



جامعة الإمام عبد الرحمن بن فيصل

IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

عمادة خدمة المجتمع والتنمية المستدامة

Deanship of Community Service and Sustainable Development



SDG 6.5.3

Sustainable Water  
Extraction  
Technologies

2023-2024

## Table of Contents

1. Introduction.....	3
2. Modern Water Irrigation System Equipment at IAU.....	3
3. Water Sanitation and Storage Tanks.....	5
4. Rain Water Harvesting.....	8
5. Desalination of Water at IAU.....	9
6. Water Treatment Plant at IAU.....	12
7. Periodic Inspection and Repair of Water Pipes at IAU to prevent Water Pollution.....	18
8. Services provided by Wastewater / Organic Analysis Lab of IAU..	20
9. IAU Participation in Sustainable Water Management.....	22
9. Marine Pollution control - Field visit.....	24
10. EnviroSpill conference.....	25
11. Saline water conversion corporation visited IAU.....	26
12. Water Desalination and Treatment Unit of IAU.....	27
13. Water And Wastewater Consultation and Engineering Solutions....	28
14. Integrated Environmental Solutions and Consultancy Office.....	33
15. Water extraction technologies on associated university grounds.	37

## 1. Introduction

IAU utilize sustainable water extraction technologies on associated university grounds on campus.

## 2. Modern Water Irrigation System Equipment at IAU





### 3. Water Sanitation and Storage Tanks





Water Sanitation and Storage Tanks



Water Sanitation Unit

## 4. Rain Water Harvesting



**Place for Rainwater Harvest at IAU, KSA**

## 5. Desalination of Water at IAU



**Brakish water well Reverse osmosis desalination, IAU, KSA**



**Water recycling at full swing in IAU Campuses**



## 6. Water Treatment Plant at IAU



Water treatment plant at IAU



**Water Conservation and Purifying plants**









**Operating Pressures for Water**

## 7. Periodic Inspection and Repair of Water Pipes at IAU to prevent Water Pollution

Through the Directorate of University Campus, IAU periodically inspects the water pipes and timely responds to the water leakage issues across the campus with enough equipment and workforce to prevent water pollution.



**Water Pipes periodically inspected and repaired for any leaks or worn outs**



**Monitoring Water pipes regularly for preventing leakages and water pollution**

## 8. Services provided by Wastewater / Organic Analysis Lab of IAU

The IAU Environmental Engineering Laboratory is a teaching & research facility that affords students pro-active prospects to explore for all kinds of fields comprising of **water treatment, solid waste, wastewater treatment, and air-pollution control**. The IAU comprises of nine laboratories with necessary sufficient space, instrumentation, and other dedicated devices for laboratory courses offered in the undergraduate program: water chemistry, environmental microbiology, physical and chemical processes, and microbiological processes, in addition to the usual analytical equipment and other pilot-scale treatment modules.

### Wastewater/Organic Analysis Lab

#### *Equipment/Service*

- Gas chromatography coupled with mass spectrometry (GC-MS)
- Ion chromatography
- High-performance liquid chromatography (HPLC)
- Radioactivity Meter
- Solid phase extraction system
- Furnace
- Rotary evaporator
- Automatic titration unit

<https://www.iau.edu.sa/en/colleges/college-of-engineering/labs-and-equipment/environmental-engineering-laboratories>

### Laboratory Analysis and Environmental Services offered by IAU

[https://www.iau.edu.sa/sites/default/files/resources/price\\_list\\_for\\_env\\_analyses\\_-\\_2017.pdf](https://www.iau.edu.sa/sites/default/files/resources/price_list_for_env_analyses_-_2017.pdf)

## Wastewater/Organic Analysis Lab

### Supervisors

**Dr. Ismail Anil**

**Email:** ianil@iau.edu.sa

**Location:** College of Engineering, A13 Building

### Equipment/Service

- Gas chromatography coupled with mass spectrometry (GC-MS)
- Ion chromatography
- High-performance liquid chromatography (HPLC)
- Radioactivity Meter
- Solid phase extraction system
- Furnace
- Rotary evaporator
- Automatic titration unit

Laboratory Analysis & Environmental Services Price List

### Wastewater / Organic Analysis Lab at IAU

<https://www.iau.edu.sa/en/colleges/college-of-engineering/labs-and-equipment/environmental-engineering-laboratories>

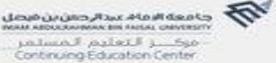
## 9. IAU Participation in Sustainable Water Management

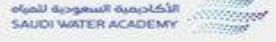


### IAU Participation in the Middle East Water Week Conference and Exhibition

The Environmental Engineering section of Faculty of Engineering Imam Abdulrahman Bin Faisal University participated in the Middle East Water Week Conference and Exhibition and presented a number of projects aimed at treating water.

