

# Power Plant Chemicals

Hot Topic agenda and knowledge  
system program

# Power Plant Chemicals Agenda

- The format is collegial and discussion is encouraged
- The session is being recorded and will be available to all power plants world wide at no charge. Will be used for decision making but also training
- Speakers
  - Overview - Bob McIlvaine, McIlvaine
  - Brad Buecker, Kiewit Power Engineers
  - Colleen Layman, HDR
  - Tom Muilenberg, MIOX
- Jeff Tate of Agape is available to review previous presentation, Sampson presentation will be posted, Light unable to attend

# Power Plant Ultrapure Water Market

World power Plant ultrapure water costs in 2015			
Generation type	MW (1000)	Capital \$ millions	Consumable and repair parts \$ millions
Gas turbine new	70	2800	
Gas turbine existing	1200	2400	3000
Coal fired power new	90	7200	
Coal fired power existing	2000	8000	9,000
Nuclear new	9	900	
Nuclear existing	430	1000	1400
total		22,300	13,400

# Power Plant Chemicals Market- By Region \$ millions

World Region	2014	2015	2016	2017	2018	2019
- Select All	4,866.02	5,080.28	5,363.54	5,643.77	5,897.99	6,242.41
Africa	133.48	146.88	160.54	171.81	180.75	184.89
CIS	209.51	212.85	215.96	219.71	224.21	227.55
East Asia	2,354.47	2,543.13	2,745.93	2,942.21	3,128.69	3,310.00
Eastern Europe	177.42	184.34	189.72	200.04	207.31	215.86
Middle East	140.93	151.61	160.53	170.83	181.31	191.71
NAFTA	851.79	809.74	808.65	812.11	818.28	823.70
South & Central America	74.58	77.34	81.07	85.37	90.78	96.25
West Asia	419.71	450.65	495.22	534.72	605.41	675.54
Western Europe	504.14	503.73	505.93	506.97	461.26	516.89

# Power Plant Chemicals Market- Individual chemicals \$ millions

Subject	2014	2015	2016	2017	2018	2019
-Total	4,866.02	5,080.28	5,363.54	5,643.77	5,897.99	6,242.41
Activated Carbon	35.84	37.42	39.50	41.57	43.44	45.98
Chelants	329.99	344.51	363.71	382.71	399.94	423.29
Corrosion Inhibitors	2,407.96	2,513.90	2,654.02	2,792.64	2,918.35	3,088.77
Defoamers	138.95	145.06	153.15	161.14	168.40	178.23
Inorganic Flocculants	44.86	46.84	49.45	52.03	54.37	57.55
Ion Exchange	230.01	240.13	253.51	266.75	278.76	295.04
Odor Control	9.48	10.06	10.72	11.38	12.06	12.74
Organic Flocculants	103.13	107.67	113.67	119.60	124.99	132.29
Oxidizers & Biocides	173.67	181.32	191.42	201.42	210.49	222.78
pH Adjusters	36.15	37.74	39.84	41.92	43.81	46.37
Scale Inhibitors	1,352.95	1,412.47	1,491.20	1,569.09	1,639.72	1,735.48

# Processes

- Coal-fired , gas turbine combined cycle. Nuclear, and concentrated solar power plants all use the same technologies for purifying the water which is converted to steam to drive the electric generator.
- The major difference is that only a portion of the power is derived from steam generation in gas turbine combined cycle power plants. However, there is a unique additional need for ultrapure water in some gas turbine plants. In dry hot climates water is introduced through fogging nozzles to reduce the inlet air temperature to the turbine.
- The system includes a series of processes starting with purification of the raw water. Particulate soluble species and gases are removed. High purity is needed to avoid fouling in boiler tubes as well as high temperature corrosion.
- Treatment is required both for the new water entering the cycle and for the condensed steam

# Equipment and Consumables

- Equipment requirements are filters, piping, pumps, valves, ion exchange or electrodeionization units, feedwater heaters, deaerators, degasifiers, condensers and instrumentation.
- Consumables and repair parts include chemicals, seals, membranes, cartridges, pump and valve parts, sensors, i.e. resins, nozzles, packing etc. Corrosion inhibitors and anti scalant chemicals are a significant portion of the total.
- Due to the activity in Asia the investment in ultrapure water systems for coal-fired power plants in 2015 will exceed that of nuclear and gas turbine combined cycle plants combined.

