using various analytical methods and devices for identification of innumerable types of chemical and biological toxicants.

Prohibited terrorist intrusion will result in immediate flagging of security authorities and immediate shut down of flow by innovated valves thereby preventing flow of contaminated water down the conduits to public utilities for consumption.

After threats have been positively detected, alerts given and water flow has been terminated, the contaminated and hazardous water in the storage or processing facilities can be then be analyzed in an attempt to detect toxic substances. The RAVEN-PROTACT and RAVEN-OREN systems are effective with and without these analytical procedures.

RAVEN ENVIRONMENTAL SECURITY TECHNOLOGIES - PROTACT and RAVEN-OREN water defense systems also include customized risk assessment, threat evaluation and vulnerability analysis of the possible course of terrorist actions taking into consideration local resources, site characteristics, counter actions and security requirements resulting from various types and level of threats.

INTRODUCTION

The attacks in North America and other parts of the free-world since 9/11, transformed terrorism into a threat that can severely agitate the public, create cracks in the sense of personal security and compromise the power of deterrence exercised by states victimized by terrorism. Unconventional terror threats in the hands of terror-sponsoring states or various movements and organizations and internal criminal acts, constitute a grave potential threat of far-reaching implications in terms of the potential causality toll and required response. Terrorist activities in various parts of the world are increasing at an alarming rate and according to anti-terrorist experts, will increase at a sharper rate. Fanatic terrorist organizations are continuously striving to attack important infrastructure facilities that provide essential services to the civil population and consequently cause immense and irreparable damage to property and human lives.

A critical threat is utilization of lethal chemicals and biological combat and/or radiological materials. This threat can materialize through a wide variety of possible scenarios and is mostly addressed by thwarting attacks, deterrence, and preparedness for immediate response to an incident aimed at containing it to a small area and minimizing damages.

As a result of terror threats and anti-terrorism actions, large efforts are invested to prevent attacks on society. However, water resources are prone to attack using minimum resources. Moreover, the possibility of contaminating and damaging drinking water supplies using semi-toxic agents (that do not result in large fatalities) and inflicting human casualties by anti-government activists as part of a fanatical objection should also be taken into account. As a consequence of the wide distribution of storage and supply, water protection by environmental and security organizations responsible for drinking water safety is an arduous task.

A drinking water storage facility is a prime target for such attacks. At the present time, water storage facilities are defended mainly by post event and not by preventative measures. Because the number and spectrum of toxicological agents are very large and time is a crucial factor, preventative monitoring of drinking water supplies using chemical, bio and physical sensors is a very large undertaking requiring huge financial and human resources. Among the scientific community, a wide range of chemical and physical sensors have been proposed to determine the presence of primary toxicants in water supplies. However, the successful achievement of this undertaking using real-time "analytical" strategies is a matter of prediction. Moreover, there are innumerable obscure and poorly defined biological agents and chemical compounds that can be introduced easily into a city and suburban drinking water supply. In certain cases even very small concentrations of a lethal agent will cause massive loss of life or injury. Consequently, at the present time, these hi-tech devices can only be deployed after terrorist contamination has occurred. Thus, it is clear that there is an urgent need for effective and cost saving solutions to defend water supplies and protect communities against this global hostile threat.

The world-wide toxicological threat by terrorism and criminal actions on water supplies for public consumption and in food and pharmaceuticals industries has several severe technical and security challenges. The aim of attacking drinking water and drinking water facilities is to cause very large health threats and disruption of water supply to the public. Among the various scenarios of terrorist attacks against drinking water storage facilities and pools include the following possible scenarios:

a. Breaching facilities using car bombs and other explosive devices, to be detonated adjacent to the water facility and its structure.
b. Perpetration of an armed or unarmed attack targeting the main water pipe carrying water out of the facility.
c. Compromising drinking water quality by breaching the water storage facility and introducing highly toxic reagents by unconventional means by injecting the reagents into the water pool through an overhead opening, Injection into the water pipe.

CHARACTERISTICS OF STORAGE FACILITIES

In most areas of the world, water for domestic, recreational and medical-pharmaceutical uses is stored in local storage containers that vary substantially in volume from 500- 10000 m^3 (e.g., surface cement tanks, concrete and steel water towers, plastic tanks on roofs). Storage facilities are also employed in purification plants. These containers, constructed of concrete, Ferro alloys and plastic, have the following characteristics: Sealed water storage tanks, input pipes from principal sources such pumping stations, boosters and treatment plants and outlet pipes to consumers. As a result of the geographic location of these containers (e.g., sole source to secured users or source to large communities in urban and also in isolated districts), every storage facility has unique characteristics requiring risk and security assessment, and individual operational solutions for design of its defense system.

These containers can be divided into two groups:

a. Large storage facilities supplying water to suburbs, housing centers, etc.
b. Storage tanks amounting to located on roofs of high rise buildings that supply water for drinking, bathing and recreation.

In both cases at present, these containers can be characterized as follows:

a. They are closed
b. A pipe is installed to rejuvenate water that is being continuously consumed. These water introduction systems do not possess exterior or interior valves
c. A delivery pipe exits from the container without valves
d. All these containers usually have a locked cover, which allows access mostly from the top, for water testing and maintenance (cleanup, water conditioning, etc).

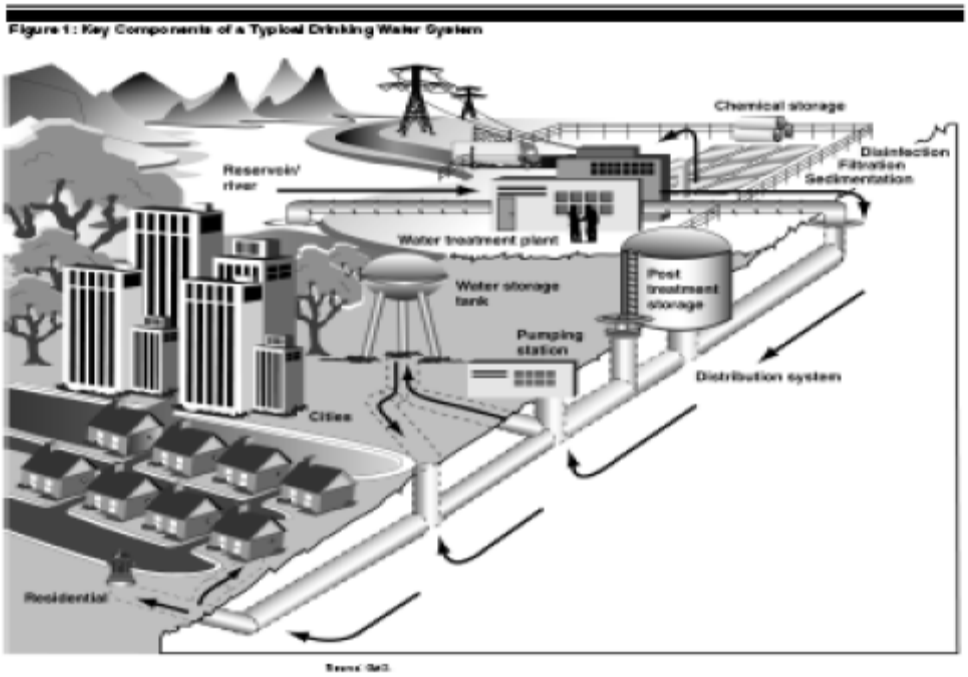
In this presentation we will describe the RAVEN active approach featuring fool proof innovated valve devices, a collecting system and versatile customized sensor and alerting systems guaranteeing water storage facility safety. Several aspects of risk assessment will be addressed.

TECHNICAL DESCRIPTIONS OF DEFENSE SYSTEMS

In general prohibited intrusion and other belligerent actions in the immediate area of the water storage facilities or the containers, aimed at introducing hazardous substances into the water, must be

an active system that will result in prompt alerting of security authorities that an incursion has taken place and that water flow down the conduits to public utilities has ceased.

Figure 1. Typical Drinking Water Distribution System (From Reference 2)



RAVEN-PROTACT VALVE-BASED SYSTEM

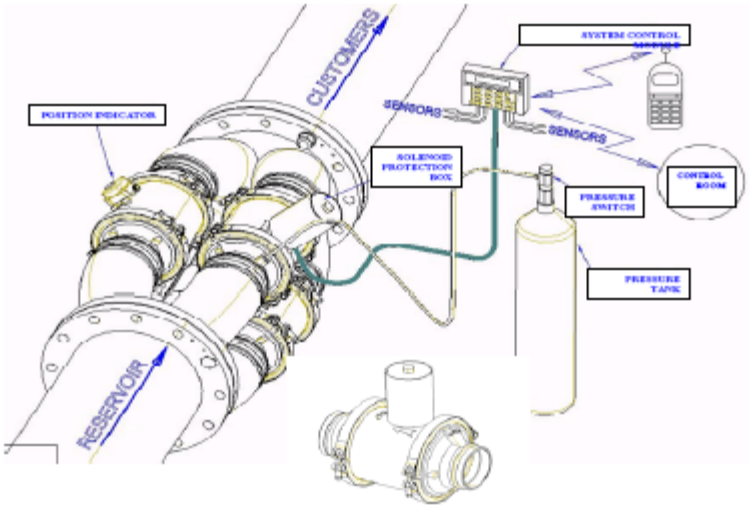
The patented Raven-PROTACT® water defense system consists of several subcomponents:

Control valve

The RAVEN-PROTACT® valve-based system (illustrated in Figures 2 and 3) is based on a fool-proof valve installed on the delivery pipes of the facility (Figure 4). Immediately on prohibited intrusion to the storage facility, this valve device shuts down resulting in prompt cessation and prevention of contaminated drinking water flowing down the conduits to public utilities for consumption with resultant fatalities or at the best injury to the consumer. Moreover, illegitimate manipulations of the valve also results in instantaneous termination of water flow from the water storage system.

