b. Fringe Benefits

	Budget Period 1	Budget Period 2	Budget Period 3	Total
Rate applied:				
Total fringe requested:				

REDACTED
EXEMPTION 4

A federally approved fringe benefit rate agreement, or a proposed rate supported and agreed upon by DOE for estimating purposes is required if reimbursement for fringe benefits is requested. Please check (X) one of the options below and provide the requested information, if it has not already been provided to the Contracting Officer, OR if it has changed since it was. Calculate the fringe rate and enter the total amount in Section B, line 6.b. ("Fringe Benefits") of form SF-424A.

____ **A fringe benefit rate has been negotiated with, or approved by, a federal government agency. A copy of the latest rate agreement is included with this application, and will be provided electronically to the Contracting Officer for this project.**
(When this option is selected, a presentation of the budget that demonstrates the appliction of the approved rate, to arrive at the proposed fringes benefits dollars should also be provided.)

X **There is not a current, federally approved rate agreement negotiated and available.**
(When this option is checked, the entity preparing this form shall submit a rate proposal in the format provided at the following website, or a format that provides the same level of information and which will support the rates being proposed for use in performance of the proposed project. Go to https://www.eere-pmc.energy.gov/forms.aspx and select PMC 400.2 Sample Rate Proposal.)

Additional explanation/comments (as necessary)

c. Travel

PLEASE READ!!!

Provide travel detail as requested below, identifying total Foreign and Domestic Travel as separate items. Purpose of travel are items such as professional conference, DOE sponsored meeting, project management meeting, etc. The Basis for Estimating Costs are items such as past trips, current quotations, Federal Travel Regulations, etc.

All listed travel must be necessary for performance of the Statement of Projecct Objectives.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Purpose of travel	No. of Travelers	Depart From (not required for domestic travel)	Destination (not required for domestic travel)	No. of Days	Cost per Traveler	Cost per Trip	Basis for Estimating Costs
Budget Period 1							
Domestic Travel							
EXAMPLE ONLY!!! Visit to PV cell mfr. to set up vendor agreement							
Domestic Travel subtotal							
International Travel							
International Travel subtotal							
Budget Period 1 Total							

REDACTED
EXEMPTION 4

Purpose of travel	No. of Travelers	Depart From (not required for domestic travel)	Destination (not required for domestic travel)	No. of Days	Cost per Traveler	Cost per Trip	Basis for Estimating Costs
Budget Period 2							
Domestic Travel							
	2			3	$1,500	$3,000	Past trips/internet prices
Domestic Travel subtotal							
International Travel							
International Travel subtotal							
Budget Period 2 Total							
Budget Period 3							
Domestic Travel							
Domestic Travel subtotal							
International Travel							

REDACTED
EXEMPTION 4

REDACTED
EXEMPTION 4

REDACTED
EXEMPTION 4

Purpose of travel	No. of Travelers	Depart From (not required for domestic travel)	Destination (not required for domestic travel)	No. of Days	Cost per Traveler	Cost per Trip	Basis for Estimating Costs
International Travel subtotal							
Budget Period 3 Total							
PROJECT TOTAL							

REDACTED
EXEMPTION 4

Additional Explanations/Comments (as necessary)

d. Equipment

PLEASE READ!!!

Equipment is generally defined as an item with an acquisition cost greater than $5,000 and a useful life expectancy of more than one year. Further definitions can be found at 10 CFR 600 found on the PMC Recipient Resources Forms page at https://www.eere-pmc.energy.gov/Forms.aspx#regs .

List all proposed equipment below, providing a basis of cost such as vendor quotes, catalog prices, prior invoices, etc., and briefly justifying its need as it applies to the Statement of Project Objectives. If it is existing equipment, and the value of its contribution to the project budget is being shown as cost share, provide logical support for the estimated value shown. If it is new equipment which will retain a useful life upon completion of the project, provide logical support for the estimated value shown.

For equipment over $50,000 in price, also include a copy of the associated vendor quote or catalog price list.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1					
EXAMPLE ONLY!!! Thermal shock chamber					
				REDACTED EXEMPTION 4	
Budget Period 1 Total					
Budget Period 2					
				REDACTED EXEMPTION 4	
Budget Period 2 Total					
Budget Period 3					

Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
					REDACTED EXEMPTION 4
Budget Period 3 Total					
PROJECT TOTAL					

Additional Explanations/Comments (as necessary)

REDACTED
EXEMPTION 4

e. Supplies

PLEASE READ!!!

Supplies are generally defined as an item with an acquisition cost of $5,000 or less and a useful life expectancy of less than one year. Supplies are generally consumed during the project performance. Further definitions can be found at 10 CFR 600 found on the PMC Recipient Resources Forms page at https://www.eere-pmc.energy.gov/Forms.aspx#regs.

List all proposed supplies below, providing a bases of cost such as vendor quotes, catalog prices, prior invoices, etc., and briefly justifying the need for the Supplies as they apply to the Statement of Project Objectives. Note that Supply items must be direct costs to the project at this budget category, and not duplicative of supply costs included in the indirect pool that is the basis of the indirect rate applied for this project.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1					
EXAMPLE ONLY!!! Wireless DAS components					
Budget Period 1 Total					
Budget Period 2					
Budget Period 2 Total					
Budget Period 3					

REDACTED
EXEMPTION 4

REDACTED
EXEMPTION 4

REDACTED
EXEMPTION 4

General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
				REDACTED	
				EXEMPTION 4	
Budget Period 3 Total					
PROJECT TOTAL					

Additional Explanations/Comments (as necessary)

f. Contractual

PLEASE READ!!!

The entity completing this form must provide all costs related to sub-recipients, vendors, contractors, consultants and FFRDC partners in the applicable boxes below.

Sub-recipients (partners, sub-awardees):
For each sub-recipient with total project costs of $100,000 or more, a separate SF-424A budget and PMC123.1 budget justification form must be submitted. These sub-recipient forms may be completed by either the sub-recipients themselves or by the preparer of this form. The budget totals on the sub-recipient's forms must match the sub-recipeint entries below.

The preparer of this form need only provide further support of the completed sub-recipient budget forms as they deem necessary. The support to justify the budgets of sub-recipients with estimated costs less than $100,000 may be in any format, and at a minimum should provide what Statement of Project Objectives task(s) are being performed, the purpose/need for the effort, and a basis of the estimated costs that is considered sufficient for DOE evaluation.

Vendors (includes contractors and consultants):
List all vendors, contractors and consultants supplying commercial supplies or services used to support the project. The support to justify vendor costs (in any amount) should provide the purpose for the products or services and a basis of the estimated costs that is considered sufficient for DOE evaluation.

Federal Research and Development Centers (FFRDCs):
For FFRDC partners, award recipient will provide a Field Work Proposal (if not already provided with the original application), along with the FFRDC labor mix and hours, by category and FFRDC major purchases greater than $25,000, including Quantity, Unit Cost, Basis of Cost, and Justification. The award recipient may allow the FFRDC to provide this information directly to DOE.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Sub-Recipient Name/Organization	Purpose/Tasks in SOPO	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
EXAMPLE ONLY!!! XYZ Corp.					
	REDACTED EXEMPTION 4				

Sub-Recipient Name/Organization	Purpose/Tasks in SOPO	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
	Sub-total				

Vendor Name/Organization	Product or Service, Purpose/Need and Basis of Cost (Provide additional support at bottom of page as needed)	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
EXAMPLE ONLY!!! ABC Corp.					
	REDACTED EXEMPTION 4				

FFRDC Name/Organization	Purpose	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
	REDACTED EXEMPTION 4				
Total Contractual					

AdditionalExplanations/Comments (as necessary)

REDACTED
EXEMPTION 4

g. Construction

PLEASE READ!!!

Construction, for the purpose of budgeting, is defined as all types of work done on a particular building, including erecting, altering, or remodeling. Construction conducted by the award recipient is entered on this page. Any construction work that is performed by a vendor or subrecipient to the award recipient should be entered under f. Contractual.

