Geological Engineering Assessment Plan

NOTE: The assessment plan and results are depicted in the Criterion 3 and Criterion 4 sections of this program's self-study for accreditation under ABET, Inc. These sections are on the following pages.

CRITERION 3. STUDENT OUTCOMES

A. Student Outcomes

Student Outcomes (SOs) for the BS GEOE program describe what students are expected to know or be able to do by the time of graduation from the geological engineering program. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program that prepare them to attain the program educational outcomes (PEOs). SOs are the ABET a-k criteria that specify expected knowledge and skills acquired by graduates of engineering programs. In addition to the a-k, we list an additional outcome, l, that is field competence. Geological engineering is strongly field-based in practice, thus, this additional outcome ensures graduates are knowledgeable about and competent in design and implementation processes that involve selecting and using a variety of instruments and field techniques required to successfully engage in the profession as valued members of society. The BS GEOE program SOs are listed in Table 3-a.1.

Table 3-a.1. BS GEOE student outcomes represent all ABET a-k criteria plus an additional field competence criteria.

Designation

Student Outcome

- a) Ability to apply knowledge of mathematics, science, and engineering.
- b) Ability to design and conduct experiments as well as to analyze and interpret data.
- c) Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) Ability to function on multidisciplinary teams.
- e) Ability to identify, formulate, and solve engineering problems.
- f) An understanding of professional and ethical responsibility.
- g) Ability to communicate effectively.
- h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- i) Recognition of the need for, and ability to engage in, life-long learning.
- j) Knowledge of contemporary issues.
- k) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- l) Field competence.

The development of the program SOs occurred simultaneously with the PEOs described above. Review and revision of the SOs also occurs simultaneously within the process of the three-year evaluation of the PEOs as illustrated in figure 2-e.1.

SOs are available online at the geological engineering

homepage <u>http://www.sdsmt.edu/Academics/Departments/Geology-and-Geological-Engineering/Undergraduate-Education/Geological-Engineering-BS/</u>, with a link to the SOs from <u>http://www.sdsmt.edu/Academics/Departments/Geology-and-Geological-Engineering/Accreditation---Assessment/</u>. The SOs are available in hardcopy form on the

display rack on the 3rd floor of the Mineral Industries building. A copy of the SOs are also posted on the bulletin board near the department office.

B. Relationship of Student Outcomes to Program Educational Objectives

BS GEOE SOs lead to the achievement of the PEOs in that they guide curricular development that ensure graduates perform competently in the professional practice of geological engineering. The SOs help ensure that graduates can design and implement economically constrained appropriate solutions to geological engineering problems by utilizing multiple skills defined in the SOs. They also help ensure that graduates are prepared to exercise ethical responsibilities and continued professional development and/or licensure. The geological engineering program provides students with an understanding of fundamental principles of geological engineering, basic engineering, mineral economics, and geology. It also provides them with academic training and design experiences to prepare them for engineering practice, career advancement, and graduate school preparation.

The coupling of PEOs to SOs is given in Table 3-b.1. SOs are evaluated in specific courses (Table 3-b.2) multiple times throughout the curriculum and are assessed according to the schedule outlined in Table 3-b.3. Assessment of course curriculum utilizes the assessment document (Fig. 1-b.1). As indicated, enhanced emphasis on SOs is achieved during the senior-level 400 numbered courses. Assessment practices are detailed in Criterion 4 below.

For the 2010-2016 evaluation cycle, new program assessment tools were adapted in 2013 and course assessments have been conducted such that each course will have gone through three assessment cycles prior to the 2016 evaluation (Table 3-b.3). For 2016 and beyond, each course will be assed three times during the 6-year evaluation cycle (Table 3-b.4).

Individual course syllabi contain the expected course outcomes and their relations to the SOs and ABET a-k. These data are typically expressed in table form. Multiple tools are utilized to evaluate attainment of the SOs such as assignments, exams, projects, field work, design reports, presentations, and oral discussions. Course assessment tools utilize three levels of attainment: 3) Exceeds Proficiency, 2) Proficient, and 3) Below Proficiency. Each outcome has verbiage describing each of these levels.

These student outcomes and their rigorous assessment ensure that graduates, by completing the BS GEOE program, can successfully demonstrate their achievement of the PEOs through competent performance in the areas of groundwater, environmental site planning and hazards, geomechanics and geotechnics, and fuels or minerals. These competencies are demonstrated through design and implementation of appropriate economically constrained solutions to geological engineering problems, in the exercise of ethical responsibilities and continued professional development throughout their careers and/or licensure, and by possessing academic training and design experiences to prepare them for engineering practice and career advancement.

These are successfully achieved by students having attained an understanding of the fundamental principles of geological engineering, basic engineering, mineral economics, and geology through regular curricular assessments as demonstrated by Tables 3-b.2 through 3-b.4. Courses

indicating basic engineering topics are not assessed directly by the BS GEOE faculty but by the instructors of these courses that are taught by faculty in other departments. These course folders and their respective assessments will be made available during the on-site evaluation.

This Space Left Blank Intentionally

Table 3-b.1. Student outcomes are coupled to the program educational outcomes as indicated here. Course-specific information on where SOs are evaluated is contained in Table 3-b.2.

