Water Pollution Control

by

Raymond W. Regan, B.E., M.C.E., Ph.D., P.E.

Department of Civil Engineering
College of Engineering

Independent Learning Program
Department of Distance Education
Division of Continuing and Distance Education

PENNSTATE

1855

Independent Learning
Continuing Education

(814) 865-5403
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The Pennsylvania State University
128 Mitchell Building
University Park, PA 16802-3693

The need for improved technologies to protect our nation's surface and groundwater supplies will continue to be a major activity of environmental and civil engineers through the next decade and beyond. I'm pleased that you are taking the time to learn more about this subject.

This course is specifically directed at introducing undergraduate civil and environmental engineers to the fundamental concepts needed for understanding and designing water and wastewater facilities. Other engineering and science majors may also benefit from the information presented.

Overall, the lesson assignments emphasize the solution of engineering design problems by application of principles of environmental chemistry, microbiology, and fluid mechanics.

My office telephone number is (814) 863-0601, and I will be glad to help you in any way I can. Welcome to the course!

Raymond W. Regan
Course Instructor

An Equal Opportunity University

PENNSTATE
The Department of Civil and Environmental Engineering

CE 472W, WATER POLLUTION CONTROL PROCESSES

Description:

- Principles and design of unit operations for water; domestic and industrial wastewater treatment, equipment selection and application.

Text:

- Veissman, W. and M. J. Hammer. *Water Supply and Pollution Control*, 4th edition, Harper & Row, 1985.
- *Notes and References*, by James C. Young and David A. Long (Supplement).

Topics:

- [L] Introduction/The Design Process 4-44
- [L] Water Quality Management/Regulations 1,2,3 69-96
- [P] Project Description/Writing Requirements
- [2L] Water Demand/Wastewater Production 4:27-37; 50-54 45-68
- [P] Project/Problem/Writing Review
- [2L] Flow Measurement/Plant Hydraulics 6:108-112; 159-165;7:171-179; 10:281-295 166-185; 778-826
- [P] Projects/Problems/Writing Review
- [L] Water Quality/Pollution Control Measures 8:237-250
- [L] Water Pollution Control Processes 8:254-269 97-165
- [P] Projects/Problems/Report Review
- [2L] Flow Equalization/Pretreatment 10:285-286; 320-322;14:664-666 186-212
- [P] Projects/Problems/Report Review
- [2L] Sedimentation Theory/Design 10:301-319 213-249
- [P] EXAM #1
- [2L] Biological Treatment Fundamentals 12:428-464
- [P] Projects/Problems/Exam #1 Review
- [2L] Trickling Filters 12:465-490 250-275
- [P] Projects/Problems/Report Review
- [2L] Activated Sludge Processes 12:497-519 276-336
- [P] Projects/Problems/Report Review
- [2L] Other Aerobic Processes 12:463-497; 546-554 336-397
- [P] Projects/Problems/Report Review
- [2L] Anaerobic Process Design 13:569-583; 600-610 583-604
- [P] EXAM #2
- [2L] Sludge Processing 13:583-600; 610-642 187-557
- [P] Projects/Problems/Exam #2 Review
- [2L] Advanced Waste Treatment 14:662-714 680-682

LIF #12

THE PENNSYLVANIA STATE UNIVERSITY

Department of Independent Learning
128 Mitchell Building
University Park, Pennsylvania 16802

Second Examination in CE 297B 01PA Social Security # 890 04 3764

Name of Student MARTIN PALESTIE Time Limit: 3 hours

Street MIRANDA 7471 City MONTEVIDEO State UNKNOWN Zip 11600

Time Started 6:30 PM Time Finished 9:00 PM Date 12/13/99

EXAMINATION CERTIFICATE

NOTE: This certificate must be dated and signed by both student and proctor at the end of the examination period in order for the examination paper to be valid. This certification sheet must accompany the examination questions or problems and the student's examination paper and be returned to the Independent Learning office only by the proctor, before the examination paper will be evaluated.

STUDENT CERTIFICATION

I hereby certify that I have received no help from anyone in writing this examination paper, and have followed the rules given for this examination by the Department of Independent Learning, The Pennsylvania State University.

