

USAMA KHAN

CHEMICAL PROCESS ENGINEER



+92-3457741844
+90-5334966466



usamakh@mail.ru
<https://cv.ukhan.org>



Current Location: **Türkiye, Osmaniye**
Ability to relocate: **Yes**



PROFILE

Hello! I am **Usama Khan**, 36 years old and here my objective is to provide my hard-earned functional knowledge to any engineering firm which is in the market for profit-generating yet professional manpower!

- Have been named **Young Process Innovator** in 2015 by Sitara Chemicals, Pakistan in recognition for developing & implementing **SPRD** (Statistical Process Review Database)
- Hired as the sole expatriate engineer by Akisan Kimya in Türkiye to lead the greenfield project through design, erection, and commissioning phases. Successfully brought the plant to full production capacity.



TRAININGS

- University of Michigan - Thermodynamics: Transferring Energy from Here to There (~12 Hours)
- University of Waikato-Data Mining with Weka (~5 Weeks)
- Udemy.com-SAP for Beginners (~8 hours)
- Udemy.com- ASPEN Plus Physical Properties (~10 Hours)
- Udemy.com- Mathematical tools for Thermodynamics (~5 Hours)
- Lynda.com-Excel Data Analysis & Forecasting (~3 Hours)
- Lynda.com-Up and Running with Excel What-If Analysis (~1.5 Hours)
- Lynda.com-Solving Optimization and Scheduling in Excel (~2 Hours)
- Udemy.com-Excel Pivot Tables Data Analysis Master Class (~5.5 Hours)
- Lynda.com-AutoCAD: Tips, Tricks, and Industry Secrets (~4 Hours)



LANGUAGES

- English**
- Urdu**
- Turkish**



PROFESSIONAL EXPERIENCE (14 Years)

SENIOR CHEMICAL PROCESS ENGINEER

SITARA CHEMICALS & CHLORALKALI | MARCH 2012 TILL JUNE 2019

The largest complex of caustic soda in Pakistan & also it is 2nd largest complex in Asia. It is a well-known ISO/9001-2000 (QMS) & ISO/14001-2004 (EMS) certified organization with SAP added system.

My job responsibilities include:

- ✓ Lead and participate in PHAs (Process Hazard Analysis) of PSM (Process Safety Management) processes such as:
 - Emergency handling in case of accidental chlorine leakage or caustic spillage
 - Ensuring availability of process safety information to operators
- ✓ Manage or assist in small capital and process improvement projects including:
 - Supporting Process queries and provide feedback calculations to ensure engineering requirements are understood and interpreted correctly
 - Resolving conflicting design requirements such as unsuitability of materials of construction, conformance with engineering design or equipment etc.
 - Perform PSSR (Pre Startup Safety Review) at commissioning
- ✓ Updating and following operational procedures for safe plant operation and prepare Lock out Tag out (LOTO) documentation for equipment's fitness for service, repair specifications, etc.
- ✓ Participate in month end closing accounting activities surrounding production, inventories, and utility usages

Following are the major plant units that I command & related KPI(s) Excellency I maintain:

- ✓ UHDE Cl₂ Electrolyzers (420MTD^[a]) & Asahi AKC Cl₂ Electrolyzers (200MTD) - Formulated & implemented a qualitative check of electrodes health using infrared temperature camera which indicated overvoltage hot-spots in buggy elements
- ✓ CAUSTIC & CALCIUM CHLORIDE 55 w.t% EVAPORATION (570MTD) - Short-circuited high steam pressure zone with lower pressure zone to extract flash steam from condensate & re-use it for heat exchange to reduce steam consumption
- ✓ COOLING TOWERS - Totaling a tonnage in excess of 2000TR I manage 3 Hamon-French cooling towers including inhibitor concentration, blowdown durations/frequency & guaranteeing 4 to 6 cycles of concentration for optimizing make-up water quantity. In addition mechanical aspects like fan rpm/angles & turbine health are also maintained

Projects I had commissioned:

York Absorption chillers 400TR (double effect & steam driven)

(DEC) 2012 - (MAR) 2013
700 MAN HOURS

- Supervised P&ID construction to ensure all instrumentation equipment and piping adhered to safety codes
- Implemented design changes and integrity / hydrotesting testing as required
- Planned & simulated load cycling schedule to best suit process needs