[https://twitter.com/CE\\_IAU\\_SA/status/1736717131863962024](https://twitter.com/CE_IAU_SA/status/1736717131863962024)





## برنامج أجيال الصيفي

يسر مركز التعليم المستمر بجامعة الإمام عبد الرحمن بن فيصل وبالتعاون  
الأكاديمية السعودية للمياه عن إطلاق برنامج أجيال الصيفي

### الأنشطة التدريبية

البرمجة باستخدام روبوت كويكو

قياس الرقم الهيدروجيني في السائل

تحدي القيادة باستخدام الليجو

روبوت اسفيرو وملعب كرة القدم

بطارية الليثيوم من باسكو

الواقع الافتراضي وللعزز

النزل الأخضر






معلومات للتسجيل



موقع التدريب

جامعة الإمام عبد الرحمن  
بن فيصل - مركز التعليم  
المستمر - 879

سعر البرنامج

350 ريال  
للقاعد محدودة

الفئة المستهدفة

الأطفال من  
7 - 12 سنوات

موعد البرنامج

14 يوليو 2024  
9:00AM - 12:00PM  
15 ساعة تدريبية



SAUDIWACD

WWW.SWACADEMY.COM

### IAU in cooperation with the Saudi Water Academy for “Generations Summer Program” for Children

The Continuing Education Center is pleased to #Imam\_AbdulRahman\_Bin\_Faisal\_University In cooperation with the Saudi Water Academy. The announcement of the launch of “Generations Summer Program”. The Target group is Children from (7 years to 12 years).

[https://twitter.com/IAU\\_KSA/status/1808112744589070344](https://twitter.com/IAU_KSA/status/1808112744589070344)

## 9. Marine Pollution control - Field visit



### **Field Visit to the Marine Pollution Control Department at Aramco by IAU Faculty and Students**

I had the honor of organizing a field visit to the Marine Pollution Control Department at Aramco - Tanura Opinion. Many thanks to Aramco for allowing the future engineers to have this unique experience and wonderful organization.

<https://twitter.com/Omer2AGA/status/1755169090157637914>

## 10. EnviroSpill conference



### **Participation of IAU Engineering College Students in the EnviroSpill Conference and Exhibition at Bahrain**

Part of the participation of College of Engineering students of IAU in the conference sessions specialized in combating pollution through the EnviroSpill Conference and Exhibition, which was held in the Kingdom of Bahrain to learn about the latest technologies in combating oil spills under the patronage and attendance of His Excellency the Minister of Oil and Environment in Bahrain.

[https://twitter.com/IAU\\_KSA/status/1582358003483029504](https://twitter.com/IAU_KSA/status/1582358003483029504)