Date Dec 13 1999 [signature]
Student Signature

PROCTOR CERTIFICATION

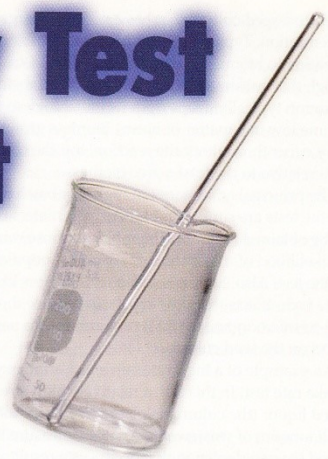
I hereby certify that I have proctored the examination for the above student, and have followed the rules given for this examination by the Department of Independent Learning, The Pennsylvania State University.

Date 12/13/99 [signature]
Proctor Signature

Environmental Scientist / Teacher
Official Title

B

Treatability Test Assessment



Used together, batch and continuous reactor tests assess wastewater treatability more accurately

James C. Young and Thomas J. Irwin

Treatability assessments are an essential, inexpensive method for illustrating whether a proposed treatment system will handle a particular wastewater effectively. However, if assessment results are based solely on batch reactor test measurements, the picture they present may be distorted or incomplete.

Treatability assessments often involve batch respirometric tests, in which a known amount of industrial wastewater is added to a microorganism culture from a laboratory reactor, full-scale treatment plant, or commercial source. The response — measured by oxygen uptake in aerobic reactions and gas production in anaerobic reactions — indicates potential biodegradability or toxicity.

Batch tests produce results within hours or a few days, are good indicators of biodegradability, and can provide reasonable estimates of the kinetic parameters that predict full-scale process performance. However, they merely represent a seed culture's short-term response to the test wastewater and only are reliable if the wastewater contains nothing toxic to the test culture, the culture is acclimated to the wastewater constituents, and no toxic byproducts accumulate during treatment. Batch tests also may produce misleading information if a toxic wastewater is diluted to below-toxic levels during testing.

These shortcomings can be offset significantly by using repetitive batch or continuous reactors to simulate the wastewater's long-term effects on a biological process. Although continuous reactor tests require more time, they provide more realistic measures of treatability, allow sufficient time for culture acclimation, and simulate full-scale operation more closely than batch tests. Therefore, treatability assessments should include both batch and continuous reactor tests to ensure that the resulting estimates of kinetic and process parameters are reliable.

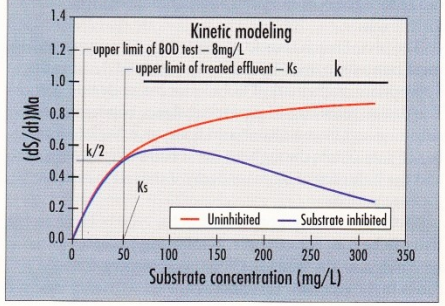
Batch and Continuous Reactors

Batch tests typically fall into two classifications: high-rate and low-rate.

High-rate batch tests. A high-rate batch test is a transient, nonsteady-state reaction in which a substrate is

FIGURE 1

Relationship of Substrate Conversion Rate to Substrate Concentration as Related to Kinetic Modeling



FUNDAMENTALS AND DESIGN OF ADVANCED ANAEROBIC PROCESSES FOR INDUSTRIAL WASTEWATER TREATMENT

by

James C. Young

JCY Environmental
Springdale, AR 72701

November, 2001

Topics for Discussion

1. Introduction
2. History of advanced anaerobic treatment
3. Fundamentals of anaerobic reactions
4. Design considerations for advanced anaerobic processes
   a. Wastewater characteristics
   b. Performance relationships
   c. Nutrient considerations
   d. Process limitations
5. Toxicity and biodegradation tests versus treatability assessments
6. Pilot scale testing
7. Anaerobic biomass inventory and activity tests

JCY Environmental
124 Woodcliff Rd., Springdale, AR 72764 Tel: (479) 927-2672; Fax: (479) 927-2459 email: jcyenv@msn.com

January 24, 2008

Beahrs ELP
4 Gianninin Hall # 3100
University of California
Berkeley, CA 94720-3100 USA

Subject: Letter of Refrence for Matrin Balestie for
Sustainable Environmental Management

Admissions Department:

I have known Martin Balestie for about ten years. During that time I have worked closely with him on a number of technical and educational projects. I find that Martin is intensly interested in leaning as much about his field of practice as possible. This includes highly technical courses – such as those that involve design of environmental control facilities – to those that are more management and policy oriented – such as the subject course on Sustainable Environmental Management. This course will help Martin to improve the decision making process related to environmental projects for which he has significant input. For example the decision to minimize water use, to minimize waste production, and to maximize re-use and thereby reduce adverse environmental impacts.