NUBERG India N₂ PSA unit (50Nm³/h) & Liquid N₂ storage

(SEP) 2014 - (DEC) 2014
300 MAN HOURS

- Designed & implemented N₂ pipe network computationally using ABZ DesigNET
- Evaluated peak consumption throughout plant and thus deduced nominal & average high-nominal factors (evaluated during emergency inert purge requirements) for SAP raw material consumption auditing

UhdeDenora 40MTD Gen.III BM2.7 Single® Electrolyzer

(JUL) 2013 - (MAR) 2014
1200 MAN HOURS

- Adding & Customizing SUPCON DCS algorithms using FTAs methodology
- DuPont NX-membranes Nitrogen pressure & integrity testing
- Ran equipment inventory reports in SAP & managed scheduling via Gantt Charts
- Designed vertical tubular exchangers for wet chlorine & hydrogen gases

Asahi Kasei 30MTD Acilyzer™ single Electrolyzer

(MAR) 2015 - (OCT) 2015
1700 MAN HOURS

- Conversion from Honeywell (PlantScape-R500) to SUPCON (AdvanTrol) DCS
- Performed extensive CapEx calculations & generated reports using SAP / EXCEL
- Added resin tower & its sequencing logic for additional ultra-pure brine requirement

HYSYS & UNISIM

- Rating valves, orifices... using vendor provided data against suspected process variations in a dynamic simulation
- Creating alarms & process disturbances using *Event Scheduler* to access control narrative
- Getting thermodynamic data for mixtures using UNISIM & DIPPR database
- Designing & running equation oriented *Spreadsheet & Optimization Solver* to tune a process parameter or to observe process parameters synergy

ABZ DesignNET

- Pipe Networks solver for deluge networks & or sprinkler system
- Rating of high throughput pumps & large mechanical valves
- Line sizing of gas / liquid networks
- Identifying gas 'choke' if happening at under-capacity valve or orifice

HTRI 6 & SSP G7

- Comprehensive *Thermal Design* of tubular & Plate Frame exchangers
- Exchange of thermodynamic data with UNISIM to embed this *Unit Operation* within a simulation
- Assist static engineers in mechanical aspects of exchangers i.e. baffles, nozzle, impinge plate...
- Can fully model phase changing (condensation / evaporation) tubular heat exchangers with non-linear temperature change curves across exchanger length

SAP ECC 6 R/3

- PP Module
- MM Module
- Resource Monitoring (via SAP ERP) & avoiding/minimizing resource-hoggy processes

SMATH STUDIO

- Frequently generate equation oriented calculations using SMATH for daily office usage
- Has generated numerous inhouse calculation worksheets for discrete sizing of equipment like horizontal / vertical tanks ullage, thermophysical predictions of lye, steam boiler ASME check procedures

Via self-endeavor I have taught myself various engineering applications enabling me to directly apply them in my engineering day to day tasks. Using modern methods of process data exploration & inference I have:

