FLORIDA ATLANTIC UNIVERSITY

COURSE CHANGE REQUEST
Undergraduate Programs

Department CEGE

College CoE&CS

UUPC Approval _____
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner Posted _____
Catalog _____

***Current* Course Prefix and Number**	ENV4514	***Current* Course Title** Water and Wastewater Treatment Systems

*Syllabus must be attached for **ANY** changes to current course details. See Checklist. Please consult and list departments that may be affected by the changes; attach documentation.*

Change title to:
RI: Water and Wastewater Treatment Systems

Change prefix
From: **To:**

Change course number
From: **To:**

Change credits*
From: **To:**

Change grading
From: **To:**

Change WAC/Gordon Rule status**
Add ☐ **Remove** ☐

Change General Education Requirements***
Add ☐ **Remove** ☐

*Review Provost Memorandum
**WAC/Gordon Rule criteria must be indicated in syllabus and approval attached to this form. See WAC Guidelines.
***General Education criteria must be indicated in syllabus and approval attached to this form. See GE Guidelines.

Change description to:
Principles and design of physical, chemical, and biological treatment systems for potable water and wastewater applications. This is a research intensive course.

Change prerequisites/minimum grades to:

Change corequisites to:

Change registration controls to:

Please list existing and new pre/corequisites, specify AND or OR and include minimum passing grade (default is D-).

Effective Term/Year for Changes:	Spring 2021	**Terminate course? Effective Term/Year for Termination:**

Faculty Contact/Email/Phone Bloetscher/fbloetsc@fau.edu/7-0744

Approved by		***Date***
Department Chair	[signature]	08/24/2020
College Curriculum Chair	Dan Moorhoff	08/24/2020
College Dean	[signature]	9/17/20
UUPC Chair	Jerry Haky	9-15-20
Undergraduate Studies Dean	Edward Pratt	9-15-20
UFS President		
Provost		

Email this form and syllabus to mjenning@fau.edu seven business days before the UUPC meeting.

Florida Atlantic University

Department of Civil Engineering

1. **Course title/number, number of credit hours**

RI: Water and Wastewater Treatment Systems (ENV 4514) 3 credits

2. Course prerequisites, co-requisites, and where the course fits in the program of study

Prerequisite: ENV 3001 and CWR 3201 (Applied Hydraulics) or equivalent*, senior standing or graduate status and instructor approval.*
Co-Requisites: None.

Principles and design of physical, chemical, and biological treatment systems for potable water and wastewater applications. This is a research intensive course.

This course contains multiple assignments designed to help students conduct research and inquiry at an intensive level. If this class is selected to participate in the university-wide assessment program, students will be asked to complete a consent form and submit electronically some of their research assignments for review. Visit the Office of Undergraduate Research and Inquiry (OURI) for additional opportunities and information at http://www.fau.edu/ouri.

Live virtual lectures will be held via Cisco Webex.

Exams will be given only at the scheduled times on line. No make-ups, except in documented emergencies. Short quizzes may be randomly given throughout the semester.

Other logistics are as follows:

1. Canvas registration is required.
2. Dropbox access required – you will upload scanned homework, projects and other info to the dropbox. Note you must include your name an assignment in the file name: I.e.: Bloetscher-assignment1. NOT ”Assignment1” since I will have no idea who’s work that is. Thx
3. The instructor will regularly post materials/announcements on Canvas. It is student’s responsibility to regularly check Canvas and their FAU email for the most recent information.
4. No hard-copy handouts will be provided. Copies will be posted in files on Canvas
5. *Attendance* is required. All classes will be virtual via webex. You are expected to participate in all sessions and keep up with the material. You are not expected to be a distraction in class. Final grades will be reduced by one full letter for class disruption or lack of participation (as determined by the instructor).
6. Participation in University-approved activities or religious observances, with prior notice, will not be penalized.
7. Students need a reliable internet condition capable of streaming Webex lectures, taking exams on Canvas, etc. Recommended: Broadband Internet connection with a speed of 4 Mbps or higher. To function properly, Canvas requires a high-speed Internet connection (cable modem, DSL, satellite broadband, T1, etc.). The minimum Internet connection speed to access Canvas is a consistent 1.5 Mbps (megabits per second) or higher. Check your Internet speed here.
8. Students should have an operational computer system equipped with Windows 10 or macOS Sierra (or higher), Microsoft Office, web browser, a webcam, speakers, and microphone, which should be compatible with the most recent version of LockDown Browser, Respondus Monitor, Cisco Webex, etc.
9. All exams will be held using LockDown Browser and Respondus Monitor, or similar features, as determined by the instructor. More information will be provided as we get closer to exams. You must be able to scan

answers and upload them to Canvas during tests. Please test this BEFORE the exam. This is subject to change as technology changes.