Martin is highly motivated to learn and should be an excellent candidate for the course for which he has applied.

Sincerely,



James C. Young
Consulting Engineer and
Professor of Environmental Engineering
University of Arkansas, Fayetteville, AR

JCY Environmental

124 Woodcliff Road, Springdale, Arkansas USA Tel: 479-927-2672 Fax: 479-9272549

Consulting Proposal

November 5, 2012

To: Ecoprenuer, Argentina

From: James C. Young
JCY Environmental
Springdale, Arkansas USA

and Martin Balestie
CTI Uruguay

Objective

This proposal addresses consulting assistance to Ecoprenuer, Argentina by James C. Young (JCY) of Springdale, Arkansas, USA and Martin Balestie (MB) of Montevideo, Uruguay. Project tasks include assisting Ecoprenuer with selection and design of anaerobic and aerobic processes for treating industrial wastewater in South America.

Quotation

We hereby offer the following evaluation and testing proposal as a means of assisting Ecoprenuer in evaluating anaerobic and aerobic treatment options for industrial wastewater treatment:

Task	**Activity**	**Time**	**Cost**
1.	Travel to Argentina by JCY to review project sites and to review the sources and characteristics of waste streams that are the subject of design proposals by Ecoprenuer.	Anticipate five days plus travel expenses (per trip)	US$ 7,500
2.	Review of records for the industrial facility to evaluate the wastewater treatment loads and to conduct preliminary modeling of process options under current and future COD/BOD loadings.	20 to 40 hours work time	US$3,000 to US$6,000
3.	Review of design calculations and equipment selection as requested by Ecoprenuer.	20 to 40 hours work time	US$3,000 to US$6,000
4.	Additional time as requested by Ecoprenuer	US$ 1,200/day	as requested
	TOTAL		US$ 13,500 to US$19,500

The listed time and costs are estimates based on our experience with similar projects but can increase or decrease depending on the task list and scope of services that ultimately will be developed. Individual tasks will be initiated only upon approval by Ecoprenuer Argentina. A Qualifications and Experience Statement is appended below for your review.

Payment by Ecoprenuer will be made as follows: A retainer of US$ 4,000 will be required at the time a project is initiated. Time and expenses by JCY will be invoiced to Ecoprenuer at monthly intervals. Payment of each invoice will be made within 30 days after the invoice is submitted to Ecoprenuer. The retainer will be applied to the last invoice.

We look forward to assisting you to evaluate aerobic and anaerobic treatment options for industrial waste treatment in Argentina and other countries in South America.

November 5, 2012
James C. Young, JCY Environmental

November 5, 2012
Martin Balestie, CTI Uruguay

1/2012

James C. Young, Ph.D., P.E.

JCY Environmental, 124 Woodcliff Rd., Springdale, AR 72764 Tel: (479) 927-2672; Fax: (479) 927-2459

QUALIFICATIONS AND EXPERIENCE

QUALIFICATIONS

PROCESS EVALUATION

- Selection of appropriate treatment technology
  - Biological processes
  - Physical/chemical processes
  - Combined physical/chemical processes
- Comparison of anaerobic and aerobic processes for municipal and industrial waste treatment
- Application of respirometry to treatment process operation and control

TREATABILITY TESTING

- Assessing treatability of organic and inorganic wastes
- Assessing anaerobic/aerobic biodegradation of specific organic chemicals
- Assessing methane production potential for wastewaters and other wastes
- Assessing treatability of inorganic wastes
- Design and operation of laboratory-scale and on-site pilot plants
- Estimation of kinetic parameters

FORENSIC EVALUATIONS

- Evaluation of existing treatment plants with view toward optimization of performance
- Assessment of process failures

OPERATIONS ASSISTANCE

- Preparation of process operating manuals
- Operator training
- Laboratory analyst training