- ▶ I created a complete dynamic gas loop tester of Electrolyzer cell room using UNISIM which accounts for valve sizing, pressure control sequencing & alarm management. The model can be used to change electrical loads which effects gas amount generation & audits pressure controlling instrumentation efficacy in handling such amounts. Additionally user can invoke dummy process disturbance & check if instrumentation sizing is sufficient so as to pull the parameters back into stable states. The *stripped down* version & how it benefitted us in deciding valve sizes & auditing DCS alarm thresholds is comprehensively discussed in following article, case files / video are also available: [\[link\]](#)
- ▶ Pumping power is one of the major energy consumer in utility bills, especially those pumps that had to work 24/7. This applies to brine & caustic pumps especially as density of solution increases pumping power. I was given task to select a pump to avoid under or over-capacity problem. I used HYDROFLO & Tahoe Pump Database to come up with an optimized solution. The simulation & case files are discussed in an article available here: [\[link\]](#)
- ▶ Created single sqlite .db as a standalone relational database for previously 3 separate cell rooms (x9 Electrolyzers | x12 HCl synthesis furnaces), 3 separate brine systems & 3 Absorption chillers (with tons of separate spreadsheets) which now can be analyzed/correlated in terms of lab data, maintenance history, material consumptions, current efficiencies... This database allowed for multi-variable analysis especially of brine impurities (like Sulphate, Calcium, Strontium...) on electrode volt increase & whether the damage is temporary or permanent. This database allowed us to win a lawsuit against UHDE for premature coating failure of 160 bipolar electrodes. The information cannot be shared but you can contact my G.M Ops [Mr. Sarfraz](#)
- ▶ Inorganic aqueous solutions in concentrated form behave very non-ideally & thermophysical properties are difficult to get across a given temperature range. Such challenge I faced twice; first in designing a lye evaporative concentrator (the last effect was entirely damaged) then a new Calcium Chloride concentrator. I utilized ASPEN & DWSIM experimental data to 'regress' & achieve mathematical non-linear models that predict such behavior & only thereafter one can accurate model whole evaporation unit. The efforts can be previewed here: [\[link\]](#)
- ▶ Conducted Process research and analysis (computer aided simulation/statistical process control) that tests the technical feasibility & or optimizes, design, operation and performance of equipment, components and systems. I have applied these skills in pipe network re-routing for compressed nitrogen/air circuits to reduce pressure losses & increase occupational safety. I was able to create fitting distribution curves to hundreds of electrodes for deducing predictive health decay models, leading to accurate budget & energy planning. For the fiscal years 2015 & 2016 my proposed electrical energy requirements for electrolyzers fell between the accuracy of $\pm 3\%$. To have a quantitative way to audit compressor health is discussed in this article: [\[link\]](#)
- ▶ I was tasked to provide a specification sheet for Plate & Frame (P/F) heat exchanger for sulphuric acid during expansion of Chlorine Drying unit. Space constraints almost always come up in brownfield projects & P/F was naturally the choice. Using a free SMATH studio which provides a visual noncryptic way to understand mathematics & design equations involved I come up with a non-iterative method to provide vendor a specification sheet. This is discussed here (process / fluids are changed): [\[link\]](#)
- ▶ My data-driven dashboards based on Microsoft Excel pointed out 'make-believe' chemical/equipment suppliers (RO/Chiller additives & pump seals) based on usage/maintenance averageness
- ▶ Deciphered cyclic problems faced by shift/maintenance engineers by clearly identifying process-pest(s) using systematic API Code approach or custom tailored solution
- ▶ Trained fresh engineers & operators with a 'look-see' approach by building mockups of DCS/PLC & process networks using dynamic models in Geogebra & VBA driven Excel spreadsheets. My Control mockups slashed training periods from 12 months to less than 4 months, it also lessened operator post-turnover headache majorly faced by HR

REFERENCES

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MR. SHAHID SARFRAZ
 GM Operations, Sitara Chemical Industries Limited

Telephone: +92-3008668190
LinkedIN: <http://bit.ly/sarfraz-linked>
Email: sarfraz@sitara.com.pk
- 
MR. CALIX ALAJAR
 Piping Design Engineer, Saud Consult Khobar

Telephone: +966-531197234
Email: calixtoalajar@saudconsult.com
- 
MR. EJAZ ZAFAR
 Instrumentation Engineer, Saud Consult Khobar

Telephone: +966-563008201
Email: zafar@saudconsult.com

EDUCATION

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BACHELORS IN CHEMICAL ENGINEERING

University of Engineering & Technology Lahore | 2006 TO 2012
 -  The only student who solved Chemical Reactor problems in Fogler & Levenspiel textbooks using free Geogebra rather than the limited & trialware Polymath
 -  Showed the capability of wxMaxima to solve higher order differential equations & general engineering mathematics instead of the bloated & resource-hungry Maple
 -  Completely designed final year project 'Formalin production via Ethanol' using OpenSource LibreOffice, ChemSep & DWSIM on Linux rather than Microsoft Excel & HYSYS on Windows
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GCE O / A LEVELS

University of Cambridge Local Examination Syndicate | 2002 TO 2006

PROFESSIONAL EXPERIENCE CONTD...