## 11. Saline water conversion corporation visited IAU



### Visit of the Delegation of the Saline Water Conversion Corporation to IAU

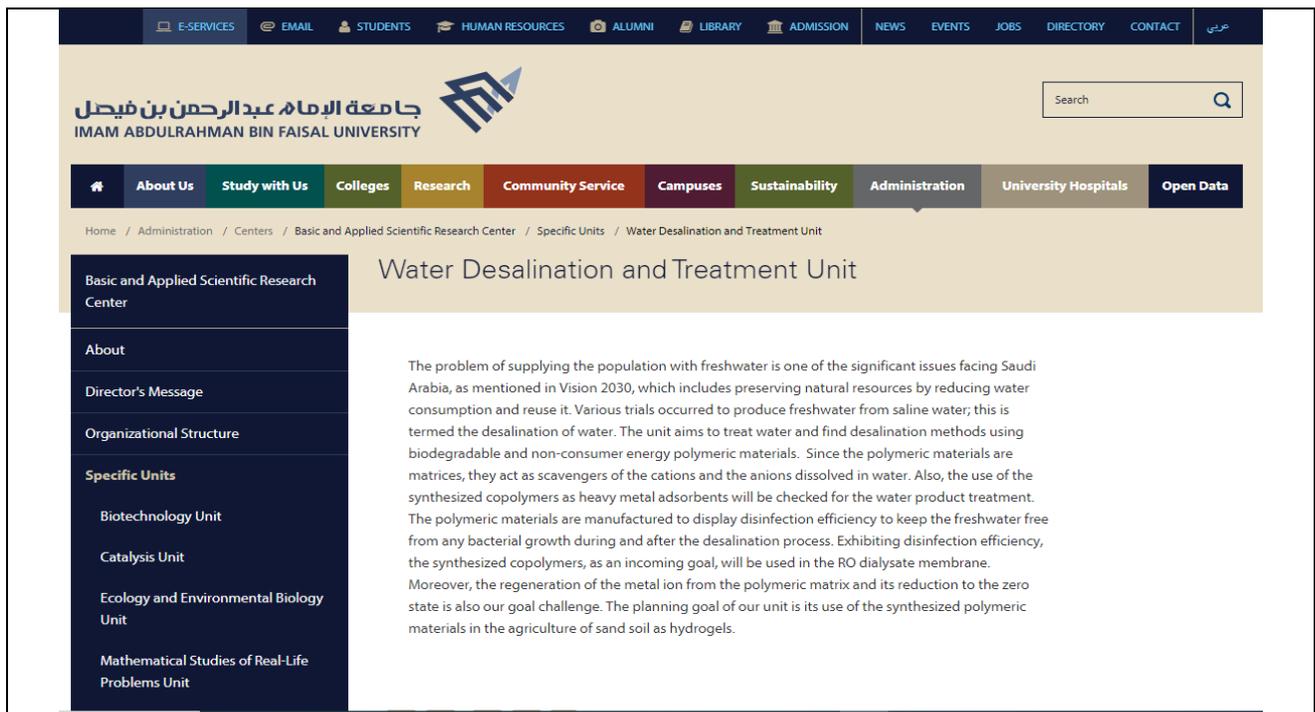
Part of the visit of the delegation of the Saline Water Conversion Corporation to Imam Abdulrahman Bin Faisal University, which included a tour of: 1) Research Center, Faculty of Science, 2) Faculty of Computer Science and Information Technology, 3) Faculty of Engineering

[https://twitter.com/IAU\\_KSA/status/1604581022351368192](https://twitter.com/IAU_KSA/status/1604581022351368192)

## 12. Water Desalination and Treatment Unit of IAU

### Water Desalination and Treatment Unit

The problem of supplying the population with freshwater is one of the significant issues facing Saudi Arabia, as mentioned in Vision 2030, which includes preserving natural resources by reducing water consumption and reuse it. Various trials occurred to produce freshwater from saline water; this is termed the desalination of water. **The unit aims to treat water and find desalination methods using biodegradable and non-consumer energy polymeric materials.**



The screenshot shows the website for the Water Desalination and Treatment Unit at Imam Abdulrahman Bin Faisal University. The page features a navigation menu with options like 'About Us', 'Study with Us', 'Colleges', 'Research', 'Community Service', 'Campuses', 'Sustainability', 'Administration', 'University Hospitals', and 'Open Data'. The main content area is titled 'Water Desalination and Treatment Unit' and contains a detailed paragraph about the unit's mission and research focus. A sidebar on the left lists various units under the 'Basic and Applied Scientific Research Center'.