List all proposed construction below, providing a basis of cost such as engineering estimates, prior construction, etc., and briefly justify its need as it applies to the Statement of Project Objectives.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Overall description of construction actiivities:

xample Only!!! - Build wind turbine platform

General Description	Cost	Basis of Cost	Justification of need
Budget Period 1			
Three days of excavation for platform site EXAMPLE ONLY!!!			
Budget Period 1 Total			
Budget Period 2			
Budget Period 2 Total			

REDACTED
EXEMPTION 4

REDACTED
EXEMPTION 4

General Description	Cost	Basis of Cost	Justification of need
Budget Period 3			
		REDACTED EXEMPTION 4	
Budget Period 3 Total			
PROJECT TOTAL			

dditional Explanations/Comments (as necessary)

h. Other Direct Costs

PLEASE READ!!!

Other direct costs are direct cost items required for the project which do not fit clearly into other categories, and are not included in the indirect pool for which the indirect rate is being applied to this project. Examples are meeting costs, postage, couriers or express mail, telephone/fax costs, printing costs, etc.

Basis of cost are items such as vendor quotes, prior purchases of similar or like items, published price list, etc.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

General description	Cost	Basis of Cost	Justification of need
Budget Period 1			
(AMPLE ONLY!!! Grad student tuition			
			REDACTED EXEMPTION 4
Budget Period 1 Total			
Budget Period 2			
			REDACTED EXEMPTION 4
Budget Period 2 Total			
Budget Period 3			
			REDACTED EXEMPTION 4
Budget Period 3 Total			
PROJECT TOTAL			

Additional Explanations/Comments (as necessary)

i. Indirect Costs

	Budget Period 1	Budget Period 2	Budget Period 3	Total
Rate applied:		REDACTED		
Total indirect costs requested:		EXEMPTION 4		

A federally approved indirect rate agreement, or rate proposed supported and agreed upon by DOE for estimating purposes is required if reimbursement of fringe benfits is requested. Please check (X) one of the options below and provide the requested information if it has not already been provided as requested, or has changed. Calculate the indirect rate dollars and enter the total in the Section B., line 6.j. (Indirect Charges) of form SF 424A.

____ **There is a federally approved indirect rate agreement. A copy is provided with this application and will be provided electronically to the Contracting Officer for this project.**
(When this option is selected, a presentation of the budget that demonstrates the application of the approved rate, to arrive at the proposed indirect charges proposed should also be provided.)

X **There is no current, federally-approved indirect rate agreement.**
(When this option is checked, the entity preparing this form shall submit an indirect cost rate proposal in the format provided at the following website, or in a format that provides the same level of information and which supports the rate(s) being proposed for use in estimating the project. Go to https://www.eere-pmc.energy.gov/forms.aspx and select PMC 400.2 Sample Rate Proposal.)

Additional Explanations/Comments (as necessary)

REDACTED
EXEMPTION 4

Cost Share

PLEASE READ!!!

A detailed presentation of the cash or cash value of all cost share proposed for the project must be provided in the table below. Identify the source & amount of each item of cost share proposed by the award recipient and each sub-recipient or vendor. Letters of committment must be submitted for all third party cost share (other than award recipient).

Note that "cost-share" is not limited to cash investment. Other items that may be assigned value in a budget as incurred as part of the project budget and necessary to performance of the project, may be considered as cost share, such as: contribution of services or property; donated, purchased or existing equipment; buildings or land; donated, purchased or existing supplies; and/or unrecovered personnel, fringe benefits and indirect costs, etc. For each cost share contribution identified as other than cash, identify the item and describe how the value of the cost share contribution was calculated.

Funds from other Federal sources MAY NOT be counted as cost share. **This prohibition includes FFRDC sub-recipients. Non-Federal sources include private, state or local Government, or any source not originally derived from Federal funds. Documentation of cost sharing commitments must be provided, if not already provided with the original application and they have not changed since its submission.**

Fee or profit will not be paid to the award recipients or subrecipients of financial assistance awards. Additionally, foregone fee or profit by the applicant shall not be considered cost sharing under any resulting award. Reimbursement of actual costs will only include those costs that are allowable and allocable to the project as determined in accordance with the applicable cost principles prescribed in 10 CFR 600.127, 10 CFR 600.222 or 10 CFR 600.317. Also see 10 CFR 600.318 relative to profit or fee.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Organization/Source	Type (cash or other)	Cost Share Item	Budget Period 1 Cost Share	Budget Period 2 Cost Share	Budget Period 3 Cost Share	Total Project Cost Share
ABC Company EXAMPLE ONLY!!!						
		REDACTED EXEMPTION 4				

Organization/Source	Type (cash or other)	Cost Share Item	Budget Period 1 Cost Share	Budget Period 2 Cost Share	Budget Period 3 Cost Share	Total Project Cost Share
		REDACTED EXEMPTION 4 Totals				

Total Project Cost:

Cost Share Percent of Award:

Additional Explanations/Comments (as necessary)

The data contained in every page (pages 1 to 30) of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant.

Every line on this page contains proprietary information that Solazyme, Inc. requests not be released to persons outside the Government, except for purposes of review and evaluation.

Project Management Plan

Project Management Plan Index:

1. Project Management Overview for SzIBR 1
2. Detailed Schedule 15
3. Key Project Decision Points and Stage Gates 17
4. Project Milestones 18
5. Detailed Resource Loaded Schedule 20
6. Detailed Spend Plan 21
7. Risk Management Plan 21
8. Quality Assurance / Quality Control Plan (QA/QC) 26
9. Earned Value Management System (EVMS) 28
10. Invoicing System Plan 30

1. Project Management Overview for SzIBR

1.1. Project Management Approach

Solazyme will utilize a traditional project management approach to manage the Solazyme Integrated Biorefinery project (SzIBR). At a high level, this approach consists of five components:

- Initiation stage – This stage has been completed
- Planning and design stage – This stage is 75% complete and will be completed in Period 1
- Execution and production stage
- Monitoring and controlling systems
- Completion stage

1.1.1. Initiation

The initiation stage determines the best approach and scope for the project. Solazyme has completed all of the following essential tasks:

- Analyzed business needs in terms of measurable goals.
- Reviewed current operations.
- Completed conceptual design of the pilot production facility.
- Assessed equipment and contracting requirements including long-lead items.
- Completed financial analysis of the costs and benefits including a budget.
- Established users and support personnel for the project.
- Assembled project data including costs, tasks, deliverables, and schedule.

1.1.2. Planning and Design

The status of the key elements of this stage is described below:

- Scope Planning. The scope has been defined and fixed.
- Work Breakdown Structure. The WBS has been completed at a level sufficient to ensure that it captures the full project scope and aligns properly to the project scope. In Period 1, some elements of the WBS will be expanded to an additional level of detail to correspond to effective work package units.
- Organizational Breakdown Structure. The OBS has been completed implicitly but not yet formalized. It will be formalized in Period 1.
- Design Development. The preliminary project, process and equipment designs have been completed and all major equipment items quoted. These designs will be revised as necessary in Period 1 to account for additional data obtained from vendor testing between now and the beginning of the project. Additional design that will be completed in Period 1 includes detailed engineering and preparation of Process & Instrumentation Drawings (P&ID).
- Resource Planning. Resource planning has been completed for the critical path activities to ensure no conflicts. The balance of detailed resource planning will be completed in Period 1.
- Project Schedule Development. The Gantt chart for the project has been completed to a level of detail sufficient to support and validate other planning activities. It will be completed to the full level of detail corresponding to the WBS in Period 1 to enable project control and tracking.
- Budget Planning. The budget has been completed and will be verified in Period 1. Once verified the budget will be transferred into Solazyme's accounting system.
- Procurement Planning. Vendors have been qualified and quotes obtained for all major equipment items. The remainder of the procurement process will be completed in Period 1 to enable purchase orders to be submitted in the first week of Period 2.
- Communication Planning. The communication strategy has been defined. The specific communication timetable for major meetings will be scheduled in the Period 1 calendar.
- Quality Planning. Planning for quality assurance to be applied to the project is mostly complete and will be finalized during Period 1.
- Risk Management Planning. Key project risks that impact the schedule and budget have been identified and mitigation strategies outlined. In Period 2, additional detail will be added to these contingency plans and additional risks (including process risks and operational hazards) will be analyzed.

1.1.3. Execution

The Execution phase of this project will consist of the processes used to complete the work defined in the SzIBR project management plan to accomplish the project's goals. The execution process involves coordinating people and resources, as well as integrating and performing project activities in accordance with the project management plan. The deliverables are produced as defined in the project management plan.