10. All questions must be sent publicly through Canvas, so other students also benefit from the answers. Only personal or confidential matters should be sent via email to the professor, all others will be ignored.
11. Keep copies of all assignments for ABET purposes.
12. Tests are closed book; however, you may use FE manual.

More details will be announced throughout the semester. It is students' responsibility to review and follow communications posted by the instructor.
Co-Requisites: None.
This is a senior level course in which Principles and design of physical, chemical and biological, and physical treatment systems for potable and wastewater applications for civil engineering projects are covered

3. Course logistics

Term: Fall 2020
This is a classroom lecture course
Class location and time: T. 7:10 pm – 10:00 pm

4. Instructor contact information

Instructor's name Dr. Frederick Bloetscher, PE, Associate Dean and Professor
Office address Engineering East (EE 308M)
Office hours 7 – 9 pm W & TH
Telephone no. 239-250-2423
Email address h2o_man@bellsouth.net

5. TA contact information

N/A

6. Course description

Principles and design of physical, chemical and biological, and physical treatment systems for potable and wastewater applications. The class meets twice per week T 7:10-10 p.m. p.m. The class will follow various aspects of management of a project from start to finish. A real example will be used as the backdrop for homework/project exercises.

1. Review Chemical and Biological Basics
2. Basics of Water/Wastewater Quality
3. Regulations
4. Application of Piping and Pumping
5. Treatment Plant schematics/Process Flow diagramming
6. Process selection
7. Chemical treatment methods (alum flocculation, lime softening)
8. Disinfection
9. Physical Treatment methods (settling, mixing)
10. Filtration and membranes
11. Biological Treatment
12. Effluent Disposal

7. Course objectives/student learning outcomes/program outcomes
Course Outcomes:

I. Present the fundamental principles applied in the analysis, design, modeling, and operation of engineered water and wastewater treatment systems.
II. Evaluate the general characteristics of water and wastewater needed for engineering design of treatment systems.
III. Develop schematics for water and wastewater treatment systems governed by physical, chemical and biological processes to remove certain water characteristics and meet design goals
IV. Understand professional practice issues such as procurement of work; how design professionals and the construction professions interact to construct a project
V. Expose students to the complex interaction between water and wastewater problems and the needs of society.

ABET 1-7 outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Student learning outcomes & relationship to ABET 1-7 Student Outcomes

A. Ability to understand the basic principles applied to the water treatment systems and the ability to calculate the major components of same (1-7)
B. Ability to understand the fundamental principles necessary to conceptualize engineered water treatment systems (1-7)
C. The ability to communicate effectively about issues in water and wastewater engineering (3)

Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives (5)

Relationship to Civil and Environmental Engineering educational objectives

Outcome 1: An understanding of the social, economic, ethical and political contexts in which engineers must function - H
Outcome 2: An ability to plan and execute an engineering design to meet an identified need. H
Outcome 3: An ability to communicate effectively and function on multi-disciplinary teams. M
Outcome 4: A working knowledge of fundamentals, engineering tools, and experimental methodologies. H

8. Course evaluation method (note percentages subject to change)

Midterms: 20%

Final	30%
Project	40%
Homework and class participation -	10%

9. Course grading scale

Course grades are assigned according to the attached Department of Civil Engineering Grading Guidelines. Assignments and reports must be prepared according to the required formats (see attached documents: (a) Assignment Presentation and (b) Technical/Project/Laboratory Report Writing). Additional requirements may be given by the instructor. **NOTE: you cannot pass the class if you fail all 3 exams regardless of you grade.**

10. Policy on makeup tests, late work, and incompletes

Exams will be given only at the scheduled times and places. No one is exempt from the final examination. *Makeup tests* are given only if there is solid evidence of a medical or otherwise serious emergency that prevented the student of participating in the exam. Makeup exams will be administered and proctored by department personnel unless there are other pre-approved arrangements.

Late work is not acceptable.

Incomplete grades are against the policy of the department. Unless there is solid evidence of medical or otherwise serious emergency situation, incomplete grades will not be given.

Attendance to class is required. You are expected to attend and participate in all class sessions. Final grades will be reduced by one letter for every three (3) unexcused absences (as determined by the instructor).