# Knowledge System Concept

- Free services are now available to power plants around the world
- Chemical treatment is included in separate websites
  - [Degasification and Demineralization - Continuous Analysis](#)
  - [Power Plant Cooling - Continuous Analyses](#)
  - [Steam Generator - Continuous Analyses](#)
  - [CCR and Effluent - Continuous Analyses](#)

It is also integrated into complete systems for power plants

- [Gas Turbine and Combined Cycle Decisions](#)
- [Power Plant Systems and Components](#)

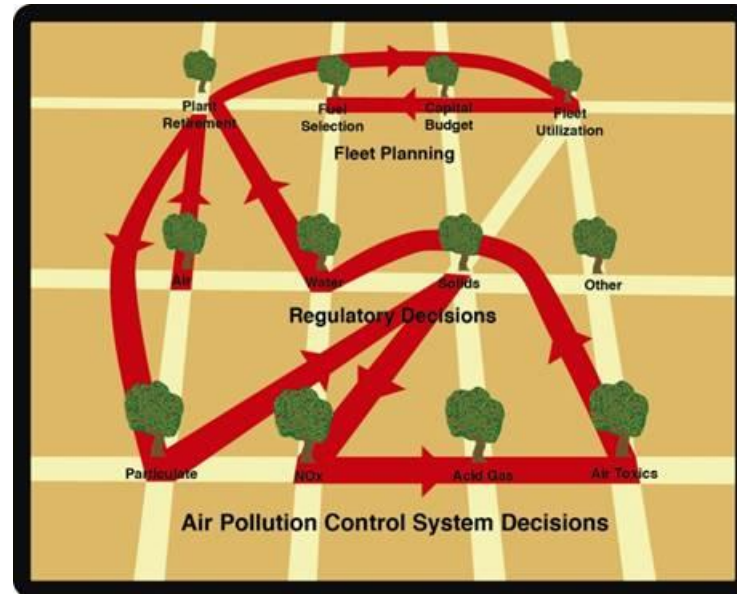


# Function of Knowledge Systems

- Empower power plants to select the best products and services
- Provide international knowledge and experience to developing countries
- Share knowledge among disparate geographies, technologies, and job functions
- Identify niche experts
- Cultivate greater expertise in narrower niches
- Lead power plants to other resources such as conferences, magazines, associations, and government services

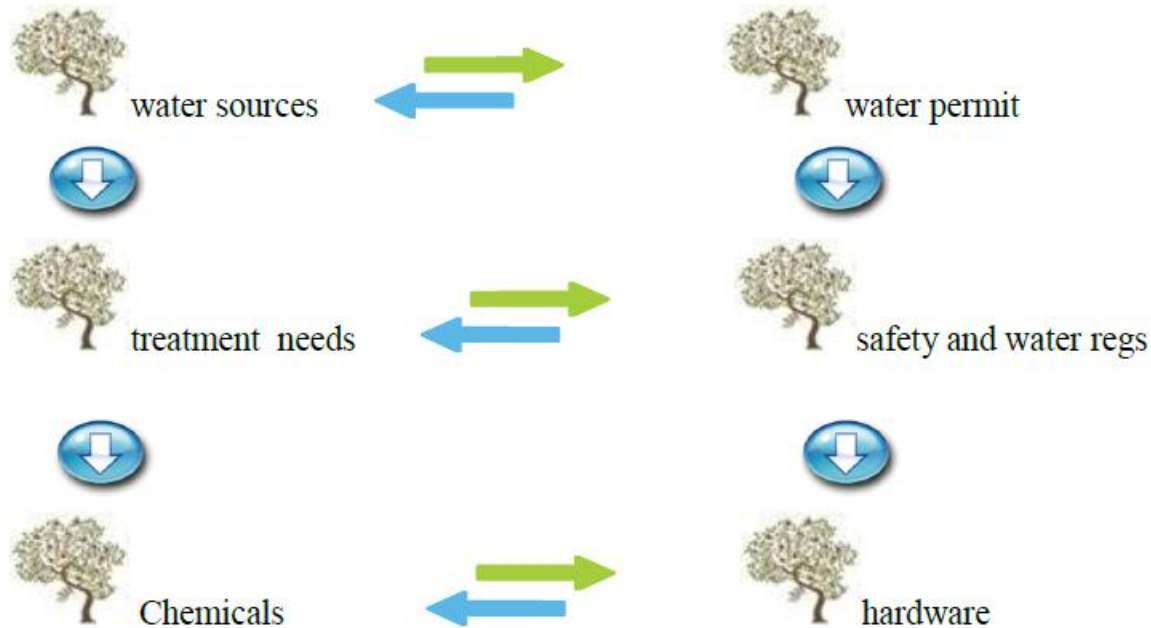
# Global Decisions System ( GDPS)