1.1.4. Monitoring and Controlling

The Monitoring and Controlling Phase follows the Execution Phase and will run concurrently with Period 2. Monitoring and Controlling involves the comparison of the actual performance with the planned performance and taking appropriate corrective action to get the desired results. The key benefit is that project performance is observed and measured regularly to identify variances from the project management plan.

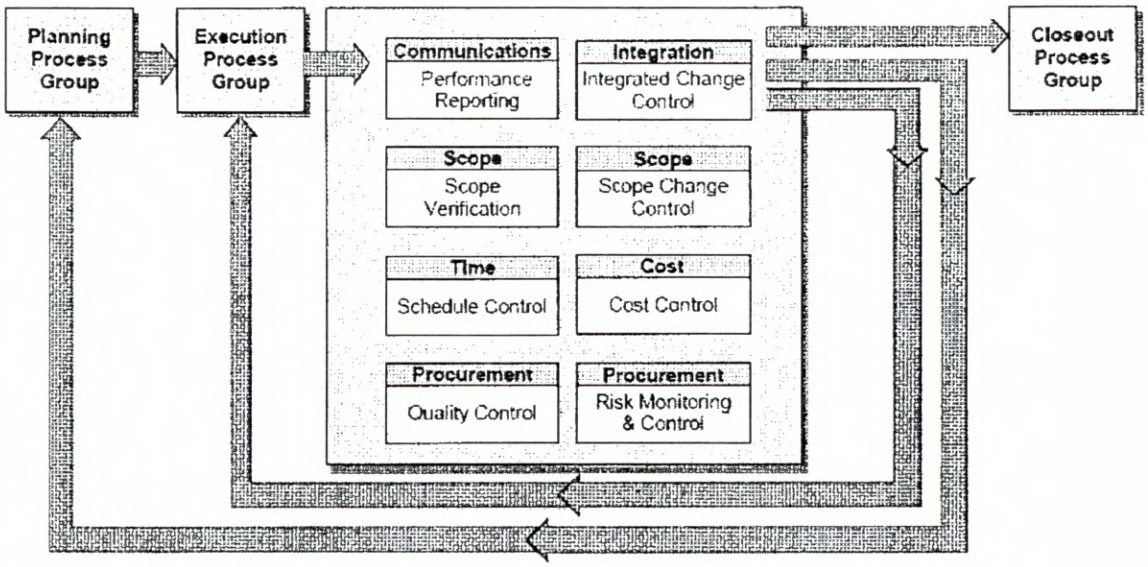

Figure PMP 1.1 – Monitoring and Controlling Phase Processes

During this phase, the Project Team is responsible for the following activities:

- Team Members execute the tasks as planned by the Project Manager.
- Project Manager is responsible for performance measurement which includes finding variances between planned and actual work, cost and schedule.
- Project Manager is responsible for providing Project Status Report to all key stakeholders to provide visibility.
- All Project Key stakeholders are responsible for the review of the metrics and variances.
- All Project Key stakeholders are responsible for taking necessary action on the variances thus determined so as to complete the project within time and budget.

The basic processes of the project Monitoring and Controlling phases will be:

- Project Plan Execution.
- Review of Metrics and Status Reports.
- Project MOC (Management of Change) Control Process. This defines the procedures to handle the changes that are introduced during the project Monitoring and Controlling phases. The procedure is covered in greater detail in section 8, Quality Assurance / Quality Control Plan (QA/QC).

The facilitating processes during project Monitoring and Controlling phases will be:

- Quality Assurance and Quality Control.
- Performance Monitoring.
- Information Distribution
- Status Reporting.
- Risk Monitoring and Control.
- Scope Control.
- Schedule and Cost Control.
- Contract Administration.

1.1.5. Closing

A number of activities will be carried out and reports compiled and submitted at close of Period 2. Note that the SzIBR will continue uninterrupted operation following Period 2 in Period 3 outside the scope of this proposal; however, reports will continue to be provided to DOE.

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EXEMPTION 4

Some closing activities are outlined below.

- Independent Engineer Performance Test will be carried out at the end of Period 2.
- Administrative closure includes preparation of closure documents and process deliverables. This includes the release and redistribution of unneeded project resources.
    - All reports required according the American Recovery and Reinvestment Act of 2009 will be finalized and submitted.
    - All other required reports required for closeout, such as Patent and Property Certification will be compiled and submitted.
    - IEPT Report submitted.
- Development of the project post implementation evaluation report include:
    - Project sign-off
    - Staffing and skills
    - Project organizational structure
    - Schedule management
    - Cost management
    - Quality Management
    - Customer expectations management
    - Lessons learned

REDACTED

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1.3. Staffing Plan

Following is the detailed staffing plan, including names and affiliations for the Solazyme Integrated Bio-refinery (SzIBR) project.

Name	Affiliation	Responsible for
Period 1: Preliminary Activities		
David Brinkmann	Solazyme, Inc.	
Nick Lurty	Solazyme, Inc.	
Peter Licari	Solazyme, Inc.	
Tyler Painter	Solazyme, Inc.	
Matthew Frome	Solazyme, Inc.	
Orlando Romero	Solazyme, Inc.	
Todd Potas	National Resource Group, LLC	
Jeff Haney	Cherokee	
Greg Spancake	Cherokee	REDACTED EXEMPTION 4
Bob Wooley	Abengoa	
John Cuzens	Blue Fire	
Period 2: Construction and Operation		
David Brinkmann	Solazyme, Inc.	
Nick Lurty	Solazyme, Inc.	
Felipe Arana	Solazyme, Inc.	
Steve Decker	Solazyme, Inc.	
Matthew Frome	Solazyme, Inc.	
Peter Licari	Solazyme, Inc.	
Tony Day	Solazyme, Inc.	
Tyler Painter	Solazyme, Inc.	
Jeff Haney	Cherokee	
Greg Spancake	Cherokee	
Bob Wooley	Abengoa	
John Cuzens	Blue Fire	
Glen Meier	REG	
Andrea Bozzano	UOP	

Table PMP 1.3 — Staffing Plan

Period 3 Staffing Plan – Extended Operation

As per Period 2 operation only

1.4. Communication Plan

The communication plan will implement a hub and spoke model with the Solazyme manager privy to all material communication regarding the project as shown in Figure PMP-1.4. Special attention will be accorded to facilitating the critical communication channel between Solazyme and Cherokee.

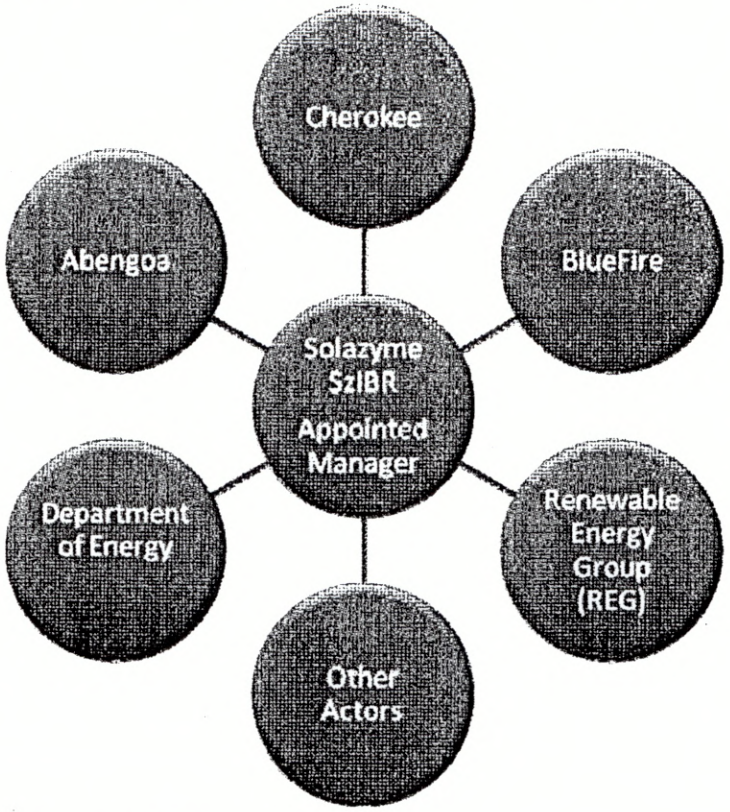

Figure PMP 1.4 – Hub and spoke communication model

Tables PMP 1.4a and PMP 1.4b represent the communication plan matrix for the Solazyme Integrated Biorefinery (SzIBR) project.

