

DACUM Research Chart for Data Collection and Analysis Function

Produced for



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8 duties & 110 tasks

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DACUM Research Chart for Data Collection and Analy

DUTIES	TASKS			
A. Perform Project* Planning	A.1 Determine project objectives (e.g., goals, hypothesis, outcomes)	A.2 Obtain management approval	A.3 Assemble project coordination team	A.4 Coordinate with project partners and stakeholders
	A.10 Establish data collection schedule	A.11 Create data management plans (e.g., study plan, retrieval, storage)	A.12 Create QA/QC plan	A.13 Develop data analysis plan
	A.19 Determine safety plans			
B. Maintain Supplies & Equipment	B.1 Purchase supplies and equipment	B.2 Maintain spare part and supply inventory	B.3 Test technical equipment (e.g., instruments, meters, motors)	B.4 Troubleshoot technical equipment
C. Conduct Field Work	C.1 Determine sampling requirements	C.2 Confirm field work permissions	C.3 Determine site access locations	C.4 Gather field work supplies and equipment (e.g., bottles, paperwork, preservatives)
	C.10 Conduct field inspections (e.g., hydraulic, structural, debris)	C.11 Conduct environmental field assessment (e.g., biological, habitat, plant/animal)	C.12 Collect field samples	C.13 Coordinate sample processing with lab (e.g., chain of custody, schedule, hold times)
D. Analyze Field Samples	D.1 Complete sample chain of custody	D.2 Subdivide field samples	D.3 Store field samples	D.4 Prepare sample per intended analysis
	D.10 Maintain laboratory glassware (e.g., clean, sterilize)	D.11 Re-analyze anomalous results	D.12 Ship samples for commercial analysis	D.13 Input data into secure information management system
E. Conduct Data Analysis and Interpretation	E.1 Compile project data and metadata	E.2 Create data optimization resources (e.g., scripts/macros, programs, templates)	E.3 Prepare data for analysis (e.g., clean, sort, filter)	E.4 Perform data exploration (e.g., compute summary statistics, initial visual representation, data gaps)
	E.10 Evaluate data and analysis outcomes (e.g., hypothesis, future data needs)	E.11 Obtain stakeholder feedback (e.g., peer review, public comment)	E.12 Address stakeholder feedback	E.13 Finalize project report

A.5 Obtain project funding (e.g., grant funds, budget, milestones)	A.6 Review historical data (e.g., reports, as -builts, video footage)	A.7 Obtain work permits/property permissions	A.8 Determine project methodologies (e.g., sampling, assessment, testing)	A.9 Identify data collection sites
A.14 Create project assets (e.g., templates, forms)	A.15 Determine project resource requirements (e.g., tools, tech, staff)	A.16 Identify project-specific training and development needs	A.17 Delegate project tasks	A.18 Develop project evaluation plan (e.g., deliverables, model confirmation, timeline)
B.5 Repair malfunctioning tools and equipment	B.6 Perform equipment preventative maintenance (e.g., clean, batteries, fuses)	B.7 Maintain equipment records	B.8 Assemble technical equipment	B.9 Update equipment firmware and software
C.5 Verify equipment calibration	C.6 Provide field work information to public	C.7 Gather site information from public	C.8 Install monitoring equipment	C.9 Collect in situ measurements
C.14 Restore work area to original condition	C.15 Verify industrial self-monitoring reports	C.16 Report nuisance conditions	C.17 Document field data (e.g., scan, transcribe, upload)	
D.5 Prepare test reagents and standards	D.6 Analyze biological samples (e.g., identify, quantify, specify)	D.7 Conduct chemical analysis (e.g., instrumental, wet chemistry)	D.8 Verify quality control checks (e.g., standards, blanks)	D.9 Maintain lab environment (e.g., temperature, humidity, cleanliness)
E.5 Conduct statistical analysis (e.g., test hypothesis, identify trends and relationships)	E.6 Develop predictive models (e.g., test, validate, calibrate)	E.7 Perform data interpretation (e.g., standards, models, targets)	E.8 Perform data visualization (e.g., figures, tables, maps)	E.9 Create draft report