11. Special course requirements

- *Projects are expected to achieve all six of the following OURI Student Learning Outcomes (SLOs):*
  - *SLO 1: Knowledge. Students are expected to demonstrate content knowledge, and knowledge of core principles and skills.*
  - *SLO 2: Formulate Questions. Students are required to formulate research questions, scholarly or creative problems in a manner appropriate to the planning discipline.*
  - *SLO 3: Plan of Action. Students are expected to develop and implement a plan of action to address research and inquiry questions or scholarly problems.*
  - *SLO 4: Critical Thinking. Students are expected to apply critical thinking skills to evaluate information, their own work, and the work of others.*
  - *SLO 5: Ethical Conduct. Students are expected to identify significant ethical issues in research and inquiry and/or address them in practice.*
  - *SLO 6: Communication. Students will convey all aspects of their research and inquiry (processes and/or products) in appropriate formats, venues, and delivery modes.*

OURI Student Learning Outcomes (SLO)	Description of Assignment Requirements and Assessments
SLO 1: **Knowledge**	Students will demonstrate a fundamental basis of discipline-specific knowledge required for effective professional practice in the fields of water and wastewater engineering. Students will also demonstrate working knowledge of tools and practical skills needed to

	analyze engineering design problems related to multiple realistic constraints, such as environmental issues, engineering economics, hurricane resiliency, design codes, ethics, land use, climate change, and/or other contemporary design issues.
SLO 2: **Formulate Questions**	Students will develop and refine a problem statement in which they specifically address their research questions. Students are expected to articulate the scope of the problem to be able to address the research question with an engineering solution. When appropriate, students should be able to create additional (albeit related) questions for smaller subsections of the overall design project.
SLO 3: **Plan of Action**	Students will create a plan of action that will include the problem statement (or research question), scope of work, literature review and background context, methodology or approach to the solution, analysis plan, conclusion and design documents. Students will develop a hypothesis if needed, identify research methods and alternative designs, and select appropriate statistical techniques, if warranted.
SLO 4: **Critical Thinking**	Students will demonstrate critical thinking skills by taking into consideration multiple perspectives and examining implications and consequences of design decisions or engineering alternatives. Students will also demonstrate an ability to use evidence and reasoning to objectively justify decisions and an ability to apply codes and design standards to make reasonable engineering judgments. Students are asked to peer review student work and provide feedback during the juried presentations.
SLO 5: **Ethical Conduct**	Students will familiarize themselves with the Code of Ethics of their engineering discipline. All work is held to the standards established by the governing professional societies (FES, ASCE, FSMS, ASPRS, AWWA, WEF, AW&MA, SWANA, etc.) of civil and environmental engineering disciplines.
SLO 6: **Communication**	Students will present and defend their work in written and oral formats (interim and final). All deliverables are expected to be of professional quality. Students are expected to demonstrate knowledge of technical report writing, visualization in 3D, and persuasive presentation skills.

12. Classroom etiquette policy

1. Cell phones and beepers should have the ringers turned off as a courtesy to the instructor and your fellow classmates.
2. Exams will be given only at the scheduled times and places. No make-ups, except in documented emergencies. No one is exempt from the final examination.
3. Attendance to class is required. You are expected to attend and participate in all class sessions. Final grades will be reduced by one letter for every three (3) unexcused absences (as determined by the instructor). Attendance to at least one (1) professional meeting is required.
4. You are expected to complete the assigned reading prior to the date indicated on the class schedule, to do all homework assignments, and to participate fully in the group projects.
5. Assignments are due at the beginning of class on the date indicated on the assignment sheet. Late assignments are not accepted. Assignments turned in early will receive extra credit.
6. Tests are CLOSED BOOK, Open FE manual ONLY

University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.

13. Attendance Policy Statement

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

14. Disability policy statement

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

15. Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

16. Code of Academic Integrity policy statement

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation

17. Recommended texts/reading

Hammer and Hammer (2011), 6-9th Edition, Water and Wastewater Treatment Systems, Prentice Hall

18. Supplementary/recommended readings

None

19. Academic Service Learning Statement

This course is designated as an "academic service-learning" course. The assistance you provide to the agency/organization during your academic service-learning (AS-L) experience is a service to the community and will allow you to apply knowledge from the course to local, national, and/or global social issues. Throughout this course you will be participating in AS-L activities while demonstrating civic engagement at campus, local, national, and/or global community levels. You will also reflect on your AS-L experience and the impact on the community as well as your professional development. Academic service-learning notation of hours will post to your transcript with submission of hours to your faculty instructor. An Academic Service-Learning Student Survey is required to be taken at the end of your AS-L project. Please visit the Weppner Center for LEAD & Service-Learning website, www.fau.edu/leadandserve, for the survey link and more information on FAU's Academic Service-Learning program.