The matrix defines the project team, communication types, communication frequency and the information to be communicated. The construction team comprises a subset of the project team, as noted in the table below, as well as the Construction Management Agent. Meetings will be face-to-face, web-cast, and voice conference calls. Documents will be placed on central repository server and distributed by email.

Management / Project Team	Name	Email Address
Project Manager	David Brinkmann	
Project Team	Nick Lurty (construction team)	
	Matthew Frome	
	Steve Decker	
	Orlando Romero	
	Felipe Arana (construction team)	REDACTED EXEMPTION 4
	Peter Licari	
	Tony Day	
	Jeff Haney (construction team)	
	Greg Spancake (construction team)	
	Bob Wooley	
	John Cuzens	
	Glen Meier (Period 2 only)	REDACTED EXEMPTION 6
	Andrea Bozzano (Period 2 only)	
	Todd Potas (Period 1 only)	
Management	Jonathan Wolfson	
	Harrison Dillon	
	Tyler Painter	
	Genet Garamendi	
	Jurgen Dominik	

Table PMP 1.4a – Project Team

REDACTED
EXEMPTION 4

1.5. Procurement Plan

1.5.1. Task Overview

Solazyme will follow the "owners approval purchasing cycle" for all procurements related to the project. The Procurement Manager will work directly with the Project Manager to validate the estimates, and to adapt the procurement schedule to the master schedule, establishing procurement budgets for each phase of the project, and allocating the necessary resources to meet the procurement targets.

1.5.2. Owner Approval Purchasing Cycle

This purchasing process is applied when the owner delegates the procurement efforts to the contractor, but the owner retains control over every aspect, to be able to respond to external auditors for every expenditure. Following this procedure demands more time than the Typical Purchasing Cycle, so provisions must be made in the master schedule to minimize the impact on the project completion date.

1.5.3. The phases of the procurement effort will be identified as follows:

- Conceptual Phase. (Completed)
- Planning Phase. (Completed)
    - Prepare pre-qualification vendor list
    - Prepare pre-qualification documents
- Equipment Procurement Phase. (In Progress)
    - Prepare equipment and material requisitions
    - Pre-qualify vendors
    - Prepare request for bid
    - Obtain bids
    - Technical evaluation of bids
    - Commercial evaluation of bids
- Construction Procurement Phase.

1.5.4. Equipment Procurement Phase – (In Progress)

This is the most demanding phase of the procurement effort, because it is expected to start immediately after the project is funded and almost in parallel to the detailed design effort of specifying and sizing equipment.

Using some of the procurement information generated during the planning phase and incorporating the approved by the "owner" equipment specifications, the procurement department has issued requests for bids to obtain "firm prices", and "firm deliveries".

To carry on this procurement task it was necessary to assemble requests for bid that included as a minimum the following information:

a) Documents (cover letter, non-disclosure agreement)
b) Scope of the work (scope of supply)
c) Equipment, material or systems specifications
d) Quantities (material take off)
e) Delivery requirement (best route, time and location)
f) Commercial terms and conditions
g) Tax or no Tax (depending on exemptions)

Immediately after the receipt of the bids, the procurement department initiated the tabulation effort to compare the bids and to facilitate the technical and commercial evaluations.

The format included a list of the specifications that were submitted with the request for bid, to allow a fast and accurate technical evaluation.

To perform the commercial evaluation, the format included at a minimum involves the following items:

a) Price
b) Time of delivery (ideally what was requested)
c) Freight to the site (pre-paid and add)
d) Terms and conditions (ideally what was requested)
e) Tax or no tax (depending on exemptions)
f) Required down payment
g) Time to deliver shop drawings.

At the conclusion of the evaluation cycle, the procurement department submitted recommendations based on the rating of each bidder with sufficient background information to support the rating process.

NOTE: *Orders have not been placed yet. Current status is Bids Received.*

Upon receiving the proper authorization to proceed (at the beginning of Period 2) the equipment orders will be placed and the procurement department will assign an expediter to follow up with the vendors to make sure that the shop drawings are released to the design group ASAP (per vendor's commitment), then expedite the marked up or approved drawings from the design group back to the vendor. This cycle may have to be repeated as many times as necessary to assure that the equipment is fabricated correctly.

Once the design group releases the vendor drawings for fabrication, arrangements will be made to schedule visits to the fabrication shop by qualified inspectors.

The expediter or the procurement manager depending on the seriousness of the deficiency will handle negative inspection reports on quality or potential delays.

There are some systems being procured as "pre-assembled" skids that will require testing at the factory prior to shipment. The Project Manager will assign a team of engineers and purchasing personnel to witness the test at the factory.

The expediter will continue to work with the vendors to assure that they are proceeding with fabrication, and that nothing that the vendor expects to get from the "owner's" team could be used as an excuse to delay the delivery of the equipment.

During the negotiating of the purchase order, it is customary to define how the equipment or goods will be delivered. However, there are situations when the expediter must act to avoid shipping delays due to labor strikes, weather, cost, or government refusal to allow "oversized" items in the highways that were originally consider the best route to the site.

At the construction site the expediter or the vendor, at the time of arrival of equipment, will notify the site receiving coordinator. Arrangements will be made to coordinate the necessary labor and equipment (crane, fork truck) to unload the equipment, and immediately install it or place it in the warehouse or storage yard.

All the procurement activities are monitored (at least weekly) to keep the project team informed and to identify potential problems or delays by the procurement group, the vendor, or the design group.

As a minimum reporting for the procurement activities the following reports will be compiled:

- The purchase order report (POR)
- The material status report (MSR)
- The master equipment and vendor drawing report (ME &VDR)

1.5.5. Construction Procurement Phase

This is the second most demanding phase of the procurement effort, because as the last phase in the procurement, it tends to catch items that were accidentally omitted from the previous phases.

Following the path established during the prior procurement phases, the procurement department will work with attorneys, accountants, the owners' representative, the Project Manager, and construction manager on establishing the "contracting strategy".

This phase will start after the environmental permits are approved, the design group issues construction bid packages, and the "owner" has hired a contractor or subcontractors.

While subcontractors are given the responsibility to include materials as part of their scope of supply, there are situations when materials and services must be contracted as they were not included in the scope of supply. The construction site procurement team will perform these activities.

The site accountant will be responsible for preparing the contracts for services, and construction work, and to coordinate with attorneys to insure that the documents will provide the proper legal protection to the "owner".

As the progress of the contracts is monitored, there is a need for the site procurement team to be knowledgeable on the interpretation of the contracts, to prevent overcharges due to high earned value estimates.

Progress payments approvals will be generated by the site procurement team, based on the equipment deliveries, and services performed.

It is imperative to require "lien releases" for services rendered, prior to each progress payment, and particularly important prior to the release of retainages.

Once the project is built and commissioned, it will be necessary to obtaining "certificates of operation" from the local authorities and "certificates of acceptance" from the plant user.

1.6. Construction Management Plan

Solazyme proposes to "construct" the SzIBR on the site of team member Cherokee Pharmaceuticals' existing commercial facility in Riverside, PA. The Cherokee plant manufactures numerous active pharmaceutical ingredients, biopesticides, and nutraceuticals

An experienced project engineering design and construction firm will be contracted to act as the Construction Management agent for the design, engineering, construction and commissioning of the SzIBR. Firms which will be considered for this role include the following:

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1.6.1. Approach

A design – bid – build project delivery system will be employed to bring this project to completion, whereas pre-qualified contractors / vendors will be solicited to provide the various elements necessary to construct the facility on a "fast track" basis as design documents become available from the engineering service provider. This process will be overseen by the Construction Management agent in consultation with both Jeff Haney at Cherokee and David Brinkmann, the Project Manager. No major decisions will be made, or expenditures incurred, without sign-off by David Brinkmann.

Pre-construction phase activities EX 4

- Review preliminary design documents to develop a baseline understanding of the project status.
- Review project design criteria and establish Quality Assurance protocol.
- Review Process Flow Diagrams (PFD's) and Process and Instrumentation Diagrams (P&ID's), if available, to gain an understanding the process.