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DUTIES	TASKS			
F. Disseminate Project Results	F.1 Present results at conferences	F.2 Participate in public dialog activities (e.g., public meetings, public comment periods, open houses)	F.3 Develop community outreach materials (e.g., flyers, signage, report cards)	F.4 Deliver required reports (e.g., internal, external)
	F.10 Recommend on-site optimizations/process improvements	F.11 Support regulatory compliance and enforcement activities	F.12 Support data-driven management decision-making (e.g., new projects, policy, funding)	F.13 Patent project discoveries
G. Maintain Data Integrity	G.1 Develop SOPs (e.g., calibration, sampling, cleaning)	G.2 Perform equipment calibration (e.g., lab, field, safety)	G.3 Coordinate third-party equipment calibration	G.4 Retain project records
	G.10 Protect sensitive/proprietary data	G.11 Qualify laboratory data	G.12 Perform proficiency testing (e.g., annual, DOC)	G.13 Maintain testing materials (e.g., standards, reagents, weights)
H. Maintain Safe Work Practices	H.1 Review safety documentation (e.g., SDS, emergency plan, health and safety plan)	H.2 Maintain safety equipment (e.g., lab, field, vehicle)	H.3 Dispose of lab waste/chemicals	H.4 Maintain chemical storage
	H.10 Participate in safety initiatives (e.g., near miss, recommend improvements)	H.11 Complete safety documentation (e.g., CSE, safety surveillance)		

***Project may refer to, but is not limited to, the following activities:**

Assignments
 Infrastructure maintenance/improvements
 Inspections
 Investigations
 Regulatory compliance activities
 Research
 Testing

About this Project

This chart was prepared by The Ohio State University using Federal funds under award NA24OARX417C0524 from National Oceanic and Atmospheric Administration's National Sea Grant College Program, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration's National Sea Grant College Program or the U.S. Department of Commerce.

For additional information on this project, please contact dacum@osu.edu.

F.5 Share findings online (e.g., web, blog, social media)	F.6 Develop public-facing data visualizations (e.g., dashboard, story maps)	F.7 Prepare press releases	F.8 Publish project data online	F.9 Prepare project publications (e.g., peer-reviewed journal, technical)
G.5 Maintain lab certification	G.6 Verify proper collection procedures (e.g., data, samples)	G.7 Perform data integrity/QC tests	G.8 Perform lab/field intercomparisons	G.9 Perform MDL studies
G.14 Develop unbiased review process	G.15 Perform routine data backup			
H.5 Complete safety trainings and certifications	H.6 Don PPE (e.g., lab, field)	H.7 Deploy safety measures (e.g., fall protection, air monitoring, traffic)	H.8 Monitor environmental conditions (e.g., weather, stream flow, hazards)	H.9 Perform LOTO

Acronyms

ADCPs	Acoustic Doppler Current Profilers	MDL	Minimum Detection Limit
ADS	Advanced Design System	NBS	Near Bank Stress Assessment
BEHI	Bank Erosion Hazard Index	NEC	National Electrical Code
CSE	Confined Space Entry	NFPAE	National Fire Protection Association Standard for Electrical Safety in the Workplace (NFPA 70E)
DI	Deionized	NRCS	Natural Resources Conservation Service
DOC	Demonstration of Capabilities	OSHA	Occupational Safety and Health Administration
EPA	Environmental Protection Agency	PDMS	Plant Design Management System
GC-MS	Gas Chromatography–Mass Spectrometry	PPE	Personal Protective Equipment
GIS	Geographic Information System	QA/QC	Quality Assurance/Quality Control
GPS	Global Positioning System	RCA	Root Cause Analysis
HAZCOM	Hazard Communication	RoHS	Restriction of Hazardous Substances
HAZMAT	Hazardous Materials	SDS	Safety Data Sheets
ISO	International Organization for Standardization	UV/VIS	Ultraviolet-visible
LC-MS	Liquid Chromatography–Mass Spectrometry		
LOTO	Lock Out Tag Out		