The valve actuator is located in the center of the valve (Figure 2), surrounded by water flow, and cannot be accessed from the outside (in contrast to other valves, where the actuator is located outside the valve body and their operation chambers are exposed to bypass attempts).

Figure 2. RAVEN-PROTACT valve.



Control system

The electronic operation system controlling the valve funstions is located in a secured stainless steel box. Any attempt of sabotage or vandalism will automatically close the valve. The electronic system is connected to the valve module by voltage and communication wires that if disconnected, will cause the valve to close, with no possibility
of bypassing.

Figure 3. Configuration of 6, 16 " valve

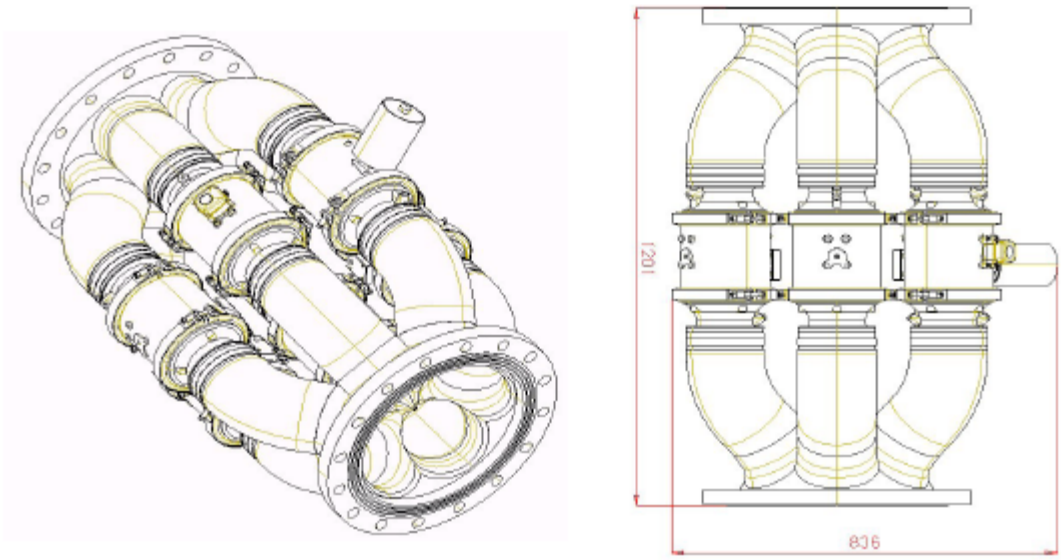


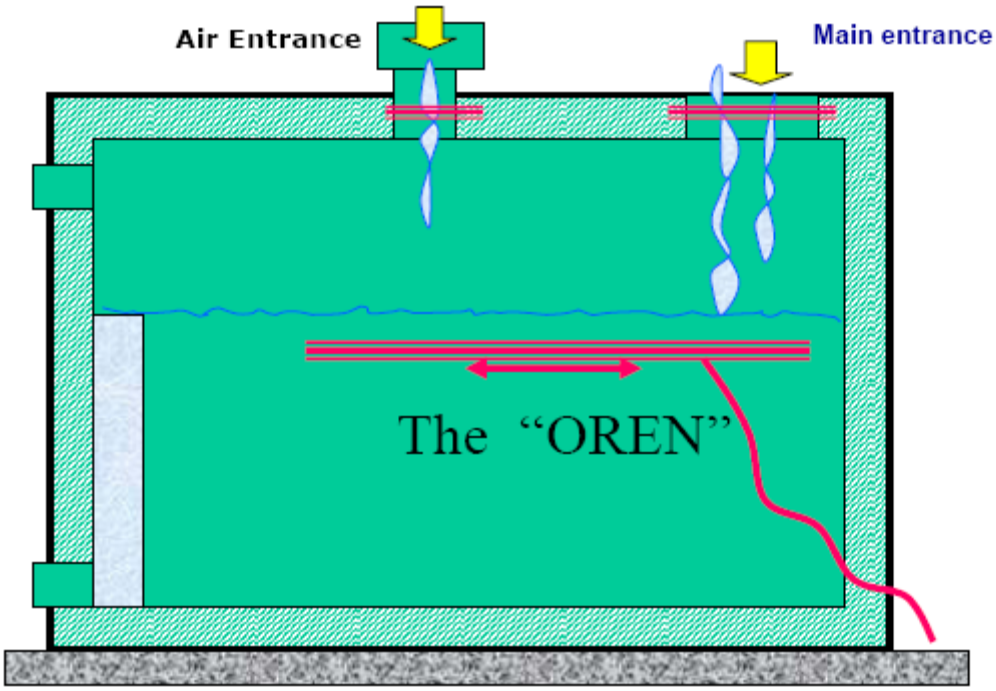
Figure 4. RAVEN-PROTACT valve system installed at the exit of a drinking water storage tank

RAVEN-OREN WATER DEFENSE SYSTEM

The RAVEN-OREN device is based on a concealed (to the hostile invader) customized, water supply protection system that protects and prevents direct contact between the contents of the water storage unit and exterior hostile and lethal materials via an several internal protection layers. I.e., installed inside the storage container (Figure 4). The external appearance of the protection layer of the storage unit does not reveal the "collection" unit thus creating a misleading visual image of multiple openings to the actual storage unit.
When the encroacher gains access to the container, removes the cover and introduces a toxic contaminant, into the storage unit, he "believes" that the water storage system has been "contaminated" with the lethal substance. In reality the toxicant has not reached the water but has been collected in the RAVEN-OREN system to be physically disposed from the system.

In comparison to the RAVEN-PROTACT system, which protects the perimeter and prevents water flow to the consumer, the RAVEN-OREN device is designed to protect the actual volume of the water storage facility.

Figure 4. The RAVEN-OREN device is based on a concealed water supply protection system that protects and prevents direct contact between the contents of the water storage unit and exterior hostile and lethal materials via several internal protection layers. I.e., installed inside the storage container



ALERTING SYSTEM AND SENSORS

In order to construct an effective alerting system associated with the valve and the in-tank device, the consumer should constructs possible access routes (vehicular, pedestrian, directions of approach) to the water storage facility and anticipate methods that could be used to insert the toxicant into the drinking water system. In both systems, incursion is detected and relayed via various security sensors, video and photo detection devices and automatic locks.

In the RAVEN-PROTACT system, selection of sensors and detector technologies configured in the alerting system controlling the valve device, takes into consideration the type of water storage facility, number and type of indications, and optimum integration of technological command and control systems needed to defend the facility. The extent of alerting defenses also depends on risk assessment, specific threats, belligerent actions and intimidations.

As in the case of the RAVEN-PROTACT system, intrusion in the RAVEN-OREN system is monitored by the so-called DEKEL electronic monitoring and control system that constantly monitors the internal protection layer. On intrusion into the storage container, the system transmits a signal to the communication and monitoring module notifying security officials and environmental officials that the liquid storage unit has been tampered with and that safety valves on the supply conduits have been activated.

The DEKEL alerting system can be installed in all pipes varying in diameter from 1" to 24". Before installation the device is cocked and calibrated to the required sensitivity and set according to the direction of the liquid flow. The device can be activated mechanically and/or by a remote electronic

signal. Vibrations caused by exterior tampering of the pipe will also activate the device. Once activated the Dekel will automatically seal off the pipe and terminate flow.

RISK ASSESSMENT

An essential part of the water defense strategy, is risk assessment. In general, it is essential to perform threat analysis and risk assessment of possible scenarios that could be pursued by various terrorist organizations in order to construct an efficient deterrence plan to evade sabotage of drinking water supplies.

Raven Water defense systems includes customized risk assessment, threat evaluations and vulnerability analysis of the possible course of terrorist actions taking into consideration local resources, site characteristics, counter actions and security requirements resulting from various types and level of threats.

After a detailed study is made of the water system operation, points of vulnerability and failure in the existing security deployment, four levels of risk are defined in accordance with the following geographical and potential threat scenarios

a. Proximity to problematic areas
b. Geographical location of the water storage facility (isolated, enclosed, community secured)
c. Supplying water to nationally and publicly sensitive sites

Three levels of threat are defined: **A** – Highest threat level (high-priority protection), **B** – Moderate threat level, **C** – Relatively low threat level.