- Review mechanical equipment layout concept to determine the required building size and configuration.
- Review the process equipment list and specifications for content and pricing status.
- Review Work Breakdown Structure (WBS) for completeness.
- Review preliminary overall project schedule and spend plan.
- Provide preliminary risk analysis to identify risk associated with preliminary design documents and recommend plan for mitigation.
- Conduct "value engineering" session to identify areas of potential cost savings.
- Expand overall project schedule and identify the critical path.
- Expand WBS to be inclusive of all aspects needed to support construction and establish a Schedule of Values (SOV) as a base line for tracking Earned Value.
- Define project team responsibilities.
- Implement project controls.
- Develop project communication protocol and establish team meeting schedule.
- Issue Non-Disclosure agreements to selected vendors and contractors.
- Issue pre-qualification packets to selected contractors.
- Reach agreement of construction contract format for contract administration (AIA, EJCDC)

Procurement phase activities

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- Procure specified equipment. Procurement will be on the owner's paper to assure that all guarantees and warrantees are passed through to the owner.
- Compare equipment quotations to WBS schedule of values.
- Monitor and report on equipment procurement status on a bi-weekly basis.
- Develop construction bid packages.
- Qualify construction bids and secure contracts.
- Monitor and report on construction procurement status on a bi-weekly basis.

Construction phase activities

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- Provide construction safety management in compliance with OSHA 29 CFR 1910 and any site-specific safety requirements.
- Provide on-site document control and distribution.
- Provide on-site receiving and receiving reports.
- Manage construction contracts.
- Monitor critical path construction schedule and provide bi-weekly updates.
- Monitor WBS schedule of values and report on earned value on a bi-weekly basis.

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- Check out and start up phase activities:
  - Motor rotational checks.
  - Instrumentation checks.
  - System installation qualification checks.
  - System operational qualification checks.
  - Water runs.
  - Validate entire integrated process.

Construction Management Plan staffing requirements:

- Construction Manager
- Construction Superintendent
- Safety Manager
- Document control/ receiving clerk
- Purchasing Agent
- Project Accountant

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2. Detailed Schedule

See Figure PMP 2.1 – 2.3 for the detailed project schedule for the Solazyme Integrated Biorefinery (SzIBR) project. The detailed project schedule is shown in two sections for clarity.

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Figure PMP 2.1 – Detailed project schedule – part 1

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3. Key Project Decision Points and Stage Gates

Table PMP – 3.0 depicts the key project decision points incorporating the stage gate review approach that will be utilized for the Solazyme Integrated Biorefinery (SzIBR) project. The stage gate review will be coordinated via the communication plan outlined in PMP section 1.4 and in conjunction with the detailed list of key project decision points.

Stage gate review will involve the project and management teams. It will take into consideration all gating factors to determine if progress to the next stage is technically and economically justified. The CEO in consultation with the CTO and the Project Manager will make the final decision.

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4. Project Milestones

Table PMP – 4.0 depicts the detailed project milestones through Periods 1, 2 and 3 for the Solazyme Integrated Biorefinery (SzIBR) project. The milestone review will be coordinated via the communication plan outlined in PMP section 1.4.

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5. Detailed Resource Loaded Schedule

See Table PMP 5.0 for the detailed resource loaded schedule for the Solazyme Integrated Biorefinery (SzIBR) project.

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6. Detailed Spend Plan

See Tables PMP 6.0a- 6.0b for the detailed spend for the Solazyme Integrated Biorefinery (SzIBR) project.

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Figure PMP 6.4 – Cumulative Cost Graph

7. Risk Management Plan

7.1. Risk Management Strategy

Following is the risk management methodology that will be followed for the Solazyme Integrated Biorefinery (SzIBR) project.

This risk management process has been adapted to be scalable to ensure that the level, type, and visibility of risk management are commensurate with both the risk and the importance of this project.

A. Preliminary Risk Identification – Risks are identified in Table PMP-7.0, listing significant risk factors. Risks will continue to be identified as additional parts of the project management plan are implemented (i.e. project monitoring, project controlling, procurement plan and construction management plan). Additional risks will be identified up to and during Period 1.

B. Risk Impact Assessment – For each risk identified, the risk will be assessed in terms of likelihood of occurrence and its effect on project objectives if the event occurs. This information will be used to prioritize the risk and develop a mitigation strategy.

C. Risk Response Planning – Each risk will be reviewed as part of the project review meeting for risk management as outlined in PMP section 1.4 – Communication Plan. The review meetings will determine the options and actions to reduce the likelihood or consequences of impact to the project's objectives. The results of the review meeting will provide an appropriate response for planning the actions to be taken to mitigate the risks.

D. Monitor Risk:

- Systematic reviews are scheduled and outlined in section 1.4 – Communication Plan.
- These reviews will ensure:
  - All of the requirements of the Risk Management Plan are being implemented
  - Assess currently defined risks
  - Evaluate effectiveness of actions taken
  - Status of actions to be taken
  - Validate previous risk assessment (likelihood and impact)
  - Validate previous assumptions
  - State new assumptions
  - Identify new risks

E. Control Risk:

- Validate mitigation strategies and alternatives
- Take corrective action when actual events occur
- Assess impact on the project of actions taken ($$, time, resources)
- Identify new risks resulting from risk mitigation actions
- Ensure the Project Execution Plan (including the Risk Management Plan) is maintained
- Ensure change control addresses risks associated with the proposed change. Change control is addressed in great detail in section PMP section 8.3- Management of Change Plan (MOC)–Production.
- Revise Risk Response Plan

7.2. Project Risks and Mitigation

It is anticipated that project milestones and schedules may change as new information is generated and unforeseen operational problems such as equipment delivery delays or breakdowns occur. When these occur, project risks and mitigation will be re-evaluated during regular meetings as outlined in the Communication Plan. Elements of effective risk management include the following:

- Experienced project team.
- Complete and effective design criteria.
- Clear project objectives.
- Clear and effective communications.
- Identify the nature of any uncertainties.
- Effective decision making.
- Effective risk control measures.
- Earned value management.
- Critical path scheduling.
- Management of change.

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Table PMP 7.0 – Project risk factors and mitigation strategies

NOTE: The proposed project schedule includes four months to gather NEPA documentation and obtain a CX. If an EA or EIS is required, the transition to Period 2 could be delayed without incurring any expense. The separation between Period 1 and Period 2 is a logical break point.

7.3. Preliminary Process Hazard Analysis (PHA)

Overview

The Construction Management Agent witl perform HAZOP analysis using a formally structured method of systematically investigating each piece of equipment in the SzIBR process. This information will be assembled in the most detailed of the four OSHA recommended formats, 29 CFR. 1910.119. The hazard and operability problems will be determined by a study of the Piping and Instrument Diagrams (P&ID's) and the equipment Standard Operating Procedures (SOPs). NFPA guidelines are also utilized where applicable. The analysis is assembled into the following categories:

- Deviation
- Causes
- Consequences
- Safeguards
- Hazard Category
- Recommended Changes

Project personnel with extensive operational and start-up experience will critically analyze the system design for potential problems arising in each component of the plant operation. Possible causes of failure will be identified. Important parameters that can deviate from the intended design conditions and their associated Consequences will then be identified. A Hazard Category will be assigned based on Frequency and Severity. The P&ID, SOP, and NFPA documents will be used to ensure that the proper instrumentation, alarms and interlocks are incorporated as Safeguards into the design to prevent injury, loss of life, significant equipment damage, and production downtime.

Multiple concurrent failures will also be included in the analysis and recommendations appropriate to risk management will be provided.

Cause

The causes are developed first through critical thinking analysis of what can go wrong. This is accomplished by asking the question "what if" there is a:

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Depending on the equipment, some of these may be Deviations or Consequences; however, most are Causes. Since instruments and DCS systems have been developed to include a certain level of self-diagnostic capability, the HazOp is limited to equipment. The intent is to "poke holes" in the design and look for weaknesses.

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Deviation

Pertinent parameters are selected, such as Then the effect of deviations from design conditions of each parameter is examined. A list of key words, such as is selected for use in describing each potential deviation.

Consequences

The Consequences list an event or chain of events associated with the deviation. Consequences are listed as if there were no safeguards in place. The consequence could be as simple as plugging a spout or as complex as The consequences are listed to assist in determining the Severity of the problem.

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Hazard Category

The Hazard Category is a number and a letter that corresponds to the Severity and Frequency of a deviation.