EXPERIENCE

CHEMICAL PROCESS INDUSTRIES

- Petroleum Refining
- Polymer production
- Complex alcohols
- Soaps and detergents
- Dyes and pigments
- Alcohols and Aldehydes
- Glycols and de-icing fluids
- Phthalic acid (PTA, DMT, PET)
- Acrylic acid
- Plastics intermediates
- Sorbic acid
- Fiber Processing
- Fuel Oxygenates (MTBE, ETBE, TAME, TBA, TAA) and cyclic ethers (1,4-dioxane, 2,3-dioxolane)
- CO_2 capture and H_2S scrubbing solvents (e.g., MEA)

PHARMACEUTICAL WASTES

- Antibiotics
- Cosmetics

FOOD and BEVERAGE PROCESSING

- Bakeries
- Breweries
- Soft drink bottling
- Alcohol production
- Yeast production
- Candy manufacturing
- Canning wastes
- Grain processing

PULP AND PAPER

- Kraft mills
- Recycle mills

OTHER WASTES

- Landfill leachates
- Refuse-to-energy conversion
- Thermal sludge processing liquors
- Contaminated groundwater
- Oil contaminated soils
- Gas pipeline and tank farm wastes
- High-solids slaughtering wastes

James C. Young, Ph.D., P.E.

JCY Environmental, 124 Woodcliff Rd., Springdale, AR 72764 Tel: (479) 927-2672; Fax: (479) 927-2459

Partial Client List: January 2012

Brown and Caldwell Engineers	**Denver, CO**
Rust Environment and Infrastructure	**Fairless Hill, PA**
Montgomery Watson Engineering	**Mexico City, Mexico/Pasadena, CA**
Eckenfelder, Inc.	**Nashville, TN**
ERM, Inc.	**Exton, PA**
JINDO Engineering	**Seoul, Korea**
Smith & Loveless	**Lenexa, KS**
ADI Systems, Inc.	**Fredericton, NB, Canada**
UEM, Inc.	**West Palm Beach, FL**
Siemens/US Filter/Zimpro	**Ames, IA; Rothschild, MN**
Advent/Environ	**Nashville, TN; Houston, TX**
HDR, Inc.	**Austin, TX/Omaha, NE**
TetraTech	**Ann Arbor, MI**
Parsons, Inc.	**Pasadena, CA**
Midwest Biogas	**Gaylord, MN**
Geosyntec Consultants	**Chicago, IL; Boca Raton, FL**
ITP Montevideo	**Montevideo, Uruguay**