Program Educational Objectives	 Graduates of the geological engineering program will perform competently in professional practice in the areas of a) groundwater, b) environmental site planning and natural hazards, c) geomechanics and geotechnics, and d) fuels or minerals 	2) Graduates will demonstrate the ability to design and implement appropriate solutions to geological engineering problems within economic constraints, while exercising ethical responsibilities and continued professional development and/or licensure
Student Outcomes	and d) fuers of minerals.	development and/or needsure.
a) Ability to apply knowledge		
of mathematics, science, and engineering	Х	Х
b) Ability to design and		
conduct experiments, as well as to analyze and interpret data	Х	Х
c) Ability to design a system.		
component, or process to meet desired needs, within	Х	Х
realistic constraints	77	37
d) Admity to function on multidisciplinary teams	Χ	Χ
e) Ability to identify		
formulate. and solve	V	V
engineering problems	Λ	Δ
f) Understanding of		
professional and ethical	Х	X
responsibility		
g) Ability to communicate	Х	Х
effectively		
n) The broad education		
impact of engineering		
solutions in a global.	X	X
economic, environmental,		
and societal context		
i) Recognition of the need for,		
and ability to engage in,	Х	Х
life-long learning		
j) Knowledge of contemporary	X	X
1ssues (c) Ability to use the		
techniques skills and		
modern engineering tools		••
necessary for engineering	X	Х
practice		
 Field competence, including critical thinking skills 	Х	Х

Table 3-b.2. Coupling of the BS GEOE student outcomes to the curriculum Primary and additional			ABET a-k										
course outcom	es are assessed in the curriculum at the	BS GEOE Student Outcomes											
indicated locations and relate to the SOs as indicated.		th/Science/Engineering	sign/Conduct Experiments	sign a System or Process	nction on Teams	ve Engineering Problems	ical Responsibility	mmunicate Effectively	obal Context	-long Learning	ttemporary Issues	gineering Tools	d Competence
Course Designation	Course Title	a. Ma	b. Des c. Des		c. Des d. Fur	e. Sol	f. Eth	g. Co	h. Glo	i. Life	j. Cor	k. Enį	l. Fiel
GEOE 110	Introduction to Geological and Mining Engineering												
GEOL 212	Mineralogy and Crystallography												
GEOE 221	Geology for Engineers												
GEOL 322	Structural Geology												
GEOE 324	Engineering Geophysics I												
GEOL 331	Stratigraphy and Sedimentation												
GEOL 341	Igneous and Metamorphic Petrology												
GEOE 410	Engineering Field Geology												
GEOL 416	Introduction to GIS												
GEOE 461	Petroleum Drilling and Production Engineering												
GEOE 464	Geological Engineering Design Project I												
GEOE 465	Geological Engineering Design Project II												
GEOE 466	Engineering and Environmental Geology												
GEOE 475	Groundwater												



Primary outcomes assessed Additional outcomes assessed

Not assessed

Table 3-b.3. Assessment schedule for the BS GEOE student outcomes. All geological engineering and geology courses are assessed as indicated.

Assessed by GEOE faculty as part of the											
GEOE required	curriculum		Curriculum								
		3EOE 110L	3EOE 221	3EOE 324	JEOE 410	3EOE 461	JEOE 464	JEOE 465	JEOE 466	3EOE 475	
Summer 2013		-			v						
		V			Λ		TZ		37	TZ	
Fall 2013		X					X		X	X	
Spring 2014			Χ	X		Х		Х		Х	
Summer 2014					Х						
Fall 2014		Χ					Χ		Χ	Χ	
Spring 2015			Χ			Χ		Χ		Х	
Summer 2015					Χ						
Fall 2015	Duanana aalf atudu	Χ					Χ		Χ	Χ	
Spring 2016	Prepare sell study		Χ	Χ		Χ		Χ		Х	
Summer 2016	Self study due				Х						
Fall 2016		Site Visit									

Cycle 1	Х
Cycle 2	Χ
Cycle 3	

Гаble 3-b.3. Continued.							
Assessed by geol	ogy faculty in support of						
the GEOE progra	m			Curri	culum		
		12	22	31	41	16	
		L 2	L 3	L 3	L 3	L4	
		EO	EO	EO	EO	EO	
Seme	ster Schedule	Ð	Ð	Ð	Ð	Ð	
Summer 2013							
Fall 2013				Χ	Χ	Х	
Spring 2014		Χ	Χ			Х	
Fall 2014				Χ	Χ	Х	
Spring 2015		Χ	Χ			Χ	
Fall 2015	Proporo colf study			Χ	Χ	Х	
Spring 2016	Frepare sen study	Χ	Χ			Χ	
Summer 2016	Self study due						
Fall 2016				Site	Visit		

Cycle 1	Х
Cycle 2	X
Cycle 3	

Table 3-b.4. A	ssessment schedule for 2016-	2022 accreditation cycle.
----------------	------------------------------	---------------------------

Assessed as part curriculum	Curriculum									
q		EOE 110L	EOE 221	EOE 324	EOE 410	EOE 461	EOE 464	EOE 465	EOE 466	EOE 475
Seme	ster Schedule	0	0	G	0	Ð	0	G	0	0
Summer 2017					X					
Fall 2017		Χ					Χ		Χ	Χ
Spring 2018			Χ	Χ		Χ		Χ		Х
Summer 2019					Χ					
Fall 2019		Χ					Χ		Χ	Χ
Spring 2020			Χ			Х		Х		Х
Summer 2021					Χ					
Fall 2021		Χ					Χ		Χ	Χ
Spring 2022	Prepare self study		Χ	Χ		Χ		Χ		Х
Summer 2022	Self study due				Х					
Fall 2022		Site Visit								

Cycle 1	X
Cycle 2	X
Cycle 3	

Table 3b-4. Continued.

Assessed by Geol faculty in support of								
the GEOE progr	am	Curriculum						
		212	322	331	341	416		
		EOL	EOL	EOL	EOL	EOL		
Seme	ster Schedule	Ū	Ū	IJ	ß	ß		
Fall 2017				Χ	Χ	Х		
Spring 2018		Χ	Χ			Χ		
Fall 2019				Χ	Χ	Χ		
Spring 2020		Χ	Χ			Χ		
Fall 2021				Χ	Χ	Х		
Spring 2022	Prepare self study	Χ	Χ			Χ		
Summer 2022	Self study due							
Fall 2022				Site	Visit			

Cycle 1	Х
Cycle 2	Х
Cycle 3	

CRITERION 4. CONTINUOUS IMPROVEMENT

A. Student Outcomes

Processes utilized by the BS GEOE program were rigorously systematized in 2013 for attaining uniformity across curricular assessment. Individual course instructors have been provided more coherent and strict evaluation guidelines to step them through the evaluation process in an orderly and methodical fashion. The primary assessment tool for the program has been presented as figure 1-b.1 which has been specifically designed for assessment of SOs addressed in a course. Its use is described below. Student outcomes, specific GEOE and GEOL courses where they are assessed, and assessment criteria are summarized on Table 4-a.1. The current evaluation cycle assessment schedule is given on Table 3-b.3 and Table 3-b.4 contains the assessment cycle from 2016 forward.