Severity

1 – Catastrophic	Over $10,000 in equipment damage and 24 hrs in downtime
2 – Critical	$1000 – 10,000 in equipment damage and less than 24 hrs downtime
3 – Marginal	Minimal expense or less than 4 hrs downtime
4 – Negligible	Minimal expense or interruption

Frequency

A – Frequent	More than once a month
B – Probable	Once in 1-3 months
C – Occasional	Once in 3 – 12 months
D – Remote	Less than once a year
E – Improbable	Rarely ever occurs

For example, in most parts or the country, it is common to lose power 3 or 4 times a year. Therefore, Loss of Power automatically gets a "C" designation for frequency. If this is the the Severity gets a because if no course of action is taken, there will most likely be a

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Safeguards

Safeguards are reactive measures that are taken to prevent the possible Consequences. It is important to note that the Safeguards do not address the Deviation or Cause. For example, motorized equipment will stop when there is a power failure. There is nothing that can be done to prevent the power failure; however, reactive measures can be put in place to prevent the Consequences from spiraling into a catastrophic failure.

As a general guideline, if the Hazard Category is a 1,2 and A, B, C, then instrumentation and alarms/interlocks should be put in place to prevent the loss.

Standard Operating Procedures (SOPs)

In order to complete a HAZOP, SOPs are required of all complex process equipment including all the controls included with each package and a written description of the control logic of each control system. Complex equipment includes

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The process equipment SOPs are required in order to perform a HAZOP analysis because the HAZOP team has to know if the risk of each possible process deviation is managed properly or if additional controls or procedures are required to insure the safety and operability of operation.

8. Quality Assurance / Quality Control Plan (QA/QC)

8.1. Design Quality Assurance/Quality Control (QA/QC).

The Project Management Plan establishes the general requirements for Quality Assurance/Quality Control (QA/QC) to be used during the design phase. Standard design QA/QC documents will be utilized. The design QA/QC procedures include the following:

- An overall design QA/QC Plan.
- Design standards to be adhered to.
- Procedures for preparing and checking individual plans, specifications, estimates, calculations, and other submittal items.
- Procedures for coordinating work performed by different persons for related tasks, to ensure that conflicts, omissions, or errors do not occur between drawings or between drawings and other design documents.
- Procedures for coordinating and obtaining permits from permitting agencies, utility companies, and railroad companies.
- Peer reviews are staged at the 30%, 60% and 90% design completion and include constructability, operability and maintainability reviews.
- Procedures for reviewing and checking design drawings and documents required during construction. Pre-construction review phase.
- Documentation and submission procedures to ensure that the established design QA/QC procedures have been followed.

8.2. Construction Quality Assurance/Quality Control (QA/QC).

The Project Management Plan establishes the general requirements for Quality Assurance/Quality Control (QA/QC) to be used during the construction phase. Standard construction QA/QC documents will be appropriate. The construction QA/QC procedures include the following:

- An overall Construction QA/QC Plan.
- Construction standards to be adhered to for performing construction inspection. Frequency and agency involvement for construction coordination (progress) and/or partnering meetings.
- Procedures for coordinating with permitting agencies, utility companies, and railroad companies during construction to ensure that all requirements are incorporated into the project such that the overall project schedule is not delayed.
- Level and frequency of inspections to identify and correct any deficiencies in the project construction that do not meet the requirements of the plans, specifications, and other binding documents.

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- Qualifications for all key construction personnel.
- Documentation and submission procedures to ensure that the established construction QA/QC procedures have been followed.

8.3. Management of Change Plan (MOC)-Production

8.3.1. Approach

Manage changes for operations and quality processes so that:

- The rationale for change, anticipated results, acceptance criteria and testing (if required) are evaluated and approved prior to initiation.
- The proposed change conforms to all regulatory and quality requirements applicable to the process.
- Documents affected by the change are revised and proper training has been conducted.
- Changes are communicated to the proper personnel.

8.3.2. Scope

The Management of Change Plan describes the procedure to be used when making changes to processes within the following areas: Operations, Chemical Labs, Customer and Quality Support Systems and/or other controlled systems. Examples of these changes include, but are not limited to:

- Standard Operating Procedures (SOPs), Work Instructions, Forms and Lists
- Changes in equipment and/or instrumentation
- Computer/control systems
- Methods
- Documentation and/or protocols
- Product specifications
- Materials
- Utilities

The Management of Change Plan does not apply to replacement with identical equipment, instrumentation, parts, etc.

8.3.3. Responsibilities

Requestor

- Initiates Process Change Order (PCO).
- Communicates the change to approvers (i.e. by attending change control meetings or communicating directly with each approver).
- Works with change owners and quality representatives to identify all approvers of the change.
- Works with various managers (Quality, Operations, Laboratory, etc.), as necessary, to determine documentation needed to complete the change.
- Ensures that the required approvals are obtained during each step of the PCO in order to proceed with the change.
- Ensure that the required resources are available to implement the change.
- Prepares, executes and completes documentation protocols or test plans as required.
- Ensures the training documentation is completed as the process change is being implemented.
- Ensures that the PCO is brought to closure in a timely manner.

PCO Facilitators (Document Specialists)

- Receives PCO requests.
- Schedules and conducts change control meetings or verifies that proper PCO approvals are obtained.
- Ensures the change is documented correctly in the PCO files.
- Ensures that documents are issued as per the change owner's direction.
- Coordinates the overall PCO process.

Approvers – Change Owners

- Reviews and approves PCO requests.
- Provides review and approval of documentation protocols, test plans and other documentation as required by the change.
- Works with requestor to determine and complete documentation (i.e. SOPs, forms, HMI graphics, etc.) that requires updating to proceed with the change.
- Provides training support and resources to ensure that the required training is completed in a timely manner.

Approvers – Quality Representatives

- Reviews and approves PCOs to assure that the changes comply with quality system requirements.
- Reviews and approves change order request to assure that method changes are consistent with established scientific principles and changes in methods and/or procedures are in accordance with industry accepted standards.
- Works with requestor to determine and complete attachments for Installation Qualifications (IQ), Operational Qualifications (OQ), Performance Qualifications (PQ) and test plans.
- Provides review and approval of documentation protocols, test plans and other documentation as required by the change.

Supporting Departments / Partners

- Reviews and approves PCOs as necessary.
- Works with the requestor to determine and complete documentation that requires updating in the supporting departments and/or partners to proceed with the change.
- Works with the requestor to ensure that the appropriate resources are available to implement process changes to established quality systems within the supporting departments and/or partners.

9. Earned Value Management System (EVMS)

The EVMS that will be utilized for the SzIBR project is comprised of several well structured and time proven formats that will adhere to ANSI/EIA 748-A-1998, DOE Order 413.1A, and DOE M 413.3-1 guidelines. A software package, such as Timberline™ will be used to integrate financial and project management data.

9.1. GENERAL OVERVIEW

A. Organization – Most of the Contractual Responsibilities have been defined, and the subcontractors have been briefed on their anticipated effort. The scope of work and completion times of the major subcontractor's responsibilities has also been identified.

B. Planning, Scheduling and Budgeting – A database format has been created to assign value to each of the project's milestones. This allows for the establishment of budgets for work through various cost types (labor, material, equipment, etc.), and facilitates the measurement of progress of task performed internally and by subcontractors.

C. Accounting – During the planning phase the accounting department manager participated on the project budget allocation task, and each project milestone was assigned area and subarea numbers to facilitate detailed tracking of the cost. At the end of the month the accounting department will work with the Project Manager to confirm that the charges to each account are accurate, and that the invoicing task can continue as planned.

D. Analysis and Management Reports – The schedule variance analysis will be performed weekly, and summarized by the end of each month to identify the amount of budget earned for the period. The cost variance analysis will also be performed weekly, and summarized by the end of each month to compare the budget earned against the actual cost for each task. It is customary and critical to report the reasons for unexpected changes of schedule variance and cost variance (higher or lower), as this is indicator of how the project is performing in budget and schedule. The report must include forecasts of budget and schedule to complete the project.

E. Revisions and Data Maintenance – Authorized (signed) change orders will be used to increase or reduce the overall budget. The Change Order's will be tracked individually, but the overall budget will be adjusted to reflect an accurate earned value (or percent completion).