### Water Desalination and Treatment Unit

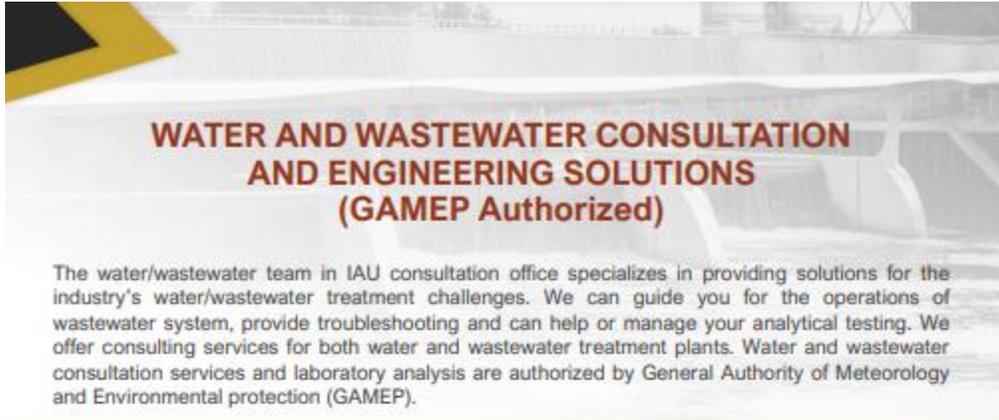
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<https://www.iau.edu.sa/en/administration/centers/basic-and-applied-scientific-research-center/specific-units/water-desalination-and-treatment-unit>

## 13. Water And Wastewater Consultation and Engineering Solutions

The **water/wastewater team in IAU consultation office** specializes in providing solutions for the industry's water/wastewater treatment challenges. We can guide you for the operations of wastewater system, provide troubleshooting and can help or manage your analytical testing. We offer consulting services for both water and wastewater treatment plants. **Water and wastewater consultation services and laboratory analysis** are authorized by **General Authority of Meteorology and Environmental protection (GAMEP)**.





## WATER AND WASTEWATER CONSULTATION AND ENGINEERING SOLUTIONS (GAMEP Authorized)

The water/wastewater team in IAU consultation office specializes in providing solutions for the industry's water/wastewater treatment challenges. We can guide you for the operations of wastewater system, provide troubleshooting and can help or manage your analytical testing. We offer consulting services for both water and wastewater treatment plants. Water and wastewater consultation services and laboratory analysis are authorized by General Authority of Meteorology and Environmental protection (GAMEP).

### Our services include:

- Analytical testing, troubleshooting & solutions
- Water and wastewater quality monitoring
- Periodic on-site water treatment plant visits
- Evaluation of water treatment processes (including chemical analyses)
- Preparation and results reporting
- Water system maintenance
- Sludge removal and dewatering solutions
- Expert witness

We also offer short courses related to the area of water and wastewater treatment. The office is part of the Integrated environmental solutions and consultancy center established in 2020 by Imam Abdulrahman Bin Faisal University and accredited by the regulatory environmental accreditation body in Saudi Arabia - General Authority of Meteorology and Environmental protection (GAMEP). All laboratory analyses are conducted following an approved environmental laboratory protocol.

### EXAMPLES OF LAB ANALYSIS

Wet analysis	Elemental analysis	Chromatographic analysis	Microbiology & Toxicity analysis
Conductivity	Total Organic Carbon	Fluorine	Total Coliform
Turbidity (NTU)	CHNS Analysis	Chlorine	Fecal Coliform
Total Solids	Sulfur	Bromide	Total Bacteria Count
Suspended & Dissolved Solids	Sulfate	Mineral oils	E. Coli (MPN)
Settleable & Volatile Solids	Phosphorous	Organics	Chlorophyll a, b, and c
Fixed Solids	Nitrate	PAHs	Fish Biological Experiment
Water Content	COD	PCBs	
pH	Phenol	BTEX	
Ion Mobility	Heavy metals	VOCs	
Zeta Potential	Trace metals		
Acidity			
Dissolved Oxygen			
Color			
Alkalinity			
Total Hardness			

### Wet analysis

Free Chlorine, Total Chlorine, Sulphur, Kjeldahl Nitrogen, Organic Nitrogen, Ammonium Nitrogen, Total Nitrogen, Total Phosphor, Phenols, Oil and Grease, Biological Oxygen Demand (BOD5), Chemical Oxygen Demand (COD), Chromium (VI), Fluoride (F-), Chloride (Cl-), Bromide (Br-), Nitrite (NO<sub>2</sub>-), Nitrate (NO<sub>3</sub>-), Sulfate (SO<sub>4</sub>2-), Phosphate (PO<sub>4</sub>3-) and Cyanide (CN-) are all tested in our lab.