CONCLUSIONS

- The threat by terrorist and from criminal vandalism on water supplies is of major concern.
- Deviation of water quality due to these actions result not only in health threats and fatalities but also in a tremendous loss of national resources
- If toxicants are positively identified, then the RAVEN-PROTACT and the RAVEN-OREN systems are indispensable for immediate termination of water flow to the consumer.
- In both systems, the hostile intruder will be unaware that a water defense system exists and is unable to identify their presence.
- RAVEN-PROTACT and RAVEN-OREN strategies eliminate the need to monitor water quality on line using various time consuming analytical methods and devices for identification of innumerable types of chemical and biological toxicants.
- In both devices, after threats have been positively detected, alerts given and water flow to the consumer has been terminated, the contaminated and hazardous water can then be analyzed in an attempt to detect toxic substances. The both systems are effective with and without these analytical procedures.
- However, if various analytical devices for on-line identification of innumerable types of chemical and biological toxicants in drinking water are installed and implemented on drinking water storage systems, there is no guarantee that these will be identified.
- Detection sensors able to secure the perimeter of site and access to the specific water storage facility, can be customized in accordance with local resources, counter actions and security requirements resulting from various levels of threats.

- A RAVEN Water Defense system is a public insurance policy that ensures that the consumer and the supplier will not be threatened by terrorist and criminal actions. Providers with this shield will gain the trust of the public and as a result possesses enhanced reputation that will provide positive points in marketing and in sales and prevent financial disasters and litigations.
- In both cases, deployment of the system requires top-secret confidentiality and only a limited amount of people will be able to have the knowledge of its existence at each location.

REFERENCES

1. United States General Accounting Office. Report to Congrssional Requesters. June 1997. Drinking Water. Information on the quality of water found at Community Water Systems and Private Wells. GAO/RCED-97-123
2. United States Government Accountability Office . Testimony before the Subcommittee on Environment and Hazardous Materials, Committee on Energy and Commerce, House of Representatives, September 30, 2004
3. United States Government Accountability Office Experts' Views on How Federal Funding Can Best Be Spent To Improve Security. Statement of John B. Stephenson, Director Natural Resources and Environment GAO-04-109ST
4. United States General Accounting Office, Report to Congressional Requesters, July 2003 Freshwater Supply, States' Views of How Federal Agencies Could Help Them Meet the Challenges of Expected Shortages GAO-03-514.
5. United States General Accounting Office. Report to the Chairman, Committee on Environment and Public Works, U.S. Senate. January 1999 Safe Drinking Water Act. Progress and Future Challenges in Implementing the 1996 Amendments GAO/RCED-99-31

2008 NEMC Proceedings

NANOTECHNOLOGY

Detection and Quantitation of Nano Materials in Water and Wastewater: An Analytical Methods Review

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ABSTRACT

Current focus on nano-material production has revealed that no clear treatment technology is in place for nano-materials in water influent or wastewater effluent. The toxicity of nano-materials indicates that aquatic systems may be impacted by this material if the effluent is left untreated. Conversely, receiving streams for wastewater effluent become source water for water treatment. The same concerns about toxicity for aquatic systems are now applicable to the water plant's end users. Analytical methods for detection of nano-materials in a water or wastewater matrix are needed. A literature review of current research analytical procedures will be presented with the emphasis on techniques that can be utilized by government, commercial and municipal laboratories.

Nanoparticle Analytical Analysis

Literature Review of Various Techniques

Dr. Edward F. Askew
LaβServe Technical Director

Current Concerns for POTWs

- Whole Effluent Toxicity (WET)
- Plant Toxicity
- Treatment Options
  - Membrane Filtration
  - Chemical Precipitation
- Digester Sludge
  - 40 CFR 503 Regulations
- Industrial Pretreatment
  - 40 CFR 403 Regulations

Nanoparticle Industrial Uses

- Material property modification
  - Composites
  - Plastics
  - Metal castings and extrusions
- Electronics
  - Solid state devices
  - LED and Plasma Screens
- Paints
- Cosmetics
- Pharmaceuticals
- Diagnostics

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Industrial Pretreatment

- No Categorical Standards exist for nanoparticles as a specific pollutant.
  - Particle formula, size and toxicity.
  - Treatment BMP or BET for direct or indirect dischargers.
  - General chemical reactivity for discharge.
    - Corrosive, flammable, reactive, color, and odor
- Significant Industry Standards have no guidance from Regulatory Agencies.
  - Impacts on the treatment works or upon the quality of effluent from the treatment works.

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Digester Sludge
• Land Application Requirements in 40 CFR 503 are not adjusted for new pollutants.
• POTW does NOT want their digester sludge defined as hazardous under 40 CFR 261.
• NO GUIDANCE for indirect industrial dischargers
– BMP
– BET
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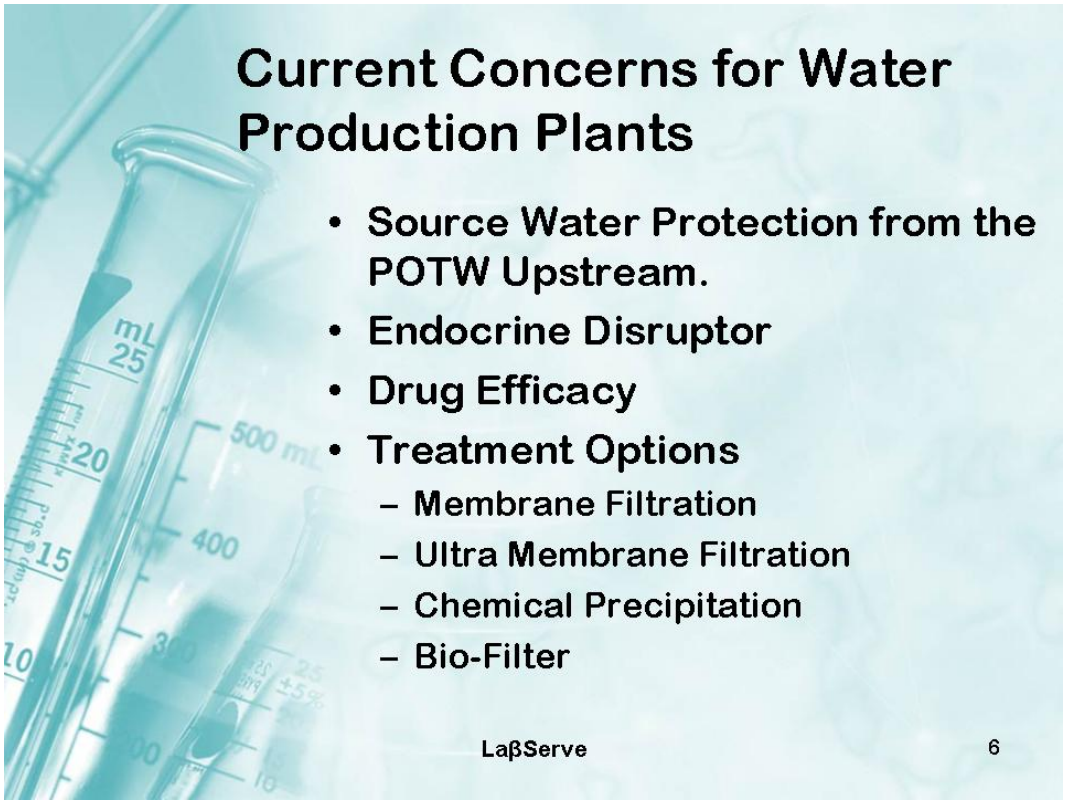
Current Concerns for Water Production Plants
• Source Water Protection from the POTW Upstream.
• Endocrine Disruptor
• Drug Efficacy
• Treatment Options
– Membrane Filtration
– Ultra Membrane Filtration
– Chemical Precipitation
– Bio-Filter
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Current State of Affairs with Nanomaterials

Whole Effluent Toxicity

C&E News, April 5, 2004

FROM THE ACS MEETING

Buckyballs Damage Bass Brains

Juvenile largemouth bass living in aquariums contaminated with 0.5 ppm of nanometer-sized, water-soluble C_{60} aggregates develop brain damage and other signs of physiological distress, according to the first toxicity study of engineered nanoparticles in aquatic species. Eva Oberdörster, a toxicologist at Southern Methodist University, Dallas, who led the study in collaboration with Rice University's Vicki L. Colvin and Christie M. Sayes, presented the work on March 28 at the ACS national meeting in Anaheim, Calif.

After 48 hours of exposure, the fish appeared to be fine, swimming about the tank normally. However, examination of their brains revealed dramatic damage, as measured by lipid peroxidation. Oberdörster found no similar lipid peroxidation in the fish's livers or gills, but she did observe evidence of altered gene expression.

USDA PHOTO/KEN HAMMOND

Oberdörster isn't certain how the buckyballs reach the brain. But she says it could be possible that the particles travel directly to the brain via the olfactory nerve—a result that emphasizes the importance of inhalation studies of engineered nanoparticles in mammals.