Industries

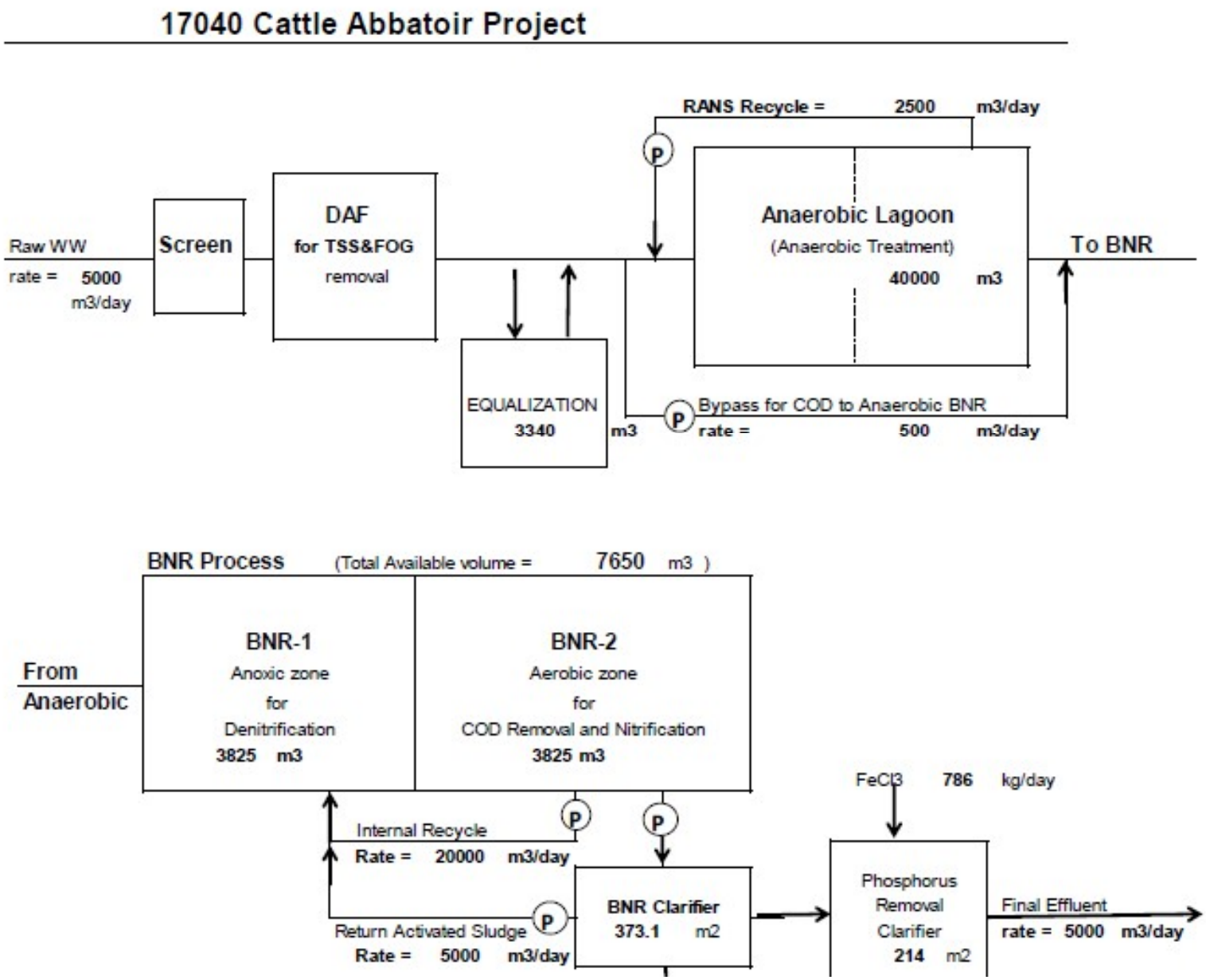
Kellogg USA Inc.	**Lancaster, PA**
Eastman Chemical Co.	**Kingsport, TN (US, Malaysia, Singapore plants)**
SmithKline Beecham	**King of Prussia, PA (Panama, Costa Rico plants)**
Hoechst-Celanese Corp.	**Bishop, TX/Corpus Christi, TX/Wilmington, NC**
Siemens/U. S. Filter/General Filter	**Ames, IA**
Monsanto, Inc.	**St. Louis, MO**
NutraSweet, Inc.	**Augusta, GA**
Miller Brewing Co.	**Fort Worth, TX; Irwindale, CA; Trenton, OH**
Procter and Gamble	**Cincinnati, OH (US, Indonesia, Mexico plants)**
BP/Amoco	**Naperville, IL**
BP Biofuels	**San Diego, CA; Houston, TX; UK; Brazil**
DuPont	**Wilmington, DE**
Mitsubishi Chemical Co.	**Japan**
Angus Chemical Co.	**Buffalo Grove, IL**
Dow Chemical Co.	**Midland, MI**
TEMBEC Paper Co.	**Temiscaming, QE Canada**
Teknor-Apex	**Pawtucket, NJ (Haywood, TN plant)**
Merck & Co., Inc.	**White House Station, NJ**
ADM, Inc.	**Decatur, IL**
Coca Cola Company	**Atlanta, GA**
E.J. Gallo Wineries	**Modesto, CA**
Abengoa Biofuels	**Chesterfield, MO**
Tate and Lyle	**Decatur, IL**
Canfor-Taylor Pulp Mills	**Canada**
Beef Packing of Uruguay	**Uruguay**