PROCESS DESIGN ENGINEER

SAUDCONSULT, KSA | JULY 2019 TILL APRIL 2022

- ✓ Package creation like FEED, Detailed Engineering Packages (DEP) & Issued For Construction (IFC)
- ✓ PHA & HAZOP review, participation & implementation of recommendations in above mentioned packages
- ✓ Modification of existing & creation of new P&IDs using respective codes & standards of clients like ARAMCO, SABIC & MA'ADEEN groups
- ✓ Three-way interfacing with Client, Contractor & Vendor for successful execution of multiple Lump Sum Turn Key (LSTK) projects

Projects where I was part of designing team:

SABIC KAYAN BPA Automation (JUL) 2019 – (MAR) 2020 1300 MAN HOURS

- Devised control philosophy for previous manual operation through HYSYS Dynamics
- Relief sizing for fire scenario for BPA Phenol filters
- Rating of existing S&T phenol heat exchangers for fouling estimates
- Issue Instrumentation Spec Sheets for control valves, flowmeters & PRVs

Ma'aden Phosphate Sulphuric Acid

(DEC) 2020 – (NOV) 2021
2000 MAN HOURS

- Conveyance & pumping requirements of concentrated sulphuric acid
- Design of x3 P&F heat exchangers for hot sulphuric acid prior to storage
- Design of storage tanks safety instrumentation & SOP
- Automatic pH based identification of cooling water to identify gasket leakage in plate & frame exchangers

Ma'aden Aluminum Smelter Underground Leakage RCA

(JAN) 2022 – (APR) 2022
200 MAN HOURS

- Used HYTRAN underground water modelling to determine magnitude & identify water surge points
- Sizing of water bladder tanks
- Applied delayed logic in PLC to avoid abrupt valve closures
- Applied delayed RPM acceleration of water pumps during transient change overs

ARAMCO KJO Offshore Relief (SEP) 2019 – (MAY) 2020 800 MAN HOURS

- Designed & Sized multi-stage orifices for flare let-down system (86 to 2 barg). Siemen engineers finally provided the hardware
- Rated tail-line pipe sizing & selected material of construction for said blowdown
- Utilized UNISIM depressurization utility for transient pressure / temperature profiles

SABIC UNITED C20+ Loading Greenfield Project

(APR) 2021 – (FEB) 2022
1800 MAN HOURS

- Designed immersed heater for C20+ oil submerged tank
- Implemented a hybrid control philosophy for filling C20+ oil tanker via DCS as well as accepting manual operator on-field input
- Audited electric heat tracing against steam tracing suitability for viscous / wax-forming C20+ oil
- Relief-sizing for non-Newtonian fluid

YASREF Yanbu Steam PZV Study Under Jurisdiction ASME Section I » Section VIII

(SEP) 2021 – (FEB) 2022
400 MAN HOURS

- Waste Heat Boilers & Superheaters in x6 Claus units were modified so as to have no infringement with ASME Section I. Modification included a changeover relief valve for streamlining maintenance. It has to be noted no isolation b/w drum & relief can be added per Section I
- Some boilers manufactured per Section I were to be upgraded so as to be in compliance with Section VIII. Various calculations like wall thickness, nozzle inter dimensions, corrosion allowances were done as per Section VIII & then compared with existing boiler make
- Wrote SOP for changeover relief procedures during maintenance periods & approved with local legislative body



DESIGN FRAMEWORK

Humble Initiations ...

- ▶ Created 14+ hydraulic studies for brine, caustic & acid pumps. Were used to determine pipe sizes thereby reducing future OPEX
- ▶ Rated ~6 control valves specifically for gas service such as chlorine, hydrogen, steam & nitrogen. Was able to verify vendor datasheets & sizing basis. Whenever significant variation were observed vendor was asked for corrective action
- ▶ Decided 30+ sampling points & their positions taking in view toxicity of fluid, wastage allowance & operator ease of access. Based on these reports civil layout was either laminated to increase longevity of cement foundation.
- ▶ Plant layout was already finalized however careful attention was given to equipment orientation to reduce piping bends reducing man-hours & pressure drops

FABRICATION STAGE

Learning New Language ...

- ▶ During fabricating multiple equipment I came across the most diverse Turkish people. A major earthquake had allowed me to spend maximum time with my workforce & learn their language as well. I was now able to at least properly annotate equipment sketches in Turkish.
- ▶ Hydrogen line welding & related practices got my utmost attention. Dye penetration tests were performed rigorously. For chlorine & caustic lines especially those under high pressure; PN rating & thickness were calculated based on Aramco standards as I was well-acquainted with those
- ▶ Two-phase piping networks were meticulously examined to ensure free-flow by eliminating gas pockets. In-house calculations were regularly performed to determine the appropriate slope, ensuring a self-venting line design.