While Oberdörster cautions against alarmist interpretations of her results, she expresses concern for industrial workers who may someday come in contact with large amounts of fullerenes. She says that, along with further research into nanoparticles, scientists "need to assess their toxicity before releasing them willy-nilly into the environment."—BETHANY HALFORD

14 C&EN / APRIL 5, 2004

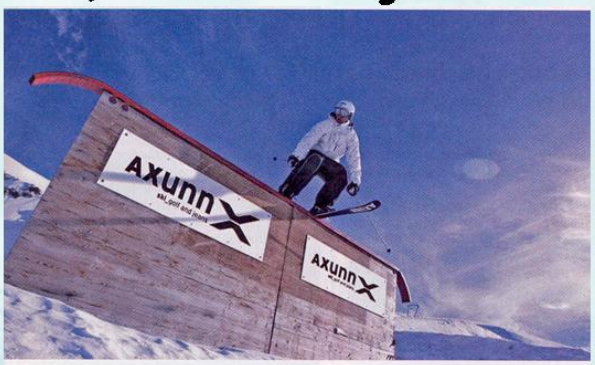
Industrial Secrecy

GROUPS ENCOURAGE NANOMATERIAL STEWARDSHIP

C&E News, July 21, 2008

- Industry trade groups that represent nanotechnology companies are urging their members to join EPA's voluntary **Nanoscale Materials Stewardship Program (NMSP)**.
  In a joint statement issued on July 14, the American Chemistry Council's Nanotechnology Panel, the Nano Business Alliance, and the Synthetic Organic Chemical Manufacturers Association's Nanotechnology Small & Medium Enterprise Coalition highlighted the importance of the program in helping EPA make informed regulatory decisions about nanomaterials. **"Information collection under the NMSP is a necessary step for EPA to better understand the potential health and environmental effects of nanoscale materials and to determine if any regulatory changes are needed,"** the groups wrote. Since EPA launched NMSP in January 2008, **only four companies** have provided basic information about their nanotech products. The agency expects only **about a dozen** more to do so by the program's July 28 deadline. Initially, EPA expected to receive information from more than **200 firms**. If participation in the pro- gram remains weak, the trade groups warn, EPA is likely to make it mandatory.

So, Here They Come!



CARBON NANOTUBES BY THE METRIC TON

Anticipating **NEW COMMERCIAL APPLICATIONS**, producers increase capacity

ANN M. THAYER, C&EN HOUSTON

Analytical Problems

- Nanoparticles are defined by:
  - Size
    - 1 nm-200 nm
    - Metallic, molecular, atomic
  - Shape
    - Spherical
    - Prismatic
    - Rods
  - Surface Treatment
    - Uncapped
    - Capped
- None of these characteristics are defined by Standard Methods tests

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Nanoparticle Terms

- Phonon: A quantum of vibrational or sound energy in a crystal lattice or solid: often characterized as being heat energy.
- Plasmon: The quasiparticle resulting from the quantization of oscillations from phonons.

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Nanoparticle Physics (cont.)

- More recently surface plasmons have been used to control colors of materials.
- This is possible since controlling the material's surface shape controls the types of surface plasmons that can couple to it and propagate across it. This in turn controls the interaction of light with the surface.

Detection Physics

- Nanoparticle bond vibration interactions with probe source.
- Scattering phenomenon of probe energy.
- Molecular orbital formation.
  - Plasmon
- Molecular orbital transitions.
  - Phonon
- Luminescence of excited states.
- UV-vis Absorbance.
- Electrochemical Redox
  - (Reversible or Irreversible)

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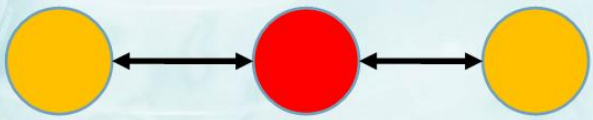
Molecular Vibrations

Asymmetric Vibration

SymmetricVibration



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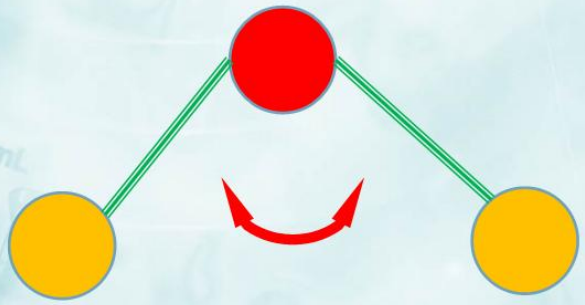
Molecular Vibrations

Bend or Scissor Vibration



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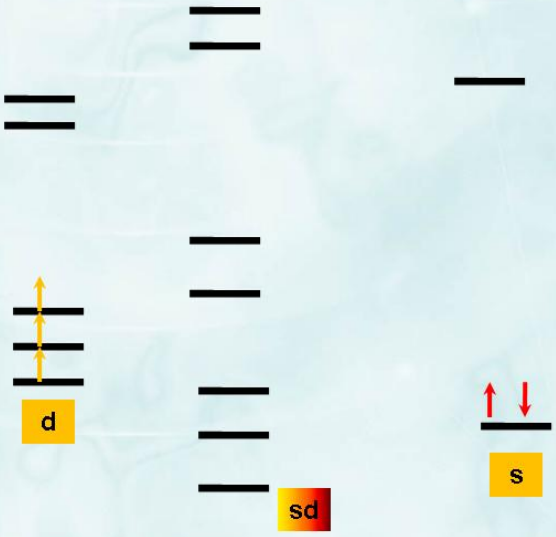
Molecular Orbital Formation



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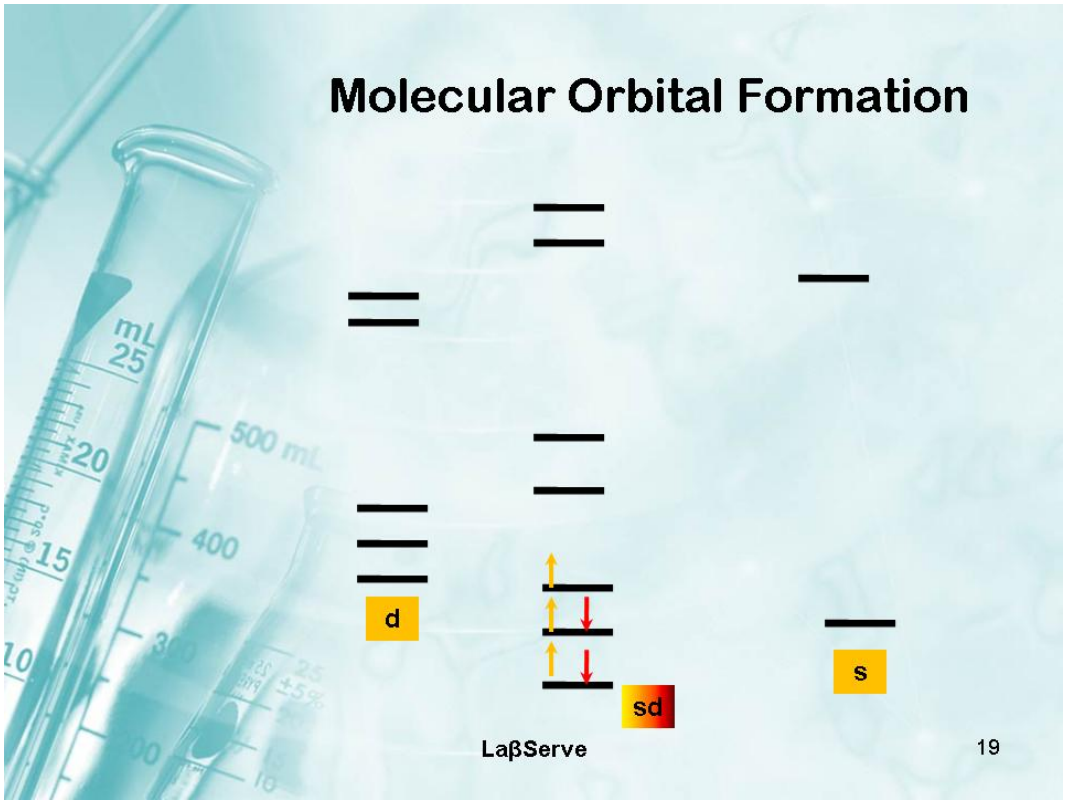
Molecular Orbital Formation
d
sd
s
LaβServe
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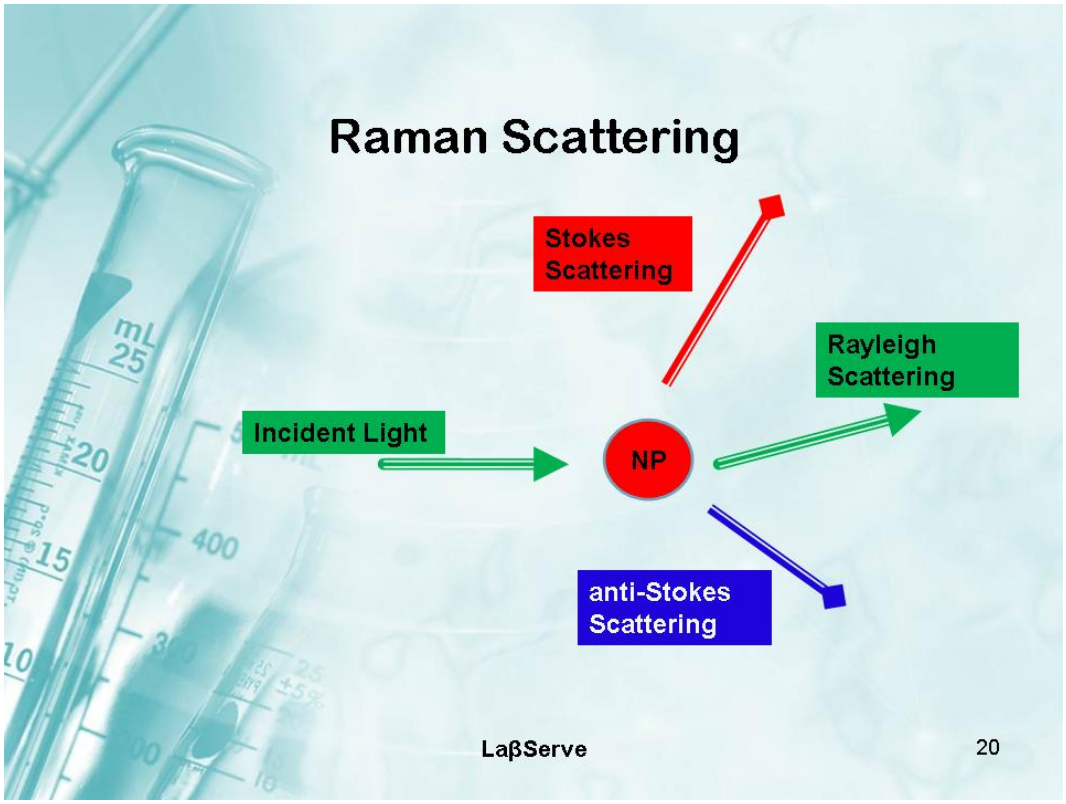
Raman Scattering
Stokes Scattering
Rayleigh Scattering
Incident Light
NP
anti-Stokes Scattering
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Particle Size Raman Influence