A.1 Description of the Assessment Processes

Assessment processes used to gather the data upon which the evaluation of each student outcome is based includes both curricular and non-curricular facets (Fig. 4-a.1). The non-curricular data include FE exam results and survey results, primarily from the professional advisory board, employers, and other faculty constituents. These data are incorporated into the program assessment through interactions between the GEOE program coordinator and faculty, GEOE curriculum committee, the advisory board, employers, and other faculty. The curricular assessment process for courses follow the general format contained in figure 4-a.1.

Curricular assessment utilizes the assessment worksheet (Fig. 1-b.1) where faculty evaluate instructor-designed course objectives mapped to program SOs. There are three levels of performance having a score of 1, 2, and 3 plus an allowance for interpolations of 0.5 units. These numeric scores are correlated to performance levels as follows: level 1 = Below Proficiency, level 2 = Proficient, and level 3 = Above Proficiency, with all values greater than 2 considered as proficient for the purposes of proficiency rate analysis.

The program has identified two sublevels of assessment for the SOs. Instructors will identify an outcome as having either a Primary or Additional emphasis in the course. Primary indicates that there is a concentrated emphasis on that SO and it is a fundamental part of the course curriculum. Additional indicates that there is not an emphasis on that SO. Both Primary and Additional sublevels are able to be assessed by one or several student products.

Course assessment consists of the following process. Each course has a specific assessment workbook that includes up to 12 assignment spreadsheets for SO assessment. Figure 1-b.1 is an example of one of the 12 spreadsheets in the workbook. Faculty are able to assess SOs using multiple student products (assignments, exams, etc.) and more assessment sheets are added if required. Each spreadsheet or student product can be used to assess a single or several SOs. As the assessments are completed, individual proficiency scores are recorded for each SO and individual student scores are averaged automatically in the far right column. At the bottom of each spreadsheet, instructors also record text addressing identified areas of weakness based on the proficiency scores and can record ideas for course improvement to address those weaknesses in the future. The sum of the averages of all proficiency scores are tallied on the last sheet in the workbook resulting in the determination of an average proficiency rate for each SO assessed in

that course. These proficiency rates are then combined on a separate spreadsheet that contain results from several years of assessment. These multi-year rates are then used to construct the summary plots for the course that contains the Primary and Additional outcomes that were assessed.

Section A.4 provides details on each SO and contains tabulated results, and proficiency rate data for each program SO. The completed assessment worksheets and instructor-proved improvement data are contained in each course binder that will be available in the Materials Room at the time of the accreditation visit.

A.2 Frequency of Assessment Process

Student outcome assessments for previous ABET accreditation visits through 2010 were based upon assessment data which were collected primarily every three years (years 3 and 6 of the evaluation cycle). With new ABET requirements having increased focus on continuous improvement, the BS GEOE program moved to a more structured and systematic assessment process that began in 2013. For the 2010-2016 accreditation cycle, a specific schedule for individual course assessment was developed (Fig. 3-b.3) that was designed to provide three years of assessment for every-year courses. Assessments included both required GEOE and GEOL courses.

Moving forward, the GEOE program will migrate from assessing every course every year to every other year so that for the 2022 site visit, we will have three assessments for each course (Table 3-b.4).

A.3 Expected Level of Attainment

The expected level of attainment for all BS GEOE program SOs is 75% of all students meeting or exceeding performance level 2: Proficient. Achievement of levels greater than 2 are sought for and attainment of levels below 2 signal areas where curricular adjustments are indicated.

Table 4-a.1. Student outcome assessment schedule and assessment criteria used for evaluation. Only Primary emphasis levels from GEOE and GEOL courses are included.

Student Outcome	Courses: Primary Outcome	3: Exceeds Proficiency	2: Proficient	1: Below Proficiency
a. Math/Science/Engineering	GEOL 212, GEOE 221, GEOL 322, GEOE 324, GEOL 341, GEOE 410, GEOE 461, GEOE 465, GEOE 466, GEOE 475	Uses math, science, and engineering concepts and equations at advanced level with no errors.	Uses math, science, and engineering concepts and equations at proficient level with only minor errors.	Uses little or no mathematics, science, or engineering above basic level, or makes significant conceptual or procedural errors.
b. Design/Conduct Experiments	GEOL 212, GEOE 324, GEOE 465, GEOE 466, GEOE 475	Student clearly articulates major aspects of experiment, designs efficient method to address it, and analyzes and interprets data.	Student articulates most aspects of experiment and designs reasonable experiment to address it; analysis and interpretation of data.	Student only articulates some of the major aspects of the experiment and does not design clear method to address it.
c. Design a System or Process	GEOE 410, GEOE 464, GEOE 465, GEOE 466, GEOE 475	Demonstrates advanced comprehension of engineering design process, including optimal conversion of resources.	Demonstrates basic comprehension of major aspects of engineering design in the conversion of resources.	Demonstrates weak understanding of engineering design and decision-making process.
d. Function on Teams	GEOE 410, GEOE 464	Team member made outstanding efforts in organizing work flow, carrying out responsibilities, and working with others on team.	Team member made above-average or acceptable efforts in work flow, responsibilities, and working with others on team.	Team member's efforts need improvement in work flow, responsibilities, and working with others on team.
e. Solve Engineering Problems	GEOE 464, GEOE 465, GEOE 466, GEOE 475	Shows outstanding ability to clearly identify, formulate, articulate, and solve engineering problems.	Shows reasonable ability to identify, formulate, articulate, and solve engineering problems.	Shows little ability to clearly identify, formulate, articulate, and solve engineering problems.