Minimum project hours: 100

Assumption of Risk Statement for Student* I understand that there are certain physical risks inherent in every form of service-learning. I understand the risks associated with this Academic Service-Learning assignment. I nonetheless agree to assume those risks so as to gain the benefits from participation in this valuable learning experience. I hereby release the State of Florida, the Board of Trustees, Florida Atlantic University and its agents and employees from any and all liability associated with my participation in this assignment at Florida Atlantic University.

Assessment of your performance in this aspect of the course is accomplished using your Professional Practice Assignments/Presentations/Reports, the Final Report, and Class Assignments, as evaluated using the rubrics at the end of this syllabus and also found in course LMS.
If you are selected to participate in the university-wide Academic Service-Learning program, you will be required to document a minimum of 10 hours of student service to the community agency.

20. Other

1. College of Engineering and Computer Science (COECS) Technology Services Group (TSG)

   TSG provides support for students with issues related to the use of College computing resources such as lamp.cse.fau.edu, the student web server, and GENIE, the Citrix Remote Application Server. TSG also supports the Microsoft Developer Network Academic Alliance portal through which students taking courses in CEECS can obtain free copies of many software products from Microsoft. Details of these and other resources are described on the TSG web site at tsg.eng.fau.edu.

   For support issues not covered on the web site students must send email to help@eng.fau.edu. TSG responds to help requests only through this email address. Do not attempt to phone them or contact them personally. TSG support is limited to assistance with COECS computing resources such as having your password on lamp reset. They do not handle specific course related questions. Those should be directed to the instructor for the course.

2. FAU Information Resource Management (IRM)

   RM provides support for general computing and network issues at FAU. General information and many resources can be found on the IRM site, www.fau.edu/irm/index.php. IRM provides direct student through an online Help Desk at www.fau.edu/helpdesk/. The help desk includes extensive online support resources and a "Ticket" submission system for support requests. Areas of particular concern to students in this course covered by the Help Desk include general Blackboard, FAU NetId and network login, and FAU Google Email. The Help Desk can also be accessed by phone at (561) 297-3999. Phone access should generally be used only if you are

unable to log in to FAU systems. For most other issues the phone consultant will simply record your concern and submit a help ticket on your behalf. The help ticket will get the same treatment as one you submit directly.

3. College of Engineering and Computer Science (COECS) Division of Engineering Student Services (ESS)

   ESS provides general advising and academic support for students in COECS including free tutoring support for all students in computer science courses. Additional information can be found on their web page at www.eng.fau.edu/engineering-student-services.

4. FAU University Center for Excellence in Writing (UCEW)

   The UCEW, sometimes referred to simply as the Writing Center, provides assistance to students with writing assignments through consultants. They can assess student writing skills and suggest approaches to dealing with problem areas. The center web site is at www.fau.edu/UCEW/WC

21. Course topical outline, including dates for exams/quizzes, papers, completion of reading

Date:	**Topic**	Reading
Week 1 8/25	Introduction Sources of Water Sustainability	Chapter 1
Week 2 9/1	Regulations Biological Contaminants Chemical Contaminants	Chapter 3, 5
Week 3 9/8	Filed Trip	Chapter 6
Week4 9/15	Water Demands Surface vs Groundwater Groundwater and Wells	Chapter 6
Week 5 9/22	**Project Discussion** Well Calculations Water Distribution Sewer Collection	Ch 4 & 10
Week 6 9/29	Project Introduction Reactors Chemical processes	Ch 7
Week 7 10/6	Chemical processes Chemical Processed Disinfection Review	
Week 8 10/13	**Midterm Exam 1**	
Week 9 10/20	Lime Softening Processes Ultraviolet light	Ch 7

Week 10 10/27	Presentation 1	
Week 11 11/3	Physical Processes Biological Processes and Sludge	Chapter 11 -14
Week 12 11/10	Biological Processes and Sludge *Review*	Not in book
Week 13 11/17	**Midterm Exam 2**	
Week 14 11/24	Non-Traditional Treatment – Ion Exchange, GAC/PAC, etc Membranes W*aste* Disposal Methods (most this is not in the book) Review	Not in book
Week 15 12/1	**Final Exam (proctored Group Design Project Presentation**	
Week 16 12/8	*Reading Day – no class*	
Week 17 12/15	**Presentation**	

Assignment Presentation
(Required Format)

All assignments (i.e., homework, projects, etc) to be completed by students attending courses offered by the Civil Engineering Department must be presented in a standardized format.