### Elemental analysis

(TOC Analyzer), analysis by Individual Test Kits (UV Spectrophotometry) (S<sub>2</sub>-, SO<sub>4</sub> 2- , P, NO<sub>3</sub> - , B, Cr<sub>6</sub>+, Cl- , CN- , NO<sub>2</sub>- , COD, F- , Phenol), Heavy & Trace Metals by ICP-OES, ICP-MS, and AAS instrument that includes: Silver (Ag), Indium (In), Aluminum (Al), Potassium (K), Boron (B), Lithium (Li), Barium (Ba), Magnesium (Mg), Bismuth (Bi), Manganese (Mg), Calcium (Ca), Sodium (Na), Cadmium (Cd), Nickel (Ni), Cobalt (Co), Lead (Pb), Chromium (Cr), Strontium (Sr), Copper (Cu), Thallium (Tl), Iron (Fe), Gallium (Ga) and Zinc (Zn).

### Chromatographic analysis

F- , Cl- , Br- , NO<sub>2</sub> -, NO<sub>3</sub> -, SO<sub>4</sub> 2-, PO<sub>4</sub>2- and cations by Ion Chromatography. Mineral Oil Analysis in Water Samples, Organics; PAHs, PCBs, BTEX, VOCs by HPLC & GC-MS.

### Microbiology & Toxicity analysis

HPC, Toxication Thinning Factor (ZSF) among others analysis.

## INSTRUMENT



### 01 INDUCTIVELY COUPLED PLASMA / ICP-MS

The Tisch Environmental PM<sub>2.5</sub> and PM<sub>10</sub> high volume air sampler is a Federal Reference Method sampler for collecting fine and coarse particulate matter fractions. Its primary uses are for regulatory sampling and institutional studies.



### 02 INDUCTIVELY COUPLED PLASMA / ICP-OES

ICP-OES offers the highest resolution along with high sensitivity and stability for the most demanding applications. It is trace-level, elemental analysis technique that determines concentrations of trace to major elements in part per million (ppm) and can detect most elements in the periodic table. Applications are drinking water, wastewater, other examples of environmental studies, petrochemistry, food, hydrogeology, and others.



### 03 GAS CHROMATOGRAPHY MASS SPECTROMETRY / GC-MS

GC-MS covers volatile to semi-volatile analytes, oil, petroleum derivative and petrochemical analysis, in matrices ranging from simple air and drinking water to the most complex food and soil/sludge. Additionally, it is equipped with Gerstel sample introduction system that expands the GC-MS capabilities such as automated sampling handling, head space sampling and solid phase micro extraction "SPME".



### 04 HIGH PERFORMANCE LIQUID CHROMATOGRAPHY- HPLC

High performance liquid chromatography with photo diode array detector, HPLC-PDA has been increasingly employed for the analytical control of environmental pollution levels. It appears promising for the identification and determination of non-volatile or strongly polar compounds in air and in surface, waste, and drinking water.



### 05 INDUCTIVELY COUPLED PLASMA / ICP-MS

The Tisch Environmental  $PM_{2.5}$  and  $PM_{10}$  high volume air sampler is a Federal Reference Method sampler for collecting fine and coarse particulate matter fractions. Its primary uses are for regulatory sampling and institutional studies.



### 06 ATOMIC ABSORPTION SPECTROMETER

Atomic absorption spectrometry (AAS) is a single element technique that measures the concentrations of elements. Applications; water and environmental analysis, geochemical analysis, food analysis and metallurgical analysis.



### 07 ELEMENTAR CHNS

Elementar CHNS system is used to detect Carbon, Hydrogen, Nitrogen and Sulfur in inorganic and other types of materials. Being fast and accurate are among the advantages of this system. CHNS can handle a wide variety of sample types including solids, liquids, volatile and viscous samples.



### 08 ROTARY EVAPORATOR

A rotary evaporator is a device used in chemical laboratories for the efficient and gentle removal of solvents from samples by evaporation. Rotary evaporators are also used in molecular cooking for the preparation of distillates and extracts. Besides being used in the Rotary Evaporator chemistry laboratories; it is also applied for necessary processes in fields such as pharmaceuticals, cosmetics, food, petrochemical and R&D.



### 09 MICROBIOLOGICAL TESTING

Our Microbiology lab is equipped with many kinds of microscopes, safety cabinet, laminar flow, incubators, and autoclave to test samples for bacteria, larvae and fungi.