Table 4-a.1. Continued.

f. Ethical Responsibility	GEOE 110, GEOE 464	Demonstrates sound understanding of professional ethics and responsibility in written work and in class discussions.	Demonstrates basic, satisfactory understanding of professional ethics and responsibility in written work and in class discussions.	Demonstrates little understanding of, or concern for, professional ethics and responsibility in written work or in class discussions.
g. Communicate Effectively	GEOE 324, GEOL 341, GEOE 410, GEOL 416, GEOE 464, GEOE 465, GEOE 466, GEOE 475	Student communicates fluently and professionally in written and oral presentations, including reports written in proper format.	Student demonstrates adequate writing and speaking style, with clear meaning and few errors; reports in appropriate format.	Student communicates poorly in written and oral presentations; many errors in grammar and spelling; inappropriate format.
h. Global Context	GEOE 461, GEOE 464, GEOE 466	Clearly applies broad educational knowledge to engineering problems; work addresses a problem that directly affects global, economic, environmental, or societal issues.	Applies educational knowledge to engineering problems; work addresses a problem that can be related to global, economic, environmental, or societal issues.	Marginally applies broad educational knowledge to engineering problems; work is only distantly related to or has little impact on global, economic, environmental, or societal issues.
i. Life-long Learning	GEOE 464, GEOE 465	Shows great awareness of need for updating skills; displays sound understanding of importance of life-long learning.	Shows reasonable awareness of need for updating skills; displays basic understanding of importance of life-long learning.	Displays little awareness of, or concern for, the necessity of updating skills and life- long learning.

Table 4-a.1. Continued.

j. Contemporary Issues	GEOE 410, GEOE 464, GEOE 466	Student shows clear ability to identify contemporary issues and apply knowledge to engineering problems in important areas.	Student shows reasonable ability to understand issues and apply knowledge to engineering problems in some areas.	Student fails to comprehend at least some aspects of basic issues, and demonstrates little ability to apply knowledge to problems.
k. Engineering Tools	GEOE 324, GEOL 416, GEOE 464, GEOE 465, GEOE 466, GEOE 475	Learns necessary tools and software quickly; uses them effectively; can choose from tools to achieve goals.	Learns necessary tools and software in a reasonable amount of time; obtains solutions; proficient in a reasonable number of tools.	Has difficulty in becoming proficient in use of tools and software; proficient in only a limited number of tools.
1. Field Competence	GEOL 322, GEOE 324, GEOL 331, GEOL 341, GEOE 410, GEOE 466, GEOE 475	Creates maps that are correct, in proper format; identifies minerals, rocks, and structures with virtually no errors; applies field geological engineering analysis correctly.	Creates maps that are substantially correct, in appropriate format; identifies minerals, rocks, and structures with few errors; applies field analysis with few errors.	Student creates maps that are incorrect or uses non- standard format; does not properly identify minerals, rocks, or structures; incorrectly applies field analysis.



Figure 4-a.1. Assessment process used to gather data for evaluation of student outcomes in courses throughout the BS GEOE curriculum.

A.4 Summaries of Results of Evaluation Processes

<u>Curricular</u>

Summary results of the course-based assessments for each student outcome based on the past three academic years are presented in Tables 4-a.3 through 4-a.14. These tables define assessment of each SO *a-l* for both Primary and Additional emphasis. Figures 4-a.2 through 4-

a.13 contain the average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years. These figures also are designed such that the expected level of attainment of proficiency (level 2) and the proficiency goal of 75% are visible. Each student outcome a-l is defined and results presented and analyzed below. There are courses in these tables where proficiency rates were low or below expectations. Those concerns will be addressed in that specific course binder where the instructor will have provided data on what the primary concern(s) were and planned steps for remediation of those concerns.

Student Outcome Discussion

Assessment of SOs at the program level support the attainment of the goals for 75% of the students obtaining a proficiency of at least level 2: Proficient. There were few values less than 75% for specific courses and many were many between 75-90%. Although proficiency averages were all >75%, this does not indicate potential curricular issues have not been identified and corrected. Indeed, many course binders have assessment data that indicate acres where SO scores were below level 2 and the corrective action that occurred. Refer to individual course binders for specific examples of curricular improvement.

This Space Left Blank Intentionally

					Academic Ye	ar			
Course		2013-2014		2014-2015				2015-2016	
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments
GEOL 212	2.28	76%	36	2.31	86%	36	2.33	85%	36
GEOE 221	2.53	89%	36	2.52	92%	36	2.50	92%	36
GEOL 322	2.59	92%	36	2.42	97%	36	2.66	97%	36
GEOE 324	2.43	89%	27		not assessed		2.62	95%	21
GEOL 341	2.61	91%	36	2.31	86%	36	2.33	85%	36
GEOE 410	2.50	100%	3	2.50	100%	3	3.00	100%	3
GEOE 461	2.64	100%	18	2.57	100%	18	2.73	100%	21
GEOE 465	2.17	100%	3	2.67	100%	3	2.33	100%	3
GEOE 466	2.58	100%	24	2.60	96%	24	2.60	100%	24
GEOE 475	2.33	100%	3	2.50	100%	3	2.70	100%	3
Average	2.47	94%		2.49	95%		2.58	95%	

Table 4-a.3a. Summary of course-based assessment of Student Outcome A (Ability to apply knowledge of mathematics, science and engineering) for courses where this outcome served as a **Primary** outcome.

Table 4-a.3b. Summary of course-based assessment of Student Outcome A (Ability to apply knowledge of mathematics, science and engineering) for courses where this outcome served as an **Additional** outcome.

					Academic Ye	ar			
Course		2013-2014			2014-2015	5		2015-2016	
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments
GEOL 331	2.72	100%	30	2.33	91%	33	2.48	88%	33
Average	2.72	100%		2.33	91%		2.48	88%	



Proficiency rate 90 - 100%



Proficiency rate 70 - 80%



Proficiency rate 80 - 90%





Figure 4-a.2. Summary of course-based assessment of Student Outcome A (Ability to apply knowledge of mathematics, science and engineering) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

					Academic Ye	ar				
Course		2013-2014		2014-2015				2015-2016		
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	
GEOL 212	2.67	100%	3	2.50	100%	3		not assessed		
GEOE 324	2.45	89%	27		not assessed	l	2.67	95%	21	
GEOE 465	2.00	100%	3	2.50	100%	3	2.33	67%	3	
GEOE 466	2.58	100%	21	2.61	95%	21	2.65	100%	7	
GEOE 475	2.67	100%	3	2.67	100%	3	2.83	100%	3	
Average	2.47	98%		2.57	99%		2.62	91%		

Table 4-a.4a. Summary of course-based assessment of Student Outcome B (Ability to design and conduct experiments as well as to analyze and interpret data) for courses where this outcome served as a **Primary** outcome.