Government Agencies

U.S. Environmental Protection Agency	**Cincinnati, OH**

PROCESS FLOW DIAGRAM

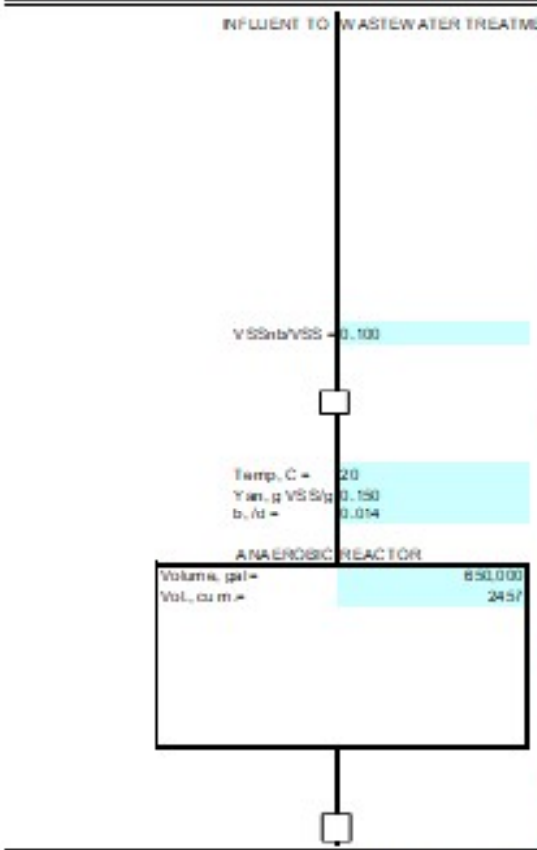
A process flow diagram is as follows:



10/30/08

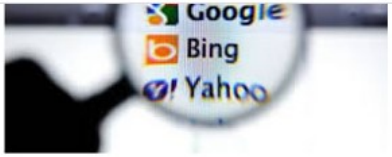
BREEDERS PROJECT PROCESS MODEL

© J.C. Young, October 2008



Flow and Load to Treatment System	Average Design	Peak Design	Notes	Average Design	Peak Design
					1.40
Infl. Flow , cu m/d =	2106	2948		557000	779800
Infl. TCOD, kg/d =	9982	13974	lb COD/d =	22010	30813
Infl TCOD, mg/L=	4740	4740			
Infl CBOD, kg/d =	5671	7939	lb BOD5/d =	12504	17505
Infl CBOD, mg/L =	2693	2693			
Infl TSS, kg/d =	3144	4402	lb TSS/d =	6933	9706
Infl TSS, mg/L =	1493	1493			
Infl VSS, kg/d =	2482	3475	lb VSS/d =	5474	7663
Infl VSS, mg/L =	1179	1179			
Infl nVSS, kg/d =	662	926	lb nVSS/d =	1459	2043
Infl nVSS, mg/L =	314	314			
Infl VSSnb, kg/d =	248	348	lb VSSnb/d =	547	766
Infl VSSnb, mg/L =	118	118			
Infl. TKN, kg/d =	632	884	lb TKN/d =	1393	1950
Infl. TKN, mg/L =	300	300			
Infl. PO4-P, kg/d =	74	104	lb PO4-P/d =	164	230
Infl. PO4-P, mg/L =	35	35			
Temp, C =	20	20			
Load fraction treated anaerobically	1.00	1.00			
COD Removal Effic., % of treated	90	90	Flow rate treated anaerobically=	557000	779800
Reactor volume, m3 =	2457	2457	(Assumed efficiency)		
Load, kg COD/cu m/d =	4.06	5.69			
Load, kg BOD5/cu m/d =	2.31	3.23	lb BOD/cu ft/d =		
ML VSS, mg/L	20000	20000	← Select ML VSS conc.		
Total Biomass, kg VSS =	49149	49149	for anticipated operation		
Biomass Yield, kg VSS/d =	771	1272	lb/d =	1701	2805
F/M, kg COD/kg VSS/d =	0.203	0.284			
Yn = kg VSS/kg COD r =	0.088	0.101			
SRT, days = (User selected)	64	39	← Change SRT manually until it equals		
SRT, days =	64	39	the value directly below		
HRT, days =	1.2	0.8			
TKN requirement, mg/L =	51	80			
TP requirement, mg/L =	10.2	12.0			

Flow and Load to Aerobic Treatment System	Average	Peak		Average	Peak
Eff. Flow , cu m/d =	2105.9	2948.2	gpd =	557000	779800
Eff. sCOD, kg/d =	998	1397			
Eff sCOD, mg/L=	474	474	lb COD/d =	2201	3081
Eff CBOD, kg/d =	200	279	lb BOD5/d =	440	616
Eff CBOD, mg/L =	95	95			
Eff TSS, kg/d =	299	419	lb TSS/d =	660	924
Eff TSS, mg/L =	142	142			
Eff VSS, kg/d =	210	293	lb VSS/d =	462	647
Eff VSS, mg/L =	100	100			
Eff nVSS, kg/d =	90	126	lb nVSS/d =	198	277
Eff nVSS, mg/L =	43	43			



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James C. Young Environmental - Balestie & Balestie Ingenieros CTI 50 Year Anniversary Edition

Sample keywords: hydrogen sulfide EGSB tannery (no commas!)