Meier (2006)

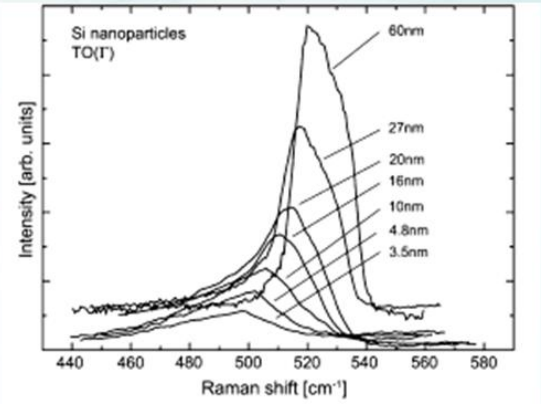

Fig. 2. First-order Raman spectra for silicon nanoparticles with BET diameters between 3.5 and 60nm.

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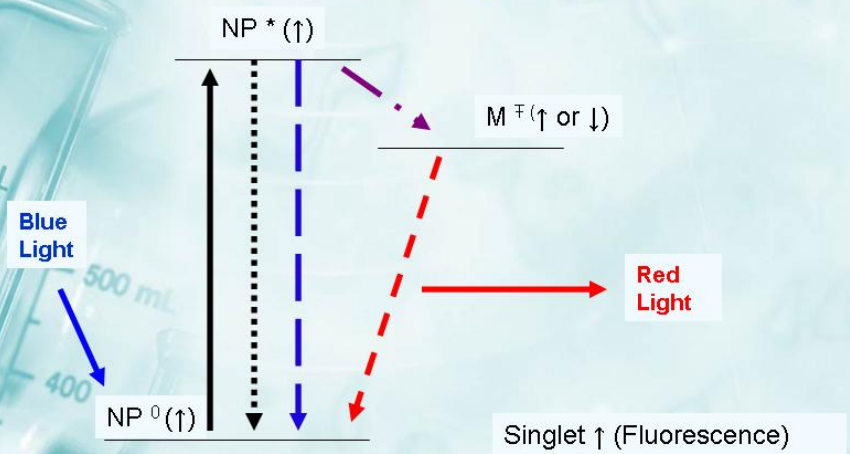
Photo Luminescence



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Nanomaterial Luminescence Fe/Zn Ratios 15% to 40%

Jin (2008)

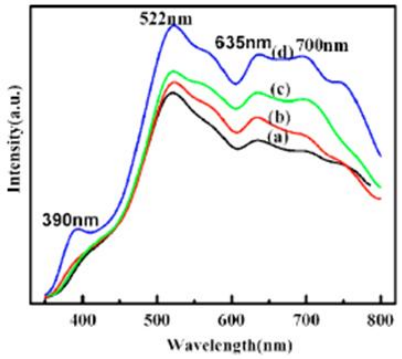

FIG. 4. (Color online) PL spectra of samples acquired at RT: (a) F/Z-15, (b) F/Z-20, (c) F/Z-30, and (d) F/Z-40.

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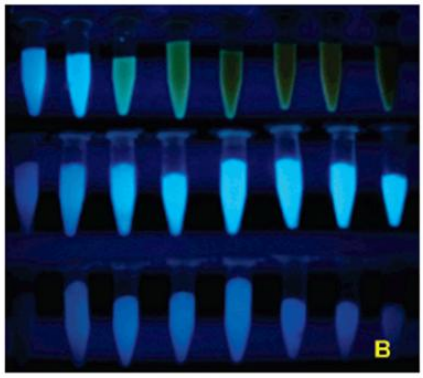

Images of Silica NPs prepared with varying percentages (3-80%) of APTS and heated at different temperatures. (B) 300 nm UV illumination

The concentration of NPs is 10 mg/mL in DI water.

Wang (2008)

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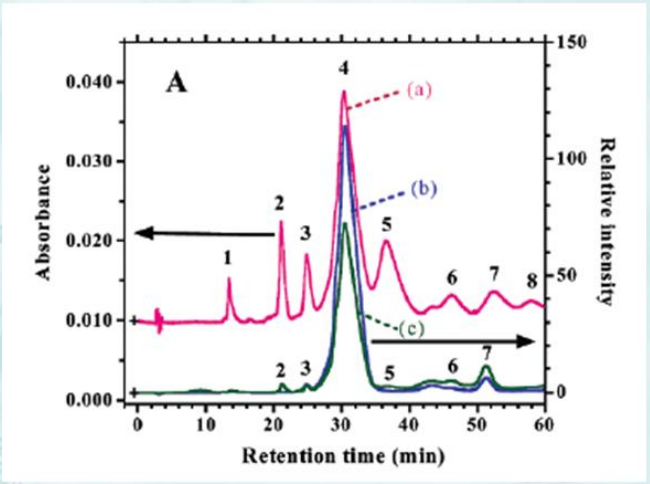
UV-vis Absorbance / Luminescence

Choi (2006)

Au_{75} MPC



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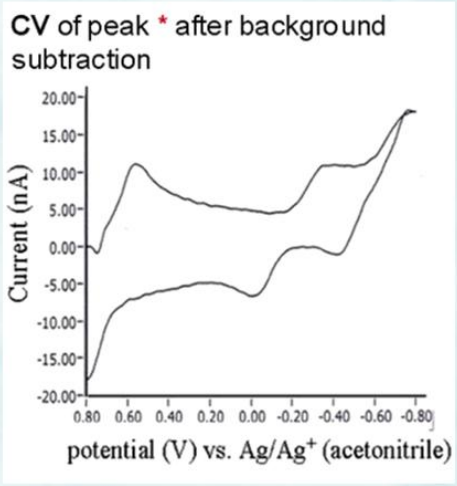
Electrochemical Redox By CV

Song (2004)