#### EXAMPLES OF PREVIOUS PROJECTS AND STUDIES

- Corrosion inhibition in oil and gas industries using new fine-tunable pH-responsive polymers
- Beach Well Filtration as Pre-Treatment for RO desalination in eastern province-Saudi Arabia
- Electro-decontamination of toxic phenolic wastewaters under different direct current supply modes<sup>10</sup>
- Pulsed-current electrokinetic remediation of groundwater contaminated with heavy metals<sup>11</sup>
- Water quality in higher education institutions



#### EXAMPLES OF PREVIOUS REFEREED JOURNAL PAPERS

- Systematic modeling of municipal wastewater activated sludge process and treatment plant capacity analysis using GPS-X.
- Sewage sludge ZnCl<sub>2</sub> activated carbon intercalated MgFe-LDH nanocomposites: insight of sorption mechanism of improved removal of phenol from water.
- Sustainable wastewater treatment by biochar/layered double hydroxide composites: Progress, challenges, and outlook
- Adsorption behavior and mechanism of methylene blue, crystal violet, eriochrome black T, and methyl orange dyes onto biochar-derived date palm fronds waste produced at different pyrolysis conditions
- Response surface modeling and optimization of sludge activated carbon production conditions for phenolic compounds removal from water

- Corrosion inhibition in oil and gas industries using new fine-tunable pH-responsive polymers
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- Systematic modeling of municipal wastewater activated sludge process and treatment plant capacity analysis using GPS-X.
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- Response surface modeling and optimization of sludge activated carbon production conditions for phenolic compounds removal from water



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IMAM ABDURRAHMAN BIN FAISAL UNIVERSITY

## WATER AND WASTEWATER CONSULTATION AND ENGINEERING SOLUTIONS

Imam Abdulrahman Bin Faisal University  
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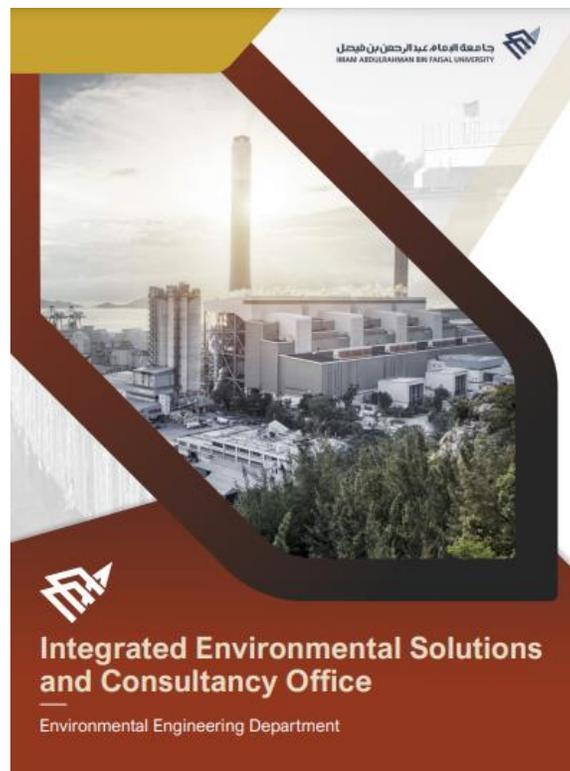
FLIP LINK  
[https://simplebooklet.com/TX\\_AZILK6iIM52nMnnqHQT3P](https://simplebooklet.com/TX_AZILK6iIM52nMnnqHQT3P)



[https://www.iau.edu.sa/sites/default/files/resources/water\\_and\\_wastewater.pdf](https://www.iau.edu.sa/sites/default/files/resources/water_and_wastewater.pdf)

## 14. Integrated Environmental Solutions and Consultancy Office

The **Integrated Environmental Solutions and Consultancy Center** established by **Imam Abdulrahman Bin Faisal University** in 2020 and Authorized by the **Presidency of General Authority of Meteorology and Environment Protection (GAMEP)**. **Water/wastewater team in IAU consultation office** specializes in providing solutions for the **industry's water/wastewater treatment challenges**. IAU can guide you for the operations of wastewater system, provide troubleshooting, and can help or manage your analytical testing. IAU offer **consulting services for both water and wastewater treatment plants**. IAU offer consultation services, conducting studies, measurements, and training in the **field of wastewater engineering, treatment, optimization, reuse, and design**.