helps power plants make best  
decisions



# You need to revisit tentative choices based on findings at the next stop

## Decision Trees in UPW GdPS Route Map



# Decisive Classification of all options in Chinese and English

: Catalyst Maintenance

Major Class	Descriptor	Chinese Descriptor	Definition
Product	Cleaning Catalyst	催化? 除灰	A dry process that utilizes vacuum and compressed air to mechanically remove as much of the fly ash accumulation as possible.
Product	Regeneration Catalyst	催化? 再生	"Catalyst cleaning" followed by a wet chemical process to remove decay compounds plus re-impregnation of the catalytic compound(s).
Product	Rejuvenation Catalyst	催化? 复原	"Catalyst cleaning" followed by a wet chemical process to remove some decay compounds with minimum removal of catalytic compound(s). There is no re-impregnation of the catalytic compound(s).

# Identify every Chemical user and supplier with corporate identifier

Beijing Guodian Longyuan Environmental Engineering		1274	北京国电龙源环境工程有限公司
Beijing Guohua Renyuan Environmental Engineering		1275	北京国华荏原环境工程有限公司
Beijing Jingming Powder Metallurgy		754	北京精明粉末冶金有限公司
Beijing Longyuan Cooling Technology		2382	
Beijing Maoxiuxuri Environmental Filter		785	北京懋修旭日环保滤材有限公司
BeiJing Origin Water Technology		3639	
Beijing Scinor Membrane Technology		3640	
Beijing Tri-High Membrane Technology Company		3641	
Beijing Ziquan Energy Environment Technology		1276	北京紫泉能源环境技术有限公司

# Associations

- EPRI has continuing important efforts. The 1999 PWR Water Chemistry guidelines is a free download on their website [www.epri.com](http://www.epri.com)
- Water demineralizers by ion exchange is one of the VGB publications at [www.vgb.org](http://www.vgb.org)
- VGB's annual Conference "Chemistry in Power Plants" was held last October in Leipzig
- Western Turbine Users, 7F Users, Combined Cycle Users, D5-5A Users , Frame 6A users, 7EA users, ACC Users, 501F Users, 501 G users, Australian HRSG Users, HRSG Users.
- User group activities are well reported in CCJ

# Specialized Journals and conferences

- Combined Cycle Journal <http://www.ccj-online.com/>
- Ultrapure Water <http://www.ultrapurewater.com/>
- PPChem [www.ppchem.net](http://www.ppchem.net)
- [34th Annual \*\*Electric Utility Chemistry\*\* Workshop](http://www.conferences.uiuc.edu/eucw/)  
[www.conferences.uiuc.edu/eucw/](http://www.conferences.uiuc.edu/eucw/)
- [50 VGB Conference "\*\*Chemistry in Power Plants 2014\*\*"](http://www.vgb.org)  
[with ...www.vgb.org](http://www.vgb.org) › [Events](#) › [VGB Events](#)
- [Workshop - NPC \*\*2014\*\* SAPPORO Nuclear Plant \*\*Chemistry ...\*\*](https://www.npc2014.net/workshop.html)
- <https://www.npc2014.net/workshop.html>

# Using the Intelligence System

- **Product** Products are clearly defined
- **Process** Processes are less important on this subsidiary site but very important on the main site
- **Corporations** So Chemtreat would show up under Danaher. You need to click on subsidiaries to see the same info under Chemtreat
- **General Subjects** markets, maintenance etc
- **Locations** Countries ,states and cities
- **Applications** Sorted by NAICS code and Chinese descriptors



# Other search tools

- [Global Search](#) Search by any keyword
- [Person](#) Search by last name first
- [Subsidiary](#) So Hach instead of Danaher
- [Format of Information](#) presentations vs. articles
- [McIlvaine Keyword Search](#) Search by any text word in summary
- [Publication](#) Search by publication name
- [Publication Date](#)
- [Title](#) Very important because all articles are listed in chronological order and you can check for the latest inputs
- [Calendar of Events](#)

# EPRI Cycle Chemistry Guidelines for CCGT

- EPRI has issued third addition of Comprehensive Cycle Chemistry Guidelines for combined cycle/heat recovery steam generators
- The cover
  - All volatile treatment (AVT)
  - Oxygenated treatment (OT)
  - Phosphate treatment (PT)
  - Amine Treatment
- Purpose is to help reduce corrosion and deposition

# Newer challenges

- Use of municipal treated wastewater (Chemtreat article posted)
- Rapid cycling (reviewed in monitoring session earlier)
- Air Cooled Condenser and iron transport (reviewed in monitoring recording ) [Steam Generator - Continuous Analyses](#)
- Effluent standards [CCR and Effluent - Continuous Analyses](#)
- Zero liquid discharge