General Knowledge and Skills

Knowledge

Analytical chemistry	Industry terminology
Basic biology	Lifting techniques/ergonomics
Basic chemistry	Machine learning methods
Basic field safety	Manufacturing processes
Basic geology	Material properties
Basic lab safety	Math (e.g., geometry, trig, stats, algebra)
Basic mass-spectrometry	Measuring erosion
Basic physics	Natural sciences
BEHI	NBS Assessment
Biological processes	Organizational structure
Calibration types and procedures	Precision measurement
Chemical properties	Process flows
Clean room best practices	Programming languages
Company protocols and procedures	QA/QC practices and requirements
Data management	RCA
Data synthesis/analysis	Regression methods
Dataloggers	Regulations/compliance (e.g., OSHA, EPA, RoHS)
Documentation practices and requirements	Safety protocols and procedures
Electrical systems	Sampling methodology
Environmental sensors	Spreadsheets
Generators	Statistical software
Geomorphology	Stream mechanics
GIS	Troubleshooting methodologies (e.g., 5-Y, fishbone)
HAZMAT/HAZCOM	Unit conversions (standards, metric)
Hydrology	Utilities (gas, electric, water)
Industry standards (e.g., NFPAE, NEC, ISO 9001)	Wet chemistry

Skills

Analysis	Modeling
Boating	Observation
Coaching	Office software
Communication (written, verbal, non-verbal)	Planning
Computer proficiency	Print/schematic reading/interpretation
Conduct condition assessments	Prioritization
Create dashboards	Problem solving
Create public outreach materials	Project management
Critical thinking	QA/QC
Customer service	Risk assessment
Data collection/analysis	Spatial awareness
Data entry	Species identification
Data visualization	Statistical analysis
Dataloggers	Statistics
Decision-making	Systems thinking
Driving	Technical writing
Environmental data collection	Time management
Environmental sensors	Training
Evaluation	Troubleshooting
Fluid dynamics	Unit conversions
Form development for data collection	Wire repair
GIS	Wire splicing
Identify areas of concern	Working in all weather conditions

Tools, Equipment, Supplies, Materials

Field

100' measuring tape	Cooler	Ratchet set
2-way radio	Crete wedge anchors	Sample containers
4 gas meter	Desiccant	Socket set
ADCPs	Drone	Spare drill batteries
Air monitoring equipment	Electrofishing supplies	Surface velocity radar gun
Area velocity sensors	Environmental sensors	Surveyor's tools
Backup charger	Extra clothes	Syringes
Bank pins	Field sheets	Telemetry systems
Batteries	Filters	Trail cameras
Boat	Flashlight	Ultrasonic
Boots	GoPro	Waders
Bucket	GPS	Water level sensors
Bug spray	Hard measuring tape	Water quality sondes
Buoys	Ice	Wrench set
Clinometer	Inflow velocity probe	Zip ties
Clipboard	Laptop/tablet	
Concrete drill bits	Macroinvertebrate sampling supplies	
Concrete hammer drill	Measuring tools	
Confined space equipment	Office supplies	
(winch, harness, helmet, tripod)	PPE	

Lab

Acid bath	Dry ovens	pH buffers
Acids (e.g., hydrochloric, nitric, sulfuric)	Erlenmeyer flask	pH meter/probe
Autoclave	Evaporating dishes	Pipette bulbs
Autosampler	Filter paper	Reagents
Autosampler fridges	First aid kit	Refrigerators
Balances	Freezers	Safety glasses
Bases (e.g., sodium hydroxide, potassium hydroxide)	GC-MS	Separatory funnels
Beakers	Glass pipettes	Solutions
Calculator	Glassware	Spectrophotometers
Centrifuges	Gloves	Standards
Clipboard	Infrared spectrometer	Storage room
Conductivity meter/probe	Instrumentation	UV/VIS spectrometer
Dissolved oxygen meter/probe	Isopropyl alcohol	Vacuum filtration unit
Distilled/DI water	LC-MS	Volumetric flasks
Document/report templates	Micropipettes	Water baths
	Muffle furnace	Weights
	Notebooks	

Software

ADS	PDMS
Excel	Predictive modeling
GIS	Python
Hydrosphere	Qstart
Machine learning	RStudio
Mat Lab	SigmaPlot
MS Office	