## INTEGRATED ENVIRONMENTAL SOLUTIONS AND CONSULTANCY OFFICE (GAMEP Authorized)



The department of environmental engineering is considered as a pioneer since it is the first department to offer the bachelor's degree environmental engineering in the kingdom of Saudi Arabia.



The Integrated Environmental Solutions and Consultancy Center established by Imam Abdulrahman Bin Faisal University in 2020 and Authorized by the Presidency of General Authority of Meteorology and Environment Protection (GAMEP).



The distinguished experience, expertise, and capabilities are utilized to develop engineering solutions that meet the customers' needs and local standards. The services include providing optimum air quality management and solutions on the indoor/outdoor air pollution and industrial emissions from oil and gas, energy, mining, and minerals sectors.



The Consulting and Engineering Office is dedicated to working with clients to implement compliance solutions using innovative approaches and advanced technologies. The measurement and analysis are conducted following stringent environmental laboratory protocol and best quality practice.



### The multi-disciplinary consultants engineering office includes:

<b>01</b> Environment services including environmental studies, design, and supervision	<b>05</b> Physical, chemical, and biological procedures and mechanisms accountable for the proclamation, conveyance, alteration and preservation of pollutants.
<b>02</b> Professional training for environmental specialists and technicians	<b>06</b> Pollutant control procedures (predominantly the exclusion of trace & toxins or pollutants).
<b>03</b> Short and long Certificate programs in environmental specialists and engineering filed	<b>07</b> Basic ideologies of physical, chemical, and biological conduct know how for water, wastewater and solid wastes scums or residues from different sources.
<b>04</b> Third-party inspection and opinion work to ensure compliance with the project specifications, codes, and standards.	<b>08</b> Pollutant control measures for Air, other contaminants removal from air & its monitoring (gases, Particulate matters & Meteorological parameters etc.).



### 1. Division of Solid and Hazardous Waste Management

This consultation office offers consultation services, conducting studies, third-party testing, inspection, and training in the field of environmental engineering and waste management, including industrial, medical among all other types of solid waste. In Addition, we offer short courses related to the area of solid waste management. The office is part of the Integrated Environmental Solutions and Consultancy Center established in 2020 by Imam Abdulrahman Bin Faisal University. All laboratory analysis are conducted following an approved environmental laboratory protocol.




### Our services include:

- Inspecting, analysis, and assessment of all types of hazardous waste.
- Landfill and incineration design
- Best applicable technology
- Oil waste management and reuse
- Industrial waste collection and disposal
- Medical waste management, disposal, and incineration
- Radioactive waste management
- Contaminated solid purification



## 2. Division of Wastewater Treatment and Reuse:

water/wastewater team in IAU consultation office specializes in providing solutions for the industry's water/wastewater treatment challenges. We can guide you for the operations of wastewater system, provide troubleshooting, and can help or manage your analytical testing. We offer consulting services for both water and wastewater treatment plants. We offer consultation services, conducting studies, measurements, and training in the field of wastewater engineering, treatment, optimization, reuse, and design.



**Our consultation services and laboratory analysis are authorized by the Presidency of Meteorology and Environment (GAMEP).**

- Conducting analysis and modeling on the existing design of wastewater engineering systems and finding cost-saving opportunities that provide a return on investment.
- Designing, implementing, and upgrading wastewater treatment systems
- Advice on best practicable and cost-effective solutions for wastewater treatment.
- Wastewater analysis and characterization
- Marine pollution and deep discharge design
- Blue flag services and consultation
- Water footprint calculations and simulations
- Wastewater plant modelling and simulation studies



## 3. Division of Air Quality and Emission Control

Offering consultation services, conducting studies, third-party testing, inspection, and training in the field of environmental engineering, indoor and outdoor air quality assessment, emission inventory calculation, dispersion modeling, health risk assessment, dose calculation.