Au_{38} MPC



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Separation and
Purification Methods
and Technology
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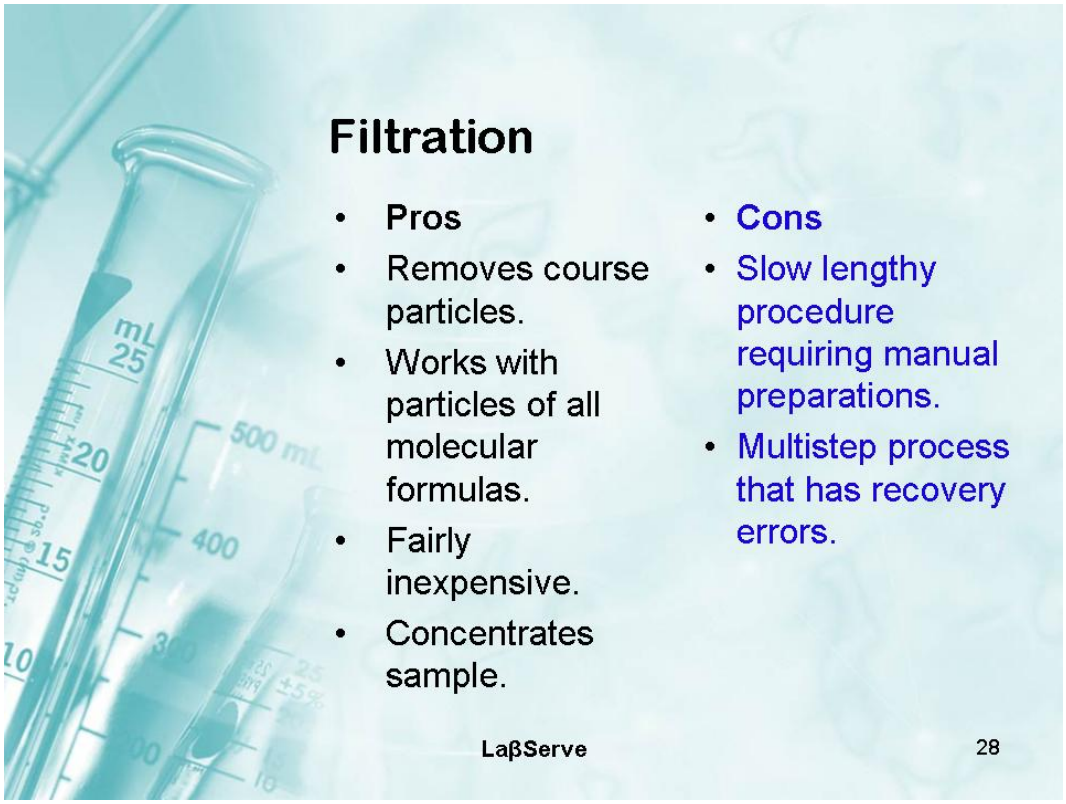
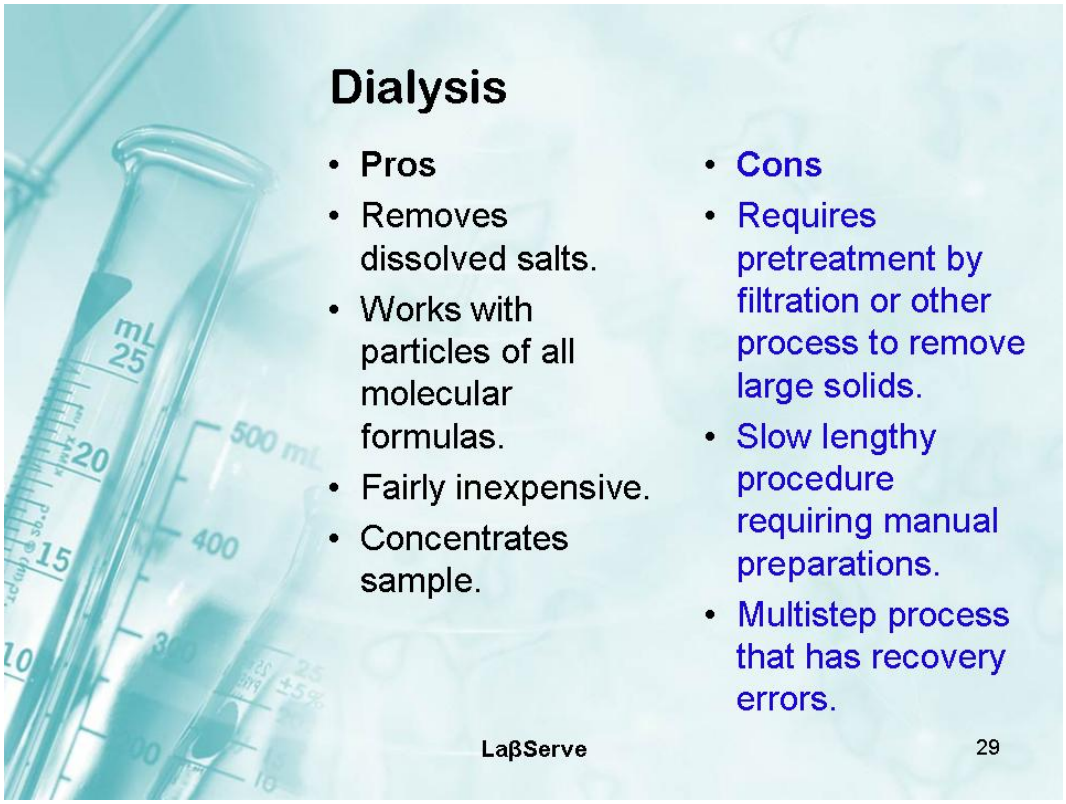
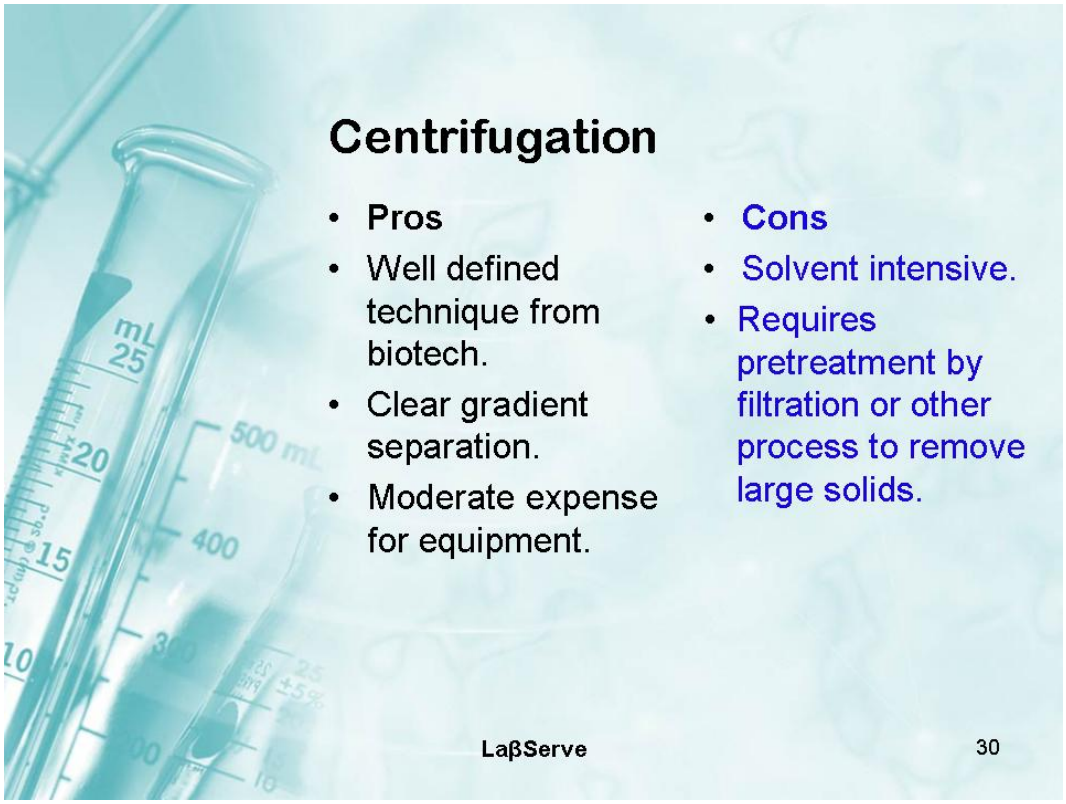

Filtration
Pros
Removes course particles.
Works with particles of all molecular formulas.
Fairly inexpensive.
Concentrates sample.
Cons
Slow lengthy procedure requiring manual preparations.
Multistep process that has recovery errors.
LaβServe
28


Dialysis
• Pros
• Removes dissolved salts.
• Works with particles of all molecular formulas.
• Fairly inexpensive.
• Concentrates sample.
• Cons
• Requires pretreatment by filtration or other process to remove large solids.
• Slow lengthy procedure requiring manual preparations.
• Multistep process that has recovery errors.
LaβServe
29


Centrifugation
• Pros
• Well defined technique from biotech.
• Clear gradient separation.
• Moderate expense for equipment.
• Cons
• Solvent intensive.
• Requires pretreatment by filtration or other process to remove large solids.
LaβServe
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Size Exclusion Chromatography

- **Pros**
- Well defined analytical technique.
- Can be scaled to large columns.
- Can be semi-auto or auto equipment.

- **Cons**
- Higher expense for equipment.
- Requires more R&D for new analytes.
- Requires pretreatment by filtration or other process to remove large solids.

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Ion Pair Reverse Phase HPLC

- **Pros**
- Well defined analytical technique.
- Can be scaled to large columns.
- Can be semi-auto or auto equipment.

- **Cons**
- Higher expense for equipment.
- Requires more R&D for new analytes and **Ion Pairs.**
- Requires pretreatment by filtration or other process to remove large solids.