9.2. Performance Measurement Baseline

A. Total Project Cost and Project Schedule – Define the WBS into work packages to allow for tracking of subcontractors' responsibilities, cost and timeline for each work package

B. Risk Management – Will define risk ownership, identify potential risks to both the budgeted cost and schedule along with a course of action of any risks and the possible mitigation of such.

C. Value Management/Engineering – Indicated through the baseline and milestones that are determined prior to the project beginning.

D. Project Controls – Assigns the responsibility of monitoring the schedule and budget and will ensure the project is going according to plan with the WBS and PMB.

9.3. Project Controlling

A. Cost – Use a cost variance (reference above to 9.1.D)

B. Schedule Position – Use a schedule variance (reference above to 9.1.D)

9.4. Financial Controlling

A. Estimate to Complete – Tracking of all direct costs and indirect costs that will be incurred between a specific point in time and the expected project end date. Also, include all future costs for items that were in addition to scopes that will be labeled in change orders.

B. Estimate at Completion – All previously recorded costs along with the estimate to complete and additional indirect costs that will potentially be allocated to the project.

C. Elaborate past for controlling the future – Tracking of previous schedule and cost variances to determine if the schedule is behind, on track or ahead of schedule to determine if any unexpected costs or savings will be incurred to get on schedule or remain on schedule.

10. Invoicing System Plan

Invoicing throughout the project will be based on criteria being met through milestones that are set in place. Milestones are indicated throughout the Work Breakdown Structure (WBS) and the Performance Measurement Baseline, outlined in section 9.2. Invoicing will occur on a monthly basis and dated the 1st business day of every month.

There will be several general areas set up in the EVMS (e.g. R&D, site & civil, equipment, operations, etc.) and more defined sub-areas. Each sub-area will have a dollar amount allocated based on estimates for completion through bids, quotes, and other pre-determined cost structures that will be listed in a schedule of values (SOV). The number of milestones could vary depending on the length of time estimated for each sub-area to be completed along with the depth of scope for each sub-area. The time and intensity of each sub-area will impact the number of milestones needed on each sub-area. The EVMS will show in detail the position of invoicing through the previous billings, the current billings and the remaining amount on the contract of each milestone.

With the possibility that any change orders could delay the milestones from being met, a plan of action will be created as described in the Risk Management section to avoid financial overruns.

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SzIBR Project Execution Plan

Sub-criteria for Review Criterion 1:

1. Overview of Solazyme's Proposed Integrated Biorefinery (Topic 5) 1
2. Critical Success Factors, Barriers, Technical Objectives and Competitive Advantage for the Proposed Project and to Proceed to a Commercial-Scale Facility 8
3. Description of the Integrated Process, Unit Operations, and Supporting Data 13
4. Work Breakdown Structure (WBS) of Project Scope 27
5. Project Schedule, Milestones, Decision Points, and Resources 30
6. Constructive Plan for SzIBR: Purpose, Period of Operation, and Data Plan 32
7. Technical and Financial Aspects of the Plan to Utilize an Existing Facility 39
8. Siting Considerations and Compliance with NEPA and Other Environmental, Health, and Safety Requirements 40
9. Financial Information 42
10. Feedstock Management for the Proposed Project 47
11. Preparatory R&D 48
12. Decommissioning Plan Summary 56
13. Applicant Experience, Capabilities and Resources 56
14. Intellectual Property Summary 60

1. Overview of Solazyme's Proposed Integrated Biorefinery (Topic 5)

Solazyme proposes to build, operate and optimize a pilot-scale "Solazyme Integrated Biorefinery." SzIBR will demonstrate integrated scale-up of Solazyme's novel heterotrophic algal oil biomanufacturing process, validate the projected commercial-scale economics of producing multiple advanced biofuels, and enable Solazyme to collect the data necessary to complete design of the first commercial-scale facility.

1.1. Solazyme's Innovative Heterotrophic Algal Oil Biofuel Process

Some algae possess internal biochemical pathways that synthesize oil more efficiently than any other known natural or engineered process. Under the right conditions, certain algal species produce so much oil that the oil constitutes over 75% of the dry weight of the cells, so it's not surprising that the world's petroleum deposits consist largely of the fossilized remains of prehistoric algal blooms.

Many strains of algae are *heterotrophic*: they can grow in the dark by ingesting organic molecules derived from domestic, renewable, scalable, and environmentally sustainable biomass sources. Solazyme has identified and isolated strains of algae that achieve high cell densities, high carbon flux (productivity) and carbon yield (utilization), and fast cell doubling times — comparable to standard microbial fermentation systems. This breakthrough enables Solazyme to exploit the proven, mature technology of industrial biomanufacturing, but for the first time apply it to produce inexpensive, high-quality **renewable oil**.

Solazyme has already produced over 70 metric tons of dried algal biomass in the same size fermentors that will be employed in the proposed project, and extracted over 2,000 gallons of algal oil from a small

portion of the biomass produced. Existing oil refineries can transesterify Solazyme's algal oil neat or blended to yield biodiesel (ASTM D6751), or hydrotreat it to make renewable diesel, which is identical to petroleum diesel (ASTM D975). More than 110 gallons of Solazyme's

algal oil have already been transformed into these standard fuels, and independent tests confirm that they comply fully with the specifications. Renewable jet fuel has passed the critical subset of tests that have been performed in work to date.

Solazyme's novel biomanufacturing technology provides several key advantages:

- Algae produce lipids with the ideal chain length and chemical structure for conversion to diesel and other fuels, in contrast to the short chain alcohols produced by other biofuel processes. Solazyme's purified algal oil is a high quality triglyceride vegetable-like oil composed predominantly of oleic acid.
- Algal oil feeds directly into the vast infrastructure that refines, distributes, retails and consumes petroleum products. Other scalable biofuel approaches present significant incompatibilities with pre-existing infrastructure and vehicles. Solazyme aims to capture rather than disrupt the petroleum economy.
- Solazyme's process is efficient and cost-effective. Algae have evolved to tolerate the oil they produce, enabling high titers, and Solazyme has discovered and honed an inexpensive method to extract the oil from cells with oil seed presses. Ethanol, in contrast, poisons yeast, and distilling it is energy intensive.
- Algae are robust organisms, better suited to tolerate the toxic compounds released during conversion of lignocellulosic biomass into fermentable sugars, and thrive on a wide range of feedstocks.

Solazyme's approach forges the crucial link from high-impact, domestic, renewable lignocellulosic feedstocks to oil-based transportation fuels that leverage and remain fully compatible with the petroleum economy. Most competing biofuel approaches that utilize lignocellulosic biomass produce fuels — such as alcohols — that are not fully compatible with petroleum-based infrastructure and vehicles, and that exhibit less desirable physical and chemical properties than petroleum-based fuels. A few other approaches do yield oil-based fuels, but they are either not scalable (e.g. biodiesel from vegetable oil or waste grease) or they are inefficient and not environmentally sustainable (e.g. long chain F-T synthesis).

It's important to distinguish Solazyme's novel approach from conventional algal biofuel concepts, which rely on *autotrophic* algae to produce their own sugar via photosynthesis. Directly photosynthetic approaches are sensible for high-priced nutraceuticals, but remain far from being economically viable for commodity fuels. A discussion of the technical and economic hurdles they confront is beyond the scope of this proposal. None of the valid criticisms of conventional algal biofuel concepts pertain to Solazyme's approach, however, which uniquely exploits *heterotrophic* growth to produce algal oil in a well-established industrial context, far more efficiently than is possible via photosynthesis. Of course, the biomass feedstocks fed to the algae exploit photosynthesis. Converting sunlight and CO_2 directly to oil sounds seductive, but separating the processes of photosynthesis and oil synthesis turns out to be most cost effective.

1.2. Summary of SzIBR Components, Scale, Feedstocks, Schedule, and Operations

1.2.1. Biorefinery Components

SzIBR will integrate the following operations:

- **Ferment** — The algae are grown from the inoculum in a media formulation optimized to promote rapid cell division. The conditions and media are then switched to promote oil production and accumulation.