Table 4-a.4b. Summary of course-based assessment of Student Outcome B (Ability to design and conduct experiments as well as to analyze and interpret data) for courses where this outcome served as an **Additional** outcome.

Course		Academic Year									
	2013-2014				2014-2015	5		2015-2016			
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 221	2.41	88%	27	2.55	93%	27	2.56	92%	27		
GEOE 410	2.50	100%	3	3	100%	3	3.00	100%	3		
Average	2.46	94%		2.78	97%		2.78	96%			



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%



Figure 4-a.3. Summary of course-based assessment of Student Outcome B (Ability to design and conduct experiments as well as to analyze and interpret data.) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Table 4-a.5a. Summary of course-based assessment of Student Outcome C (Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability) for courses where this outcome served as a **Primary** outcome.

					Academic Ye	ar			
Course		2013-2014			2014-2015			2015-2016	
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments
GEOE 410	2.67	100%	3	2.67	100%	3	2.50	100%	3
GEOE 464	2.33	100%	3	2.75	100%	3	2.67	100%	3
GEOE 465	2.50	100%	3	2.33	100%	3	2.33	100%	3
GEOE 466	2.48	83%	12	2.61	100%	12	2.58	100%	12
GEOE 475	2.33	100%	3	2.75	100%	3	2.77	100%	3
Average	2.46	97%		2.62	100%		2.57	100%	

Table 4-a.5b. Summary of course-based assessment of Student Outcome C (Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability) for courses where this outcome served as an **Additional** outcome.

					Academic Ye	ar			
Course		2013-2014			2014-2015	5		2015-2016	
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments
GEOE 110	2.61	92%	12	2.61	92%	12	2.42	100%	12
GEOE 324	2.50	92%	12		not assesse	d	2.63	100%	24
GEOE 461	3.00	100%	3	2.67	100%	3	2.67	100%	3
Average	2.70	95%		2.64	96%		2.57	100%	

Proficiency rate 90 - 100%

Proficiency rate 80 - 90%

Proficiency rate 70 - 80%



Figure 4-a.4. Summary of course-based assessment of Student Outcome C (Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Table 4-a.6a. Summary of course-based assessment of Student Outcome D (Ability to function on multidisciplinary teams) for courses where this outcome served as a **Primary** outcome.

Course		Academic Year									
	2013-2014				2014-2015		2015-2016				
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 410	3.00	100%	3	2.67	100%	3.00	3.00	100%	3		
GEOE 464	2.00	100%	3	2.67	100%	3.00	3.00	100%	3		
Average	2.50	100%		2.67	100%		3.00	100%			

Table 4-a.6b. Summary of course-based assessment of Student Outcome D (Ability to function on multidisciplinary teams) for courses where this outcome served as an **Additional** outcome.

		Academic Year									
Course		2013-2014	ļ		2014-2015	5		2015-2016			
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 324	2.67	100%	6		not assesse	d	2.50	100%	12		
GEOE 465	2.00	100%	3	3.00	100%	3.00	2.33	100%	3		
Average	2.34	100%		3.00	100%		2.42	100%			



Proficiency rate 80 - 90%



_

Proficiency rate 70 - 80%





Figure 4-a.5. Summary of course-based assessment of Student Outcome D (Ability to function on multidisciplinary teams) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

		Academic Year										
Course		2013-2014			2014-2015			2015-2016				
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments			
GEOE 464	2.67	100%	3	2.75	100%	3	2.33	100%	3			
GEOE 465	2.50	67%	3	2.50	100%	3	2.67	100%	3			
GEOE 466	2.52	94%	18	2.63	94%	18	2.57	100%	18			
GEOE 475	2.33	100%	3	2.75	100%	3	2.78	100%	3			
Average	2.51	90%		2.66	99%		2.59	100%				

Table 4-a.7a. Summary of course-based assessment of Student Outcome E (Ability to identify, formulate, and solve engineering problems) for courses where this outcome served as a **Primary** outcome.

Table 4-a.7b. Summary of course-based assessment of Student Outcome E (Ability to identify, formulate, and solve engineering problems) for courses where this outcome served as an **Additional** outcome.

					Academic Ye	ar			
Course		2013-2014		2014-2015			2015-2016		
GEOE 110	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments
GEOE 110	2.51	92%	12	2.40	92%	12	2.39	92%	12
GEOE 221	2.42	75%	9	2.54	89%	9	2.34	78%	9
GEOE 324	2.43	83%	24		not assesse	d	2.33	100%	15
GEOE 410	2.75	100%	3	2.17	67%	3	3.00	100%	3
GEOE 461	2.63	100%	12	2.54	100%	12	2.70	100%	12
Average	2.55	90%		2.41	87%		2.55	94%	



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.6. Summary of course-based assessment of Student Outcome E (Ability to identify, formulate, and solve engineering problems) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Table 4-a.8a. Summary of course-based assessment of Student Outcome F (An understanding of professional and ethical responsibility) for courses where this outcome served as a **Primary** outcome.

Course		Academic Year									
	2013-2014			2014-2015			2015-2016				
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 110	2.72	100%	6	2.28	100%	6	2.58	100%	6		
GEOE 464	2.33	100%	3	2.75	100%	3	3.00	100%	3		
Average	2.53	100%		2.52	100%		2.79	100%			

Table 4-a.8b. Summary of course-based assessment of Student Outcome F (An understanding of professional and ethical responsibility) for courses where this outcome served as an **Additional** outcome.