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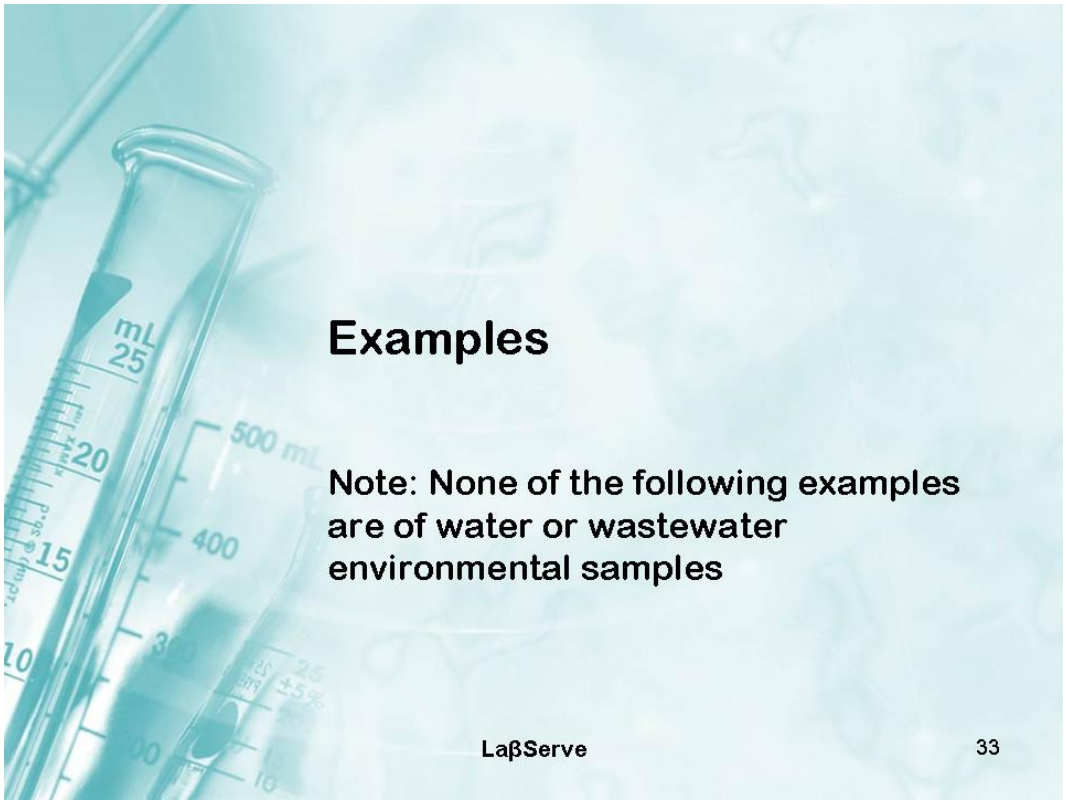
Examples
Note: None of the following examples are of water or wastewater environmental samples
LaβServe
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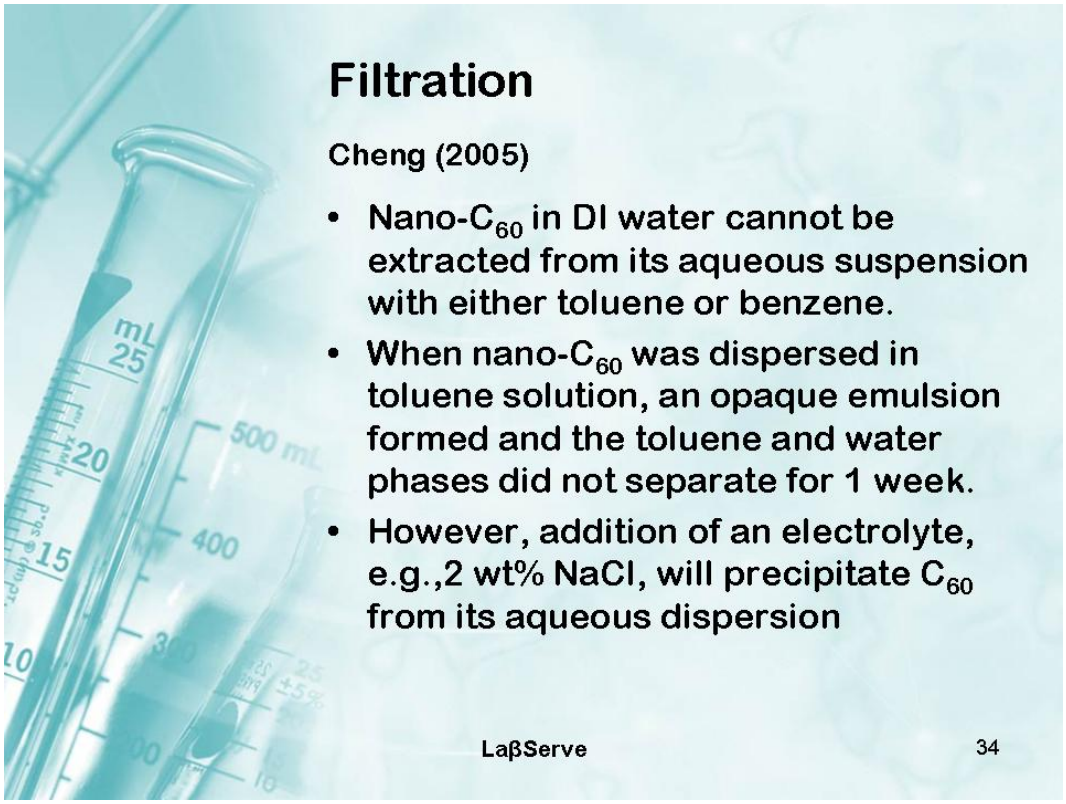
Filtration
Cheng (2005)
• Nano-C_{60} in DI water cannot be extracted from its aqueous suspension with either toluene or benzene.
• When nano-C_{60} was dispersed in toluene solution, an opaque emulsion formed and the toluene and water phases did not separate for 1 week.
• However, addition of an electrolyte, e.g.,2 wt% NaCl, will precipitate C_{60} from its aqueous dispersion
LaβServe
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Filtration

Cheng (2005)

- The resultant nano-C_{60} suspension was cooled and was filtered through glass fiber (1 μm nominal pore size, Fisherbrand, Fisher Scientific.) to remove larger aggregates.
- To measure nano-C_{60} concentration, a nano-C_{60} sample was filtered with 20 nm Anodisc ® filter membrane.
- The nano-C_{60} on the membrane was dissolved in toluene and the nano-C_{60} concentration in toluene was measured spectrophotometrically.

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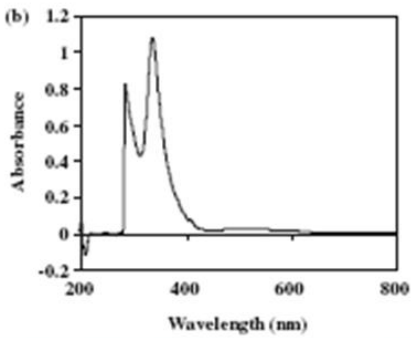
The absorption spectra showed clear C_{60} characteristic peaks at **336** nm and **407** nm



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Centrifugation and Size Exclusion Chromatography

Novak (2001)

- bis(p-sulfonatophenyl)phenylphosphine (BSPP)
- Ligand exchange was accomplished by adding 1 mg/mL of the disodium BSPP salt to the nanoparticle array suspension and stirring for 4 h.
- The water-soluble BSPP-capped nanoparticle array mixture was centrifuged in 1M aqueous sucrose solution.

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- Density gradient centrifugation was used to separate particles with different densities.
- The centrifugation speed was increased systematically to increase the g force. Thus, the method used here is a stepwise g-force density centrifugation.
- The sample was rotated at an initial
- rate of 2500 rpm for 30 min. The rotation rate was then increased by 500 rpm every 30 min until a final rate of 6000 rpm was reached.
- Fractions were collected from the bottom of the centrifuge tube after each 30 min. increment.

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- Purifying gold nanoparticles by size exclusion chromatography has the same complications as centrifugation plus the additional problem of irreversible adsorption to the stationary phase.
- This was prevented by using an aqueous mobile phase containing 40 mM sodium dodecyl sulfate (SDS) buffer, as described by Wang and coworkers for purifying metal nanorods.
- The size exclusion chromatography contained a Waters UK6 injector, 590 programmable solvent pump,

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- and Rainin Dynomax UV-C single wavelength UV-vis detector set at 525 nm (λ_{max} for the single particle plasmon absorbance).
- A 500- and a 350-Å pore diameter silica microsphere GPC column were mounted in series (Alltech, Inc.).
- Injection volumes were 25 μL for all samples studied.

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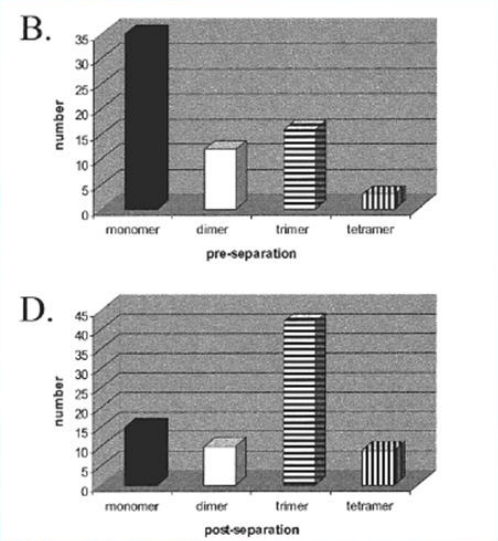
Results



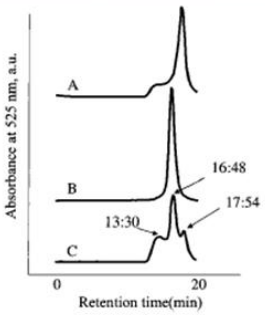


Figure 4. Chromatogram showing retention times of (a) 10-nm-diameter gold monomers, (b) 30-nm-diameter gold monomers, and (c) a 1:1 mixture of 10- and 30-nm-diameter gold monomers.