- Mobile station air quality monitoring for EIA studies
- Stack Gas Monitoring
- Designing Innovative Air Pollution Control Technologies
- Optimizing Current Air Pollution Control Technologies
- Short courses and training
- Calibration and maintenance
- Bioserosol Sampling and Analysis
- Noise Pollution Monitoring, Mapping, Modeling, and Control
- Monitoring of Meteorological Parameters
- Air Toxics Health Risk Assessments
- Dispersion Modelling
- Source Apportionment Modelling
- Air Quality Program Management
- Air Pollution and Air Quality Mapping
- GIS maps for measured pollutants
- Source and stack emission monitoring
- Ambient air quality studies
- Mobile lab services
- Environmental management plan (EMP)
- Environmental impact assessment studies (EIA)
- Life cycle assessment studies (LCA)
- Pollutants dispersion modelling (AREMOD)
- Risk assessment and dose calculation
- Auditing and inspection
- Energy efficiency
- Carbon footprint
- Global warming and greenhouse gases
- Ambient/Indoor Sampling, Monitoring, Analysis of Air Pollutants



**Mobile Air Quality Monitoring Station**



**Integrated  
Environmental  
Solutions and  
Consultancy office**

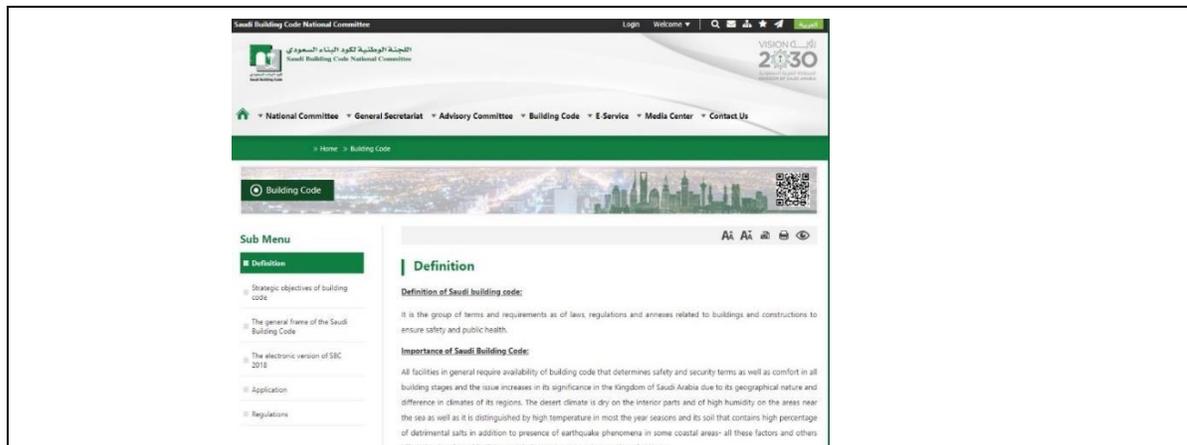
**One-Stop-Shop.**  
Backed up with our well-equipped laboratories  
enables us to test and diagnose prior to  
consultation

 **FLIP LINK**  
<https://simplebooklet.com/Y3PjySVJ0PTkaCE6vOKo5y>

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[https://www.iau.edu.sa/sites/default/files/resources/general\\_introduction-compressed.pdf](https://www.iau.edu.sa/sites/default/files/resources/general_introduction-compressed.pdf)

## 15. Water extraction technologies on associated university grounds



Snapshot of Saudi Building Code National Committee's website



Example of Green Building Implementation – efforts in IAU, The cultivation of Nano Plants

### Description:

All buildings of the IAU Campus fulfil the requirements of the Saudi Building Code National Standard for construction of buildings, whereby many of our building follow the international building standard code, which is of much higher standard.

As stated in Saudi Building Code that “all facilities in general require availability of building code that determines safety and security terms as well as comfort in all building stages and the issue increases in its significance in the Kingdom of Saudi Arabia due to its geographical nature and difference in climates of its regions. The desert climate is dry on the interior parts and of high humidity on the areas near the sea as well as it is distinguished by high temperature in most the year seasons and its soil that contains high percentage of detrimental salts in addition to presence of earthquake phenomena in some coastal areas- all these factors and others affect clearly safety of facilities and their sustainment and protection of citizens.”

As far as Green Building implementation is concern, one of the steps IAU had started implemented that is the cultivation of invented nano - plants in IAU as a tool for removal of air pollutants.

**Additional evidence link:**

<https://www.sbc.gov.sa/En/BuildingCode/>