COMMISSIONING STAGE

Tough Nut To Crack ...

- ▶ Synergy is the study of multiple variables which are acting in unison; it is the reason behind commissioning being so difficult. Especially for gas systems I created dynamic (non-steady) models on UNISIM to study the effect of controlling one valve's set-point on other(s). Response time & lag was optimized through this method (PID tuning)
- ▶ Efforts were made to safely start & stop a process or an equipment. For the former a DCS chain-command was devised & for the latter paper checklist were written. Writing SOPs is not an easy task especially when you have little time in office & the trainees around you has little to no experience
- ▶ Line purging & cleanliness was given due diligence especially upstream of rotating equipment like pumps or compressors
- ▶ One thing I feel really proud here is the zero-time delay because of faulty instrumentation. In the aforementioned design phase I identified vital process variables & as much as possible created redundancy monitoring for those.



TECHNICAL MANAGER

AKINSAN KIMYA, TURKIYE | December 2022 TILL PRESENT

This plant can be truly said as my child. Looking back x2 years all seems so daunting. Now I am able to create an adequate team of youngsters that can perform daily tasks superbly. While the plant is proudly performing at 100% production there are yet following tasks that I endeavor to complete:

- ✓ Generating trainee materials for young engineers. This includes introduction to global engineering standards like ASME, AICHE ... I also weekly update assignments that are controlled centrally using Google Workplace to visualize individual performance. With experience at numerous multinational design firms, I have compiled extensive documentation to share. Despite the significant effort required, I have created an online digital library and a search engine to parse thousands of engineering-specific standards and documents for my team [\[link\]](#)
- ✓ Onsite training. Almost all engineers, operators & supervisors have little to no experience so workshops are essential to give them a know-how about equipment & process. Safety trainings (chemical & electrical) are currently outsourced
- ✓ Linked databases are made between process variables & results published by laboratory. I have gathered immense experience to create relational tables & provide insightful correlations using raw data. This helps to predict equipment failures & point out excessive raw material usage.
- ✓ I have also took part in setting up management workflows & digitize those workflows. For instance equipment order, quotations & inventory list keeps always in sync thanks to Google Sheets
- ✓ Throughout the commissioning phase, we implemented numerous small but frequent modifications across the plant. Now that the plant is operating smoothly, I am overseeing the generation of *as-built* engineering drawings. These drawings will be instrumental in future projects, ensuring safe and efficient interfacing with the existing infrastructure.

Projects where I am currently involved in:

Installation of 200TPD HCl / Steam Co-Generation Furnace

(JAN) 2025 – (MAR) 2026
2000 MAN HOURS

- Used Korf Hydraulics estimated new pumping power requirements & line size adjustments
- Sized & fabricated adequate buffer tanks to suppress gas transients as predicted by UNISIM simulation
- Generated *to-scale* equipment layout drawings using opensource LibreCAD. Taught this skill to trainee engineers on how to realistically & efficiently route lines avoiding conflicts at design stage
- Documentation related to project management such as Gantt chart, Tie-point list, Tag-list, Conflict Resolution List was shown & taught to trainee engineers
- Cl₂ & H₂ dehydration units (heat exchangers & H₂SO₄ washing towers) were rated for increased gas duty
- Increased capacity of acid vapor recovery system to suppress emissions of fumes to environment from storage tanks

Installation of Steam powered Absorption LiBr Chiller

(JAN) 2025 – (SEP) 2025
1000 MAN HOURS

- The presence of a steam cogeneration furnace requires efficient steam utilization. The current chillers operate on a compression cycle. My extensive experience with Lithium Bromide (LiBr) chillers will enable the company to achieve significant annual savings on electricity bills
- A steady steam supply is a critical parameter for the efficient operation of an absorption chiller. Therefore, the control valve is rated and verified against the vendor's specifications. Additionally, I installed a back-pressure auto-regulator (pilot type) to maintain constant pressure towards the chiller
- To ensure proper control of water chemistry, sufficient sample points and analysis methods are documented to provide accurate and reliable results.