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Ion Pair Chromatography

Choi (2006)

- **Au Monolayer Protected Clusters**
- The chromatography was carried out with a Waters (Milford, MA) instrument consisting of a model 600 controller pump capable of gradient elution; a model 2996 PDA and a model 2475 multiwavelength fluorescence detector.
- PDA spectra (1.2 nm resolution) were taken over 250-800 and 280-800 nm for N-acetyl-L-cysteine MPC and tiopronin MPC eluates, respectively,

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- whereas fluorescence (10-nm resolution) was monitored respectively at 540-740 and at 580-780 nm, exciting at 400 nm.
- The chromatographic column (150 4.6 mm i.d. stainless steel) was packed with 5-μm C18 bonded silica with 300-Å pore size (BioBasic-18, Thermo Electron Corp., Bellefonte, PA).
- The mobile phase contained $Bu_4N^+F^-$ as ion-pairing reagent, MeOH as organic modifier, and phosphate buffer.

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- An aqueous solution of $Bu_4N^+F^-$ and NaH_2PO_4/Na_2HPO_4 buffer (total phosphate concentration 0.050 M, with proportions giving pH values from 4.5 to 7.5) was mixed with the desired volume of MeOH to prepare the mobile phase, which was filtered through a 0.4-μm HTTP Isopore membrane filter (Millipore, Billerica, MA) and, during chromatography, sparged with a stream of He.
- The mobile-phase flow rate was 0.70 mL/ min, and the column temperature was 23 (± 1 °C. The column was pre-equilibrated with at least 40 mL (at 0.70 mL/min) of each mobile-phase composition.

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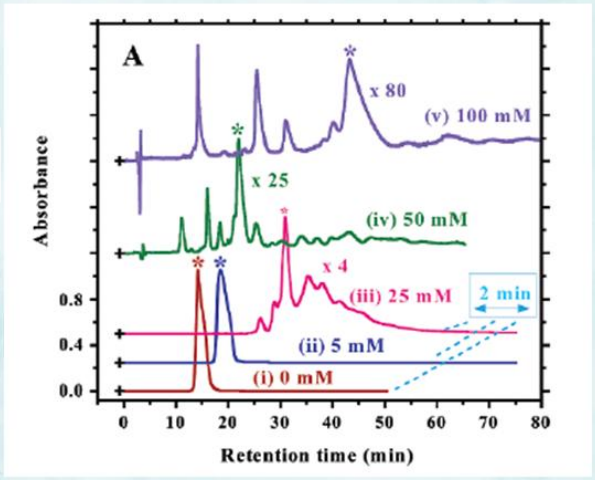
Results

Ion Pair Concentration



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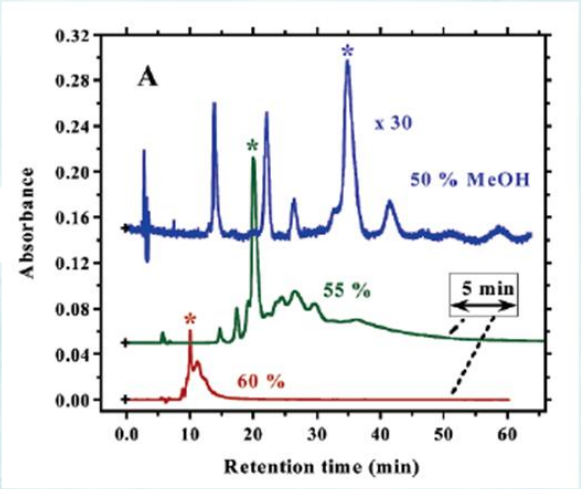
MeOH Concentration



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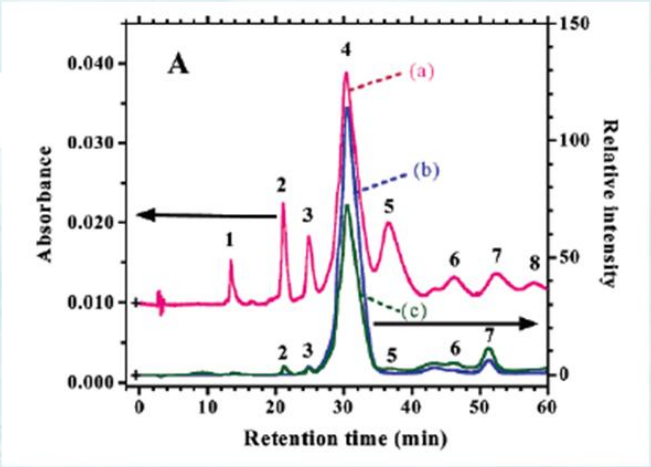
Separation on the C18 column using a mobile phase (1:1) MeOH/0.025 M, pH 4.5, phosphate buffer containing 55 mM [$Bu_4N^+F^-$] (a), pink absorbance chromatogram detected by PDA at 400 nm (offset for clarity) and (b) blue and (c) green, fluorescence detection at 640 and 720 nm, respectively, with excitation at 400 nm.

Absorbance & Luminescence



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Current Problems for Wastewater and Water

- No current research is published on general or Standard Methods for determination of nanoparticles in our matrix types.
- Toxicity impact of nanoparticles on aquatic or terrestrial life is not known.
- NO GUIDANCE FROM:
  - EPA
  - State Agencies
  - Consensus Bodies (Standard Methods, ASTM, etc.)

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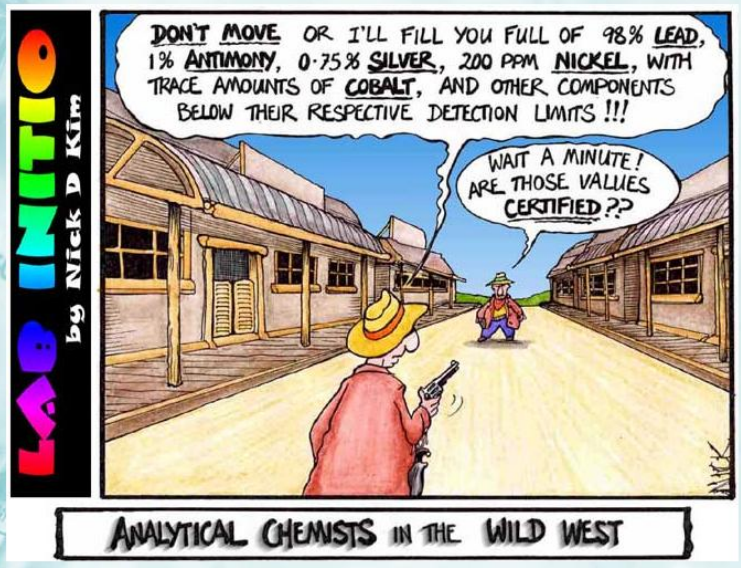
Suggested Solutions

- Formation of ad hoc group at the 2008 NEMC made up of members:
  - EPA
  - State Agencies
  - Consensus Bodies
  - Analytical Laboratories
  - Instrument Manufacturers, Others.
- Set up process to compile, review and test methods for nanoparticle analysis in matrixes of concern.
- Transfer knowledge to regulators

Questions



Nanocavity Sensor Array for the Isolation, Detection and Quantitation of Engineered Nanoparticles

Omowunmi A. Sadik, Spencer Robins, Sam Mwilu, Ola Habboub; Center for Advanced Sensors & Environmental Monitoring Department of Chemistry, State University of New York-Binghamton (SUNY), Binghamton, NY 13902-6000; 607-777-4132; osadik@binghamton.edu

ABSTRACT

Environmental nanotechnology—the science of engaging matter at the nanoscale level, and its potential application for "green" chemical products and processes, risk assessment, remediation, and exposure studies—offers a variety of new products and problems.[1] Although nanotechnology may change the way we live, but the incidental release of these materials into the environment creates associated risks that are difficult to monitor than those previously encountered. With this emerging technology, one area of specific interest to the EPA is the detection of engineered nanomaterials (ENMs) that can be accurately assessed and monitored.[2,3] The desired technology should be capable of in-situ, remote and continuously reflecting the concentrations of these materials, distinguish them from incidental nanomaterials resulting from combustion, industrial and anthropogenic sources as well as ultra fine natural materials such as pollen fragments, viral components, and other particulate matter that could affect human health.

In this presentation, we will describe the development of a multiplex, integrated capillary waveguide optical chem/biosensor for direct fixation, and spatial alignment and continuous monitoring of engineered nanoparticles. This sensor is capable of distinguishing between engineered nanomaterials (e.g. hybrid organic metal nanoparticles), and naturally occurring nanomaterials (e.g. dead bacteria, living bacteria, spores, viral components, or fungi) that may be present in the environment.

REFERENCES

1. Sadik OA, Detecting Engineered Nanomaterials, Journal of Environmental Monitoring, 9, 1154, 2007
2. The U.S. Environmental Protection Agency Nanotechnology White Paper, Science Policy Council, U.S. Environmental Protection Agency, Washington, DC, February 2007 http://www.epa.gov/osa/pdfs/nanotech/epa-nanotechnology-whitepaper-0207.pdf (132 pp, 4.1 MB, about PDF)
3. EPA's Strategic Plan, http://www.epa.gov/ocfo/plan/2006/entire_report.pdf(PDF); (b) Nanotechnology and the Environment, Report of the National Nanotechnology Initiative Workshop, May 2-3, 2003 http://nano.gov/NNI_Nanotechnology_and_the_Environment.pdf (66 pp, 1.8 MB, about PDF).

AUTHOR INDEX

NATIONAL ENVIRONMENTAL MONITORING CONFERENCE PROCEEDINGS 2008

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