Course		Academic Year									
	2013-2014			2014-2015			2015-2016				
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 465	2.00	100%	3	2.67	100%	3	3.00	100%	3		
GEOE 466	2.50	100%	3	2.50	100%	3	2.50	100%	3		
Average	2.25	100%		2.59	100%		2.75	100%			





Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.7. Summary of course-based assessment of Student Outcome F (An understanding of professional and ethical responsibility) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

					Academic Ye	ar			
Course		2013-2014		2014-2015			2015-2016		
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments
GEOE 324	2.17	100%	3		not assessed		2.48	100%	21
GEOL 341	2.72	100%	27		not assessed		not assessed		
GEOE 410	2.00	67%	3	2.17	67%	3	2.50	100%	3
GEOL 416	2.49	89%	27	2.27	93%	15	2.39	94%	18
GEOE 464	2.33	100%	3	2.75	100%	3	2.50	100%	3
GEOE 465	2.50	67%	3	3.00	100%	3	2.83	100%	3
GEOE 466	2.58	91%	12	2.58	100%	12	2.58	100%	12
GEOE 475	2.50	100%	3	2.75	100%	3	2.70	100%	3
Average	2.41	89%		2.59	93%		2.57	99%	

Table 4-a.9a. Summary of course-based assessment of Student Outcome G (Ability to communicate effectively) for courses where this outcome served as a **Primary** outcome.

Table 4-a.9b. Summary of course-based assessment of Student Outcome G (Ability to communicate effectively) for courses where this outcome served as an **Additional** outcome.

Course		Academic Year									
	2013-2014				2014-2015			2015-2016			
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOL 322	2.55	94%	36	2.53	100%	36	2.62	97%	36		
GEOL 331	2.68	94%	18	2.46	94%	18	2.57	87%	15		
Average	2.62	94%		2.50	97%		2.60	92%			

Proficiency rate 90 - 100%





Proficiency rate 70 - 80%





Figure 4-a.8. Summary of course-based assessment of Student Outcome G (Ability to communicate effectively) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Table 4-a.10a. Summary of course-based assessment of Student Outcome H (The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context) for courses where this outcome served as a **Primary** outcome.

Course		Academic Year										
	2013-2014			2014-2015			2015-2016					
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments			
GEOE 461	2.50	100%	3	2.67	100%	3	2.83	100%	6			
GEOE 464	2.50	100%	3	2.75	100%	3	3.00	100%	3			
GEOE 466	2.59	100%	12	2.72	100%	12	2.73	100%	12			
Average	2.53	100%		2.71	100%		2.85	100%				

Table 4-a.10b. Summary of course-based assessment of Student Outcome H (The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context) for courses where this outcome served as an **Additional** outcome.

Course		Academic Year									
	2013-2014				2014-2015			2015-2016			
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 221	2.53	100%	6	2.50	83%	6	2.30	83%	6		
GEOE 465	2.00	100%	3	2.33	100%	3	3.00	100%	3		
Average	2.27	100%		2.42	92%		2.65	92%			



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.9. Summary of course-based assessment of Student Outcome H (The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Table 4-a.11a. Summary of course-based assessment of Student Outcome I (Recognition of the need for, and ability to engage in, life-long learning) for courses where this outcome served as a **Primary** outcome.

Course		Academic Year									
	2013-2014			2014-2015			2015-2016				
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 464	2.50	100%	3	2.75	100%	3	3.00	100%	3		
GEOE 465	2.00	100%	3	3.00	100%	3	3.00	100%	3		
Average	2.25	100%		2.88	100%		3.00	100%			

Table 4-a.11b. Summary of course-based assessment of Student Outcome I (Recognition of the need for, and ability to engage in, life-long learning) for courses where this outcome served as an **Additional** outcome.

					Academic Ye	ar				
Course		2013-2014			2014-2015			2015-2016		
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	
GEOE 221	2.58	100%	6	2.58	100%	6	3.00	100%	6	
GEOE 324	2.25	100%	6		not assesse	d	3.00	100%	3	
GEOE 410	2.75	100%	3	2.00	67%	3	3.00	100%	3	
GEOE 466	2.61	100%	12	2.73	100%	12	2.71	100%	12	
Average	2.55	100%		2.44	89%		2.93	100%		



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.10. Summary of course-based assessment of Student Outcome I (Recognition of the need for, and ability to engage in, life-long learning) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Table 4-a.12a. Summary of course-based assessment of Student Outcome J (Knowledge of contemporary issues) for courses where this outcome served as a **Primary** outcome.

Course		Academic Year									
	2013-2014			2014-2015			2015-2016				
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 410	2.75	100%	3	2.67	100%	3	2.83	100%	3		
GEOE 464	2.50	100%	3	2.83	100%	3	3.00	100%	3		
GEOE 466	2.59	100%	18	2.51	94%	18	2.58	94%	18		
Average	2.61	100%		2.67	98%		2.80	98%			

Table 4-a.12b. Summary of course-based assessment of Student Outcome J (Knowledge of contemporary issues) for courses where this outcome served as an **Additional** outcome.

		Academic Year										
Course		2013-2014		2014-2015			2015-2016					
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments			
GEOE 221	2.51	76%	18	2.71	100%	18	2.39	87%	18			
GEOE 324	2.39	100%	9		not assesse	d	3.00	100%	3			
GEOE 461	2.44	100%	9	2.61	100%	9	2.74	100%	9			
Average	2.45	92%		2.66	100%		2.71	96%				



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.11. Summary of course-based assessment of Student Outcome J (Knowledge of contemporary issues) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

	Academic Year										
Course		2013-2014		2014-2015			2015-2016				
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 324	2.39	89%	27		not assessed		2.72	100%	18		
GEOL 416	2.48	83%	36	2.53	93%	15	2.50	89%	18		
GEOE 464	2.50	100%	3	2.75	100%	3	2.67	100%	3		
GEOE 465	2.50	67%	3	2.67	100%	3	1.83	67%	3		
GEOE 466	2.61	94%	18	2.60	88%	18	2.62	94%	18		
GEOE 475	2.50	100%	3	2.75	100%	3	2.83	100%	3		
Average	2.50	89%		2.66	96%		2.53	92%			

Table 4-a.13a. Summary of course-based assessment of Student Outcome K (Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice) for courses where this outcome served as a **Primary** outcome.