Web Apps

Arc GIS online
NearMap
NRCS Soil Survey
Stream Stats
Survey123
Telloggers for Windows

Future Trends and Concerns

- Be open to the various environmental careers
- Changing technology (e.g., lack of batteries, software programs)
- Changing physical environment: species extinction, invasive species, and impacts of climate change
- Challenge finding folks who are able or willing to work a full day doing field work, especially during hot/cold temperatures
- Covid-era lack of field work opportunities
- Data security
- Engineering projects for a climate adaptive environment
- Existing models are no longer accurate; need to revise models to keep up with rapidly changing conditions (e.g., flood, stormwater planning)
- Fewer younger people pursuing field work
- Funding concerns and uncertainty
- Importance of programming in training programs
- Increasing automation of some processes
- Introduction to field work: early, often, and authentic experience
- Lack of manufacturer support for tools and equipment
- Lack of value of scientific literacy in teaching and among the public
- Machine learning impacting data analytics
- More extreme climate events (flooding, droughts, fires)
- Need to value critical thinking in education
- Political priorities impacting jobs, funding, and environmental protections
- Promoting field work to individuals with interests in seemingly unrelated topics (hands-on learning, building, construction)
- Public mistrust of sound science
- Public perception of scientific funding for research and suspicion of motives
- Set realistic pay expectations
- Staffing concerns: finding and retaining talent
- Stress importance of training in field work
- Value in advocating for funding and policies (e.g., congressional testimony)
- Work/life balance
- Younger folks are less comfortable using desktop computers

Worker Behaviors

Coachable
Consistent
Culturally-sensitive
Curious
Decisive
Detail-oriented
Disciplined
Emotionally intelligent
Ethical
Flexible
Goal-oriented
Honest
Hygienic
Motivated
Not claustrophobic
Organized
Patient
Positive
Professional
Resilient
Tactful
Team player
Thorough
Trustworthy
Unbiased

Alternative titles associated with this job include, but are not limited to:

Advanced Instrumentation Chemist	Lab Analyst
Aquatic Biologist	Laboratory And Pretreatment Coordinator
Aquatic Ecologist	Laboratory Technician
Biological Science Technician	Monitoring Coordinator
Biologist	Natural Resources Technician
Chemist	Physical Scientist
Environmental Biologist	Research Biologist
Environmental Specialist/Scientist	Research Coordinator
Field Biologist	Senior Wastewater Analyst
Field Chemist	Specialist And Instrument Technician
Fish Biologist	Stream Restoration Ecologist
Flow Monitoring Technician	Wastewater Analyst
Geologist	Water Quality Technician
Hydrogeologist	Watershed Program Manager
Hydrologist	

About the Process

This analysis of the Data Collection and Analysis function was conducted using a process called DACUM. DACUM is an acronym that stands for **D**eveloping **a** **C**urriculum because it is the *foundation* of the program/curriculum development process (not the actual curriculum).

The process uses subject matter experts in the job as panelists who were selected by The Ohio State University's Center on Education & Training for Employment after being recommended for participation by a representative from their organization via the Employer Needs Assessment Survey.

The panel works under the guidance of a team of trained facilitators for two days to develop the DACUM Research Chart. The chart contains a list of general areas of competence called DUTIES and multiple TASKS for each duty. Brainstorming techniques are used to obtain the collective expertise and consensus of the panel. As the panel determines each task, it is written on a card which is then attached to the wall in front of the panel. The completed chart is a graphic profile of the duties and tasks performed by the panel members.

The panel also identifies the general knowledge and skills required to perform the tasks they identified, the tools, equipment, supplies and materials used, the important worker behaviors essential for success, and the future trends and concerns regarding the job.

The process is used internationally to ensure that new curricula being developed aligns precisely with what employees in business and industry actually do on the job. This DACUM workshop was conducted by a team of experienced OSU facilitators.

To learn more about the DACUM methodology for job and occupational analysis, as well as CETE's suite of workforce development and professional learning solutions, please visit cete.osu.edu.



DACUM subject matter experts pictured from left to right: Paul Skerl, Hannah Boesinger, Justin Telep, Dan Murphy, Andriana Hays, David Perry, Leila Jackson, and Steven McMurray.