Any assignments that do not comply with the following guidelines will not be accepted.

1. The assignment must be written in an 8.5 x 11 inches engineering or white paper. The problem narrative must not be repeated in the assignment sheet. However, the problem number from the textbook must be given as well as the GIVEN data and the FIND (whatever the problem is asking for) must be listed briefly. If homework is a handout, attach the handout at the front of the homework.

2. Each page must have:

    (a) Course Number and Name (e.g., ENV-4514 Environmental Engineering and Science) at the top center,
    (b) Assignment Number (e.g. HW#5) at the top left,
    (c) Student's Name (e.g., J.M. Dover) at the top right, and
    (d) Page Number and Total Number of Pages (e.g. 2/3) at the bottom center.

3. The text and computations in the assignment must be written in a professional manner, i.e.:
    (a) Any derivations of formulas/equations, symbols, etc must be properly explained,
    (b) Any assumptions/simplifications made must be mentioned and justified,
    (c) The solution must be written in reasonable sequence,
    (d) The final result(s) must be given at the end of the problem written within a box,
    (e) Half way "solutions" are not acceptable,
    (f) Just mentioning the solution algorithm/process of the problem is not acceptable; all of the computations must be carried to the very end, and
    (g) Any unsuccessful initial attempts of solving the problem must be kept out of the assignment submitted.

4. The assignments must be presented also in a legible and well-written manner. The handwriting must be neat otherwise the assignment must be typed.

5. The assignment sheets must not be creased or folded but be stapled together at the upper left corner.

An example of an acceptable HW assignment is attached.

HW#5 **ENV-4514 Environmental Engineering and Science** **I. Dover**

Problem #3.24 (Doe, J.R. "Fundamentals of Environmental Engineering", 1999)

GIVEN: Min value of Oxygen Sag = 3.0 mg/L
Naturally Occurring DO in the stream = 10 mg/L
Min allowable DO = 5.0 mg/L
Reaeration coefficient = 0.80/day
Deoxygenation Coefficient = 0.20/day
Stream velocity = 60 miles/day

FIND: (a) Percentage of BOD that must be treated to ensure healthy environmental conditions
(b) How far downstream in miles the lowest DO would occur?

SOLUTION:

a) The minimum DO of 3.0 mg/L means that the maximum deficit (before fixing it) is

$DO_{max} = 10 - 3 = 7$ mg/L

For healthy conditions, the DO_{min} should be 5 mg/L so that the new DO_{max} should be

$DO_{max(new)} = 10 - 5 = 5$ mg/L

Then $DO_{max} / DO_{max(new)} = 5.0/7.0 = 0.71$

ANSWER: Thus, 29% of the BOD needs to be removed. Since a primary treatment plant removes about 35% of the BOD (Chapter 3, pp 76) then **it would be enough**.

b) Using Eq. (5.34) the critical time and distance downstream are given as:

Critical time: $t_c = \ln(k_r/k_d)/(k_r - k_d) = \ln(0.8/0.2)/(0.8 - 0.2) = 2.31$ days

Distance: L = 60 mi/day x 2.31 days = 138.6 miles

ANSWER: Critical time is **2.31 days**; Distance is **138.6 miles**

Project Report Outline

(Required Format)

ABSTRACT/EXECUTIVE SUMMARY

Brief but concise description of the project objectives, methodologies, results and conclusions.

TABLE OF CONTENTS

Including List of Figures and List of Tables.

INTRODUCTION/Background

Background information; Description of the existing state-of-the-art; Objectives and goals of the present project; anticipated results.

DESIGN NEEDS/ANALYSIS OF ALTERNATIVES

Detailed description of the (a) current deficiencies (b) Design goals (c) options to achieve design needs (d)materials utilized (e.g., chemicals, type of soils, type of liquids, etc), (e) comparison of alternatives, and (f) summary of alternatives and matrix. Recommend and alternative and why.

DESIGN OF SELECTED OPTION

Data collection, compilation, and analysis using appropriate statistical and/or other analytical tools. Presentation of the analysis results in tabular or graphical formats for easy assimilation. Drawings of the solution plus any equipment cut sheets.

SUMMARY/CONCLUSIONS/RECOMMENDATION

Very brief description of the project and the conclusions reached.

REFERENCES

List of references cited.

ACKNOWLEDGEMENTS

Give credit to where it belongs.

APPENDICES

All cut sheets, manufacturer information used, product data, chemical data. Might be largest part of report.