Match ALL words | Search

Wastewater Engineering

www.AerationFundamentals.com - - www.ExtendedAeration.com

www.MechanicalAerators.com - www.FineBubbleDiffusers.com

www.TricklingFilters.com - www.Biotowers.com

www.AnaerobicSystems.com - www.AnaerobicReactors.com - www.AnaerobicFilters.com - www.UASBs.com - www.EGSBs.com

www.AnaerobicMBRs.com

www.MembraneBioreactors.com

PRINCIPLES AND PRACTICES

OF

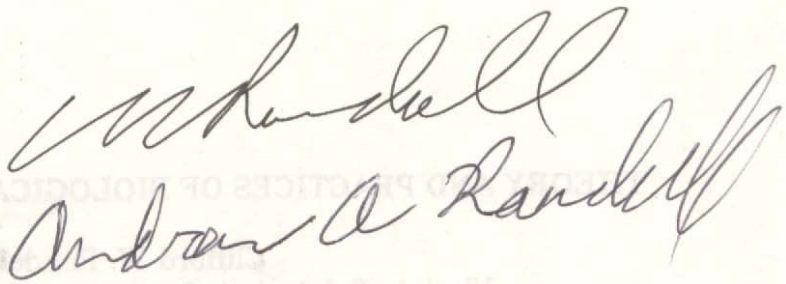
INDUSTRIAL WASTEWATER TREATMENT

A SHORT COURSE DEVELOPED BY

Clifford W. Randall, Ph.D.
The C. P. Lunsford Professor of Environmental Engineering
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061 USA

Andrew A. Randall, Ph.D.
Assistant Professor of Environmental Engineering
University of Central Florida
Orlando, Florida 32816 USA

August, 1995



THEORY AND PRACTICES OF NUTRIENT REMOVAL

Clifford W. Randall

Virginia Polytechnic Institute and State University

COLLEGE OF **ENGINEERING**
UNIVERSITY OF **WISCONSIN**-MADISON

Department of Engineering Professional Development

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Madison, Wisconsin 53706
Web: epdweb.engr.wisc.edu

Phone: 800.462.0876
608.262.2061
Fax: 608.263.3160

Welcome!

This notebook contains the complete continuing education course entitled "Developing and Operating Solid-Waste Landfills." Upon completion of this course you will be awarded a certificate and 2.0 Continuing Education Units (CEUs).

This notebook is divided into 15 tabs. The first 12 tabs contain the course lessons. The last three tabs are the exams.

Each lesson consists of learning objectives, an article that was published in Waste Age magazine, a study guide and attachments. It is required that you read each article and the study guide for each lesson (yellow paper). Attached to the study guide are a number of the reference documents. The purpose of these reference documents is for you to learn additional information in subject areas in which you have limited background. You are encouraged to look over the reference documents but you are not required to read the reference documents (white paper).

After you have completed lessons 4, 8 and 12, complete the exams that are located in tabs 13, 14, and 15. You can use any reference materials that you want while completing these exams but you must do all the work yourself. When the exams are completed, put them in the mail or fax them to me. I recommend that you send me the exams as you complete them and not wait to do them all at one time.

If you have any follow-up questions regarding the materials in this course, please free to contact me by phone or e-mail.

Sincerely your,

CV_ENG 402 : Bioremediation

MU Direct
Continuing & Distance Education
University of Missouri-Columbia
102 Whitten Hall
Columbia, MO 65211-6300

Level: graduate

Description: This course provides for study of the fundamental mechanisms underlying the engineered design of bioremediation systems. Microbial processes resulting in the transformation and/or mobilization of organic contaminants in soil and aqueous systems, particularly in-situ aquifer systems, will be emphasized. Biodegradation kinetics will be coupled with contaminant transport phenomena in bioremediation models as a tool for design and site evaluation.

Materials may be purchased through Amazon.com or other online services.

Textbook: "Bioremediation Principles", Eweis, Ergas, Chang, and Schroeder, McGraw-Hill. 1998.

Prerequisites: BS in Engineering (any branch) w/ one environmental engineering course or instructor's consent

Instructor: Rob Segar