Table 4-a.13b. Summary of course-based assessment of Student Outcome K (Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice) for courses where this outcome served as an **Additional** outcome.

	Academic Year										
Course	2013-2014			2014-2015			2015-2016				
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOE 110	2.56	89%	9	2.26	78%	9	2.33	89%	6		
GEOE 410	3.00	100%	3	3.00	100%	3	3.00	100%	3		
GEOE 461	2.64	100%	18	2.57	100%	18	2.72	100%	18		
Average	2.73	96%		2.61	93%		2.68	96%			



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.12. Summary of course-based assessment of Student Outcome K (Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

	Academic Year										
Course	2013-2014			2014-2015			2015-2016				
Course	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments		
GEOL 322	2.59	94%	36	2.44	97%	36	2.70	97%	36		
GEOE 324	2.67	100%	6	not assessed			2.17	100%	12		
GEOL 331	2.62	93%	15	2.46 94% 18			2.57	87%	15		
GEOL 341	2.40	67%	6	not assessed			not assessed				
GEOE 410	2.50	100%	3	2.17	67%	3	3.00	100%	3		
GEOE 466	2.74	100%	9	2.53	78%	9	2.49	89%	9		
GEOE 475	2.50	100%	3	2.75	100%	3	2.83	100%	3		
Average	2.57	93%		2.47	87%		2.63	96%			

Table 4-a.14a. Summary of course-based assessment of Student Outcome L (Field competence) for courses where this outcome served as a **Primary** outcome.

Table 4-a.14b. Summary of course-based assessment of Student Outcome L (Field competence) for courses where this outcome served as an **Additional** outcome.

Course	Academic Year											
	2013-2014			2014-2015			2015-2016					
	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments	Average Score	Proficiency Rate	Number of Assessments			
GEOE 221	2.59	92%	12	2.74	100%	12	2.52	87%	12			
Average	2.59	92%		2.74	100%		2.52	87%				



Proficiency rate 90 - 100%



Proficiency rate 80 - 90%



Proficiency rate 70 - 80%





Figure 4-a.13. Summary of course-based assessment of Student Outcome L (Field competence) for average assessed scores and the proficiency rate for Primary and Additional outcome emphasis for the past three academic years.

Non-Curricular:

FE Exam Results: BS GEOE students are not required to sit for the Fundamentals of Engineering (FE) exam, however, students are encouraged to take the exam and a few usually do so each semester. Table 4-a.15 contains the FE results for geological engineering students vs. the numbers enrolled and passing the exam at the national level. These data include both active students and those who are siting for the exam within 1-year of their graduation. Although the SDSMT numbers are only a fraction of those siting for the exam nationally, the pass rate was 59% since 2010 compared to 57% nationally for the same time period. These data indicate that BS GEOE students from SDSMT are well prepared academically and have demonstrated they compete with their peers at a national level.

Table 4-a.15. Comparison of the results of SDSMT BS GEOE students enrolled and passing the FE exam from 2010-2016 to all other BS GEOE students nationally.

	Fall							Spring					
Year		SDSMT		National			SDSMT			National			
	Enrolled	Passed	Pass %	Enrolled	Passed	Pass %	Enrolled	Passed	Pass %	Enrolled	Passed	Pass %	
2010-2011	1	1	100	24	16	67	1	0	0	40	22	55	
2011-2012	1	0	0	4	2	50	2	0	0	46	22	48	
2012-2013	2	2	100	38	19	50	3	0	0	53	31	58	
2013-2014													
2014-2015	2	1	50	18	13	72	7	6	86	34	22	65	
2015-2016	3	3	100	37	22	59							
Totals All P	eriods												
	2	SDSMT			National		_						
	22	13		294	169								
Pass Rate:		59%			57%								

A.5 Documentation and Maintenance of Evaluation Results

Documentation of records have primarily been in the form of photocopies or scans of student work. In some cases, original work has also been retained by permission of the students. These data have then been used to complete the course assessments by course instructors. The completed electronic documents are then placed in a password protected (faculty access only) folder on the campus file server. Individual faculty maintain records of student performance by way of assignments, exams, reports, presentations, etc., in their files. Many of these records will be contained in each course assessment folder that will be available at the time of the campus visit. In addition to the file server location, backups of all program records (non-course specific) are maintained on removable hard drives by the GEOE program coordinator.

B. Continuous Improvement

During the past cycle of assessment and evaluation of the BS GEOE program, all major areas of the program were reviewed. These areas included the curriculum, students and student advising, POEs and SOs, faculty, constituents, and facilities. Details on students and advising are contained in Criterion 1-D.2; PEOs, SOs, and constituents are detailed in Criterion 2 and

Criterion 3; faculty is addressed in Criterion 6; and facilities in Criterion 7. The following sections will detail examples and results of continuous improvement of the curriculum.

B.1 BS GEOE Program Review

Faculty regularly review curricular issues and make evaluations of the program in light of SOs, PEOs, and constituency feedback using data collected as described in prior sections. Starting in the fall term each academic year, the GEOE curriculum committee begin regular meetings to address identified issues with courses that might require changes to facilitate more accurate assessment of SOs. Potential concerns having been identified during course assessments completed by individual faculty the previous academic year are discussed in terms of the SOs resulting in an evaluation of the concern being a course-issue or a program-issue. If a shortcoming is able to be defined based on assessment, a solution is devised and a curricular change is made, either to the course, the program, or both.

B.2 Curricular Improvements

Course-specific improvements are identified using the summary plots discussed in C4-A.4 above. Individual faculty, or the GEOE faculty as a whole, will devise a strategy to provide improvement regarding the identified concern that is then applied to the course or program. The course instructor is then responsible to use the next assessment cycle to define if the concern has been remedied or not. Specific comments are entered on the annual assessment forms and the process is repeated through the assessment cycle. New summary plots (generated every three years) will be necessary to define the degree of effectiveness of the changes. The GEOE faculty and the GEOE curriculum committee perform the same systematic analysis for any program changes. This systematic approach was initiated in 2013 has undergone one 3-year cycle to date as discussed above.

Within the current accreditation cycle the BS GEOE program was reduced from 136 to 130 credit hours based on a SD Board of Regents mandate

(https://www.sdbor.edu/theboard/agenda/2012/march/14.pdf). The overall effect on the program was to eliminate or streamline a few courses. These changes are specified below.

- 1) eliminate the requirement for physical education from 2-credits to 0-credits,
- 2) reduce GEOE 110 from 2-credits to a 1-credit course that is listed as (0-1),
- 3) reduce the Humanities/Social Science credits from 16 to 15 credits which eliminated the need for students to either enroll in a rare 4-creidt hour course or to take an additional 3-crdit hour course to obtain the single extra required hour,
- 4) working with mining engineering to reduce the rock mechanics course from 4-credits to 3credits, and
- 5) eliminate 1-credit of free electives to the current 3-credits required for Approved Elective.

Examples of continuous improvements driven by evaluation of the PEOs, SOs and input from the Professional Advisory Board for both courses and the program are detailed below.

Example 1: Course and Program Improvement—Merging GEOE 461 and GEOE 462

To ensure that GEOE graduates are being provided the background necessary to be successful in the petroleum industry, as per section one of the GEOE Program Educational Objectives, the decision was made to merge GEOE 461 – Petroleum Production and GEOE 462 – Drilling

Engineering in 2011. Prior to this merger, students were required to take GEOE 461, but GEOE 462 was offered as an elective and didn't always meet the 10 student minimum (a requirement of the South Dakota Board of Regents for undergraduate courses) to be offered. While exceptions to the 10 student requirement are possible (and were done for GEOE 462 in 2000 and 2008, they are not viewed favorably by administration). A solution was reached as a programmatic and curricular improvement by merging the content of the elective course GEOE 462 with that of GEOE 461 which was taught every year. The faculty teaching these courses agreed upon a merging of the courses into the renamed GEOE 461 Petroleum Drilling and Production Engineering and was initially taught in spring 2012 and every year since. The course GEOE 462 was ultimately deleted from the catalog. The first one-half of the semester of the newly created course, students are taught drilling engineering (including a redesigned comprehensive drilling design project) and the second half of the semester students receive the petroleum production aspect of the course. This adjustment has allowed students to be exposed to both drilling and production practices in a single required course. As with every course, individual adjustments made to course content on an annual basis are documented on the yearly course assessment sheets.

Example 2: Course and Program Improvement – Instructor and Content Change in GEOE <u>466</u>

In the spring of 2011, the decision was made to strengthen Student Outcome "k" (Ability to use the techniques, skills and modern engineering tools necessary for engineering practice). Verbal discussion with one of our Advisory Board members emphasized the importance of graduates having expertise in using software programs to perform assess geologic hazards (i.e. slope failure, etc.). At the time, courses using software to conduct engineering analysis included the areas of geophysics (seismic profile analysis) and groundwater (AQTESOLV and MODFLOW). However, at this time, slope analysis presented within required curriculum was limited to a simple spreadsheet analysis. In the fall of 2009, an elective course, GEOE 468 – Geohazards, was offered and student opinion surveys indicated a great appreciation for the inclusion of more detailed slope analyses techniques, including the use of a dedicated software to suite this purpose. To remain current with industry standards, it was deemed imperative that a required course should provide graduates the a level of expertise in geotechnical and geomechanical software that could be used to evaluate geologic hazards such as slope failure, rockfall, etc. As such, the department purchased an educational license for Rocscience's suite of software in order to help in strengthening the curriculum and the PEO-stated focus on geomechanical expertise by program graduates. Thus, beginning in fall 2011, the required 3-credit course GEOE 466 content was modified to include a substantial use of the Rocscience suite of geomechanical programs. Course content was adjusted and a change of instructor for the course was made such that geomechanical expertise was present to deliver these new materials.

B.3 Program Impacts from Improvements

The continuous improvements detailed above have been in place for a full 3-year assessment cycle and have resulted in positive impacts for program attainment of SOs and its students.

The program and course impact from example 1 has been positive. Table 4-b.1 contains the enrollment data and the years the course was taught as GEOE 462 vs. GEOE 461 after the merger in 2012. Prior to the merger, drilling engineering was able to be offered four times and

two of those times the course received an exception for the low enrollment (<10). The total number of senior students in the program is reflected by the enrollment in the required course GEOE 461. Over these 14 years, 23% of the students were able to enroll in GEOE 462. Since 2012, all students in the program, helping to ensure that all graduates will be competent for employment in the petroleum industry.

Table 4-b.1. Enrollment data for the courses GEOE 462 and GEOE 461 prior to the merger of the two in 2012. Since the merger into a single required course, all geological engineering students have had the drilling engineering curriculum and has expanded the assessment opportunities for SO h) Global Context.

	GEOE	GEOE
	462	461
Year	Enrol	lment
1997		10
1998		9
1999		12
2000	8	
2001		12
2002		6
2003		9
2004		15
2005	10	13
2006		17
2007	12	12
2008	9	11
2009		15
2010		11
2011		16
Totals	39	168
Since Mei	ger betwee	en GEOE
462 and 0	GEOE 461	in 2012
2012		17
2013		2
2014		22
2015		24
2016		21

The program and course impact from example 2 has been positive. The success of this change has been realized in additional courses where students are now capable of using the Rocscience software programs on assignments and projects. Two of the impacted courses include GEOE 410 Engineering Field Geology and GEOE 465 Geological Engineering Design II. Students in these courses are able to perform slope stability analysis as part of assignments and projects.

The increase in quality of products in these exercises and has risen substantially since this change was implemented. The assessment of SO k) Engineering Tools has been attained at a high level with the addition of the Rocscience suite of engineering programs.

C. Additional Information

All assessment instruments and evaluation results utilized for individual courses and the program will be available for review at the campus visitation.

This Space Left Blank Intentionally