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1.4. Description of the Proposed Facility and Rationale for Modifying an Existing Facility

Solazyme proposes to "construct" SzIBR on the site of team member Cherokee Pharmaceuticals' existing commercial facility in Riverside, PA. The Cherokee plant manufactures numerous active pharmaceutical ingredients, biopesticides and nutraceuticals in bulk, and has been manufacturing specialty chemicals for over 55 years. The site encompasses 323 acres, with 127 acres inside the fence-line. The facility has been extensively renovated since 1995 and is fully operational and permitted. A corner of the site comprises a fermentation facility that produced xanthan gum until 2005. Since then it has manufactured various fermented products for external biotechnology companies. Solazyme will leverage spare fermentation capacity in this corner of the site. SzIBR will represent about 10% of the activity in this corner of the site, and a minor blip in the overall activities at Cherokee, which employees about EX 4

Two Solazyme process engineers will work on-site at Cherokee and supervise the Cherokee employees, who will operate the equipment. Additional Solazyme process engineers will travel to Cherokee for extended periods as necessary.

The available section of Cherokee contains 20 G-tanks (20,000 gallons each), 1 large G-tank (40,000 gal), and 12 F-tanks (1,500 gal) — all pressure, temperature, and sterile airflow controlled and agitated — along with 10 E-tanks (150 gal) for seed culture growth. Two G-tanks, one F-tank and one E-tank will be dedicated to the SzIBR project. Many of the remaining tanks are also available and all the tanks are interconnected, so new tanks could easily be transferred to SzIBR if problems were to develop with any of the assigned tanks, or to facilitate maintenance without interrupting the project. No modifications of any kind are needed to the existing plant with respect to fermentation, and all the necessary supporting infrastructure (pumps, steam generators, air compressors, electrical switchgear, distributed control system, backup power, chillers, waste water treatment, harvest tanks, pH control systems, seed fermentors, sterile filters, continuous sterilizers, media handling, mix tanks, sugar solution handling, fork trucks, railcar and truck receiving, autoclaves, etc.) is available. The tanks that would be assigned to Solazyme are fully operational and ready to operate on short notice. Cherokee has a staff of 12 people tending this section of the

plant and has committed to add up to more as the number of fermentors in operation increases, drawing from other sections of the plant. This deep pool can support the surge of effort needed to turn fermentors around quickly — clean, sterilize, prep media, inoculate, etc. — without requiring SzIBR to hire a large dedicated staff. The SzIBR project will pay only for time expended by Cherokee personnel, enjoying the benefits of a large staff during peak work periods without paying for idle time between campaigns.

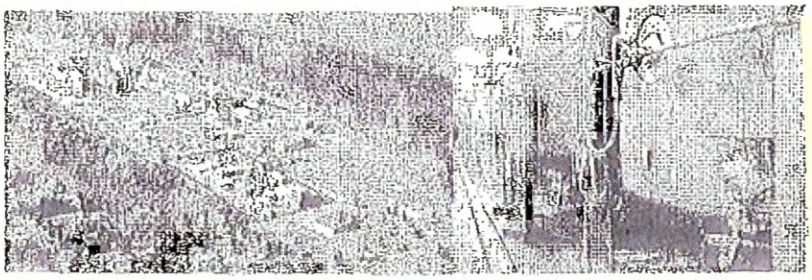

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Figure PEP-1. SzIBR will be constructed within and extensively leverage Cherokee Pharmaceuticals' existing commercial facility in Riverside, PA. (Left) Fermentation area shown in red (Center) A few of the many G-tanks available (Right) Space available in an existing process building to house SzIBR's oil recovery equipment.

Data collection systems include *in situ* probes in the production vessels to monitor pressure, temperature, pH, and dissolved oxygen. On-site laboratory and analytical support capabilities include freezers, drying ovens, laminar flow hoods, centrifuge, autoclaves, incubators, microscopes, spectrophotometer for optical density analysis, two mass spectrometers for continuous off-gas analysis, two YSI biochemistry analyzers for sugar analysis, and pH meters. Complete chemistry and microbiological laboratories are also available on site with additional capabilities (HPLC, GC, AA, NMR, NIRA, FTIR, TOC, etc.).

The equipment downstream of fermentation will need to be installed for drying, extraction, and purification. Cherokee has a suitable, appropriately located process building on the site adjacent to the fermentation tanks with empty space that can host this equipment. This building formerly housed the xanthan gum recovery and processing equipment. Only relatively minor remodeling of the interior space is needed. Nearly all the equipment that SzIBR requires can be ordered and delivered as skid-mounted or floor-standing units and installed accordingly. Utilities such as steam, gas, compressed air and water are already available in the building, but will need to be hooked up. Ample space is available should it prove necessary to bring in additional equipment or exchange equipment. Cherokee staff will also run the downstream process equipmen

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All previous barriers to the scale-up proposed for this project have been overcome. Specific discussion by process stage and unit operation can be found in Sections 3.3-3.7 and the separate PFD Attachment.

Critical Success Factors for the Proposed Project (to Proceed to Commercialization)

In the proposed project, the following critical success factors will guide consideration to proceed along the path to build a full-scale commercial plant:

- Expeditiously commence construction and operations in earnest.
- Integrate all unit operations successfully into a unified biorefinery.
- Validate low cost production at commercial scale.
- Demonstrate refining of the algal oil into fully-compliant liquid transportation fuels.
- Accelerate high-impact lignocellulosic feedstocks to near parity with interim transitional feedstocks.
- Successfully complete the project on schedule.

These CSFs are tied to quantitative technical and process values below. Additional CSFs pertaining to full-scale commercialization are discussed in the Business and Commercialization Plan Section 2.1.

Project Objectives

To achieve the above overarching critical success factors, Solazyme will accomplish the following specific project objectives:

- Complete all preliminary project activities on schedule by preparing in advance to the extent possible and employing best management and environmental assessment practices guided by experts in these areas.
- Build a pilot-scale integrated biorefinery (SzIBR) quickly by leveraging spare fermentation capacity at a pre-selected, pre-existing, fully-operational, commercial-scale bioproduction facility (Cherokee Pharmaceuticals) and adding and integrating the necessary algal oil extraction and purification equipment — all standard commercial equipment that vendors will build quickly to order, deliver and install.
- Operate SzIBR successfully and achieve all technical performance objectives (embodied in the KPPs and milestones tabulated below) necessary to validate production cost projections at full commercial scale. Solazyme has already developed credible cost models and will populate them with technical data that will be collected and proven at integrated pilot scale.
- Refine the purified algal oil to biodiesel and renewable diesel, with the assistance of partners REG and UOP, at a scale sufficiently large to demonstrate quality consistency of the biofuels.
- Optimize fermentation on sugars derived from at least two high-impact lignocellulosic feedstocks (by BlueFire and Abengoa via distinct cellulosic processes from opposite ends of the technology spectrum) at laboratory scale (7L) and transition these feedstocks to integrated pilot scale at SzIBR, with technical performance rapidly approaching parity with the initial transitional feedstock (sucrose).
- Maintain a flexible project plan and adhere to best project management practices to meet all objectives on or ahead of schedule and on or below budget.

These objectives are embodied in specific, actionable milestones, discussed in Section 5.3 and the PMP. The project plan is unusually flexible and robust for this type of project because it extensively leverages existing infrastructure, benefits from (but does not pay extra for) redundancies, follows a very straightforward critical path with remarkably few critical dependencies, and offers straightforward workarounds for nearly all potential problems and failures.

Project Key Performance Parameters (KPPs)

The Key Performance Parameters for the project will progress through three stages, as shown in Table PEP-1. All of the KPPs (and many other parameters) will be tracked, but net cost to produce purified algal oil at commercial scale is what really matters. Solazyme is resolutely focused on this bottom line cost as the primary driver, and the process development team analyzes all process optimizations with respect to impact on the cost model. The KPP levels will be achieved at milestones as summarized in Table PEP-2.

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2.2. Competitive Advantage

2.2.1. Advantages over Competing Processes and Feedstocks

Competing renewable processes and feedstocks that can produce ***oil-based*** transportation fuels include:

- Waste oils, grease, etc. — The supply is limited and already nearly fully exploited.
- Vegetable oils — Oil producing plants require intensive cultivation on prime agricultural land. By 2008, demand for biodiesel already strained the limits of supply at less than 1 billion gallons per year. The recent collapse of oil prices has since resulted in a glut of vegetable oil, but as the economy recovers and fuel prices increase, the limits will be reached again quickly. While US production can increase somewhat above the previous peak, it will exert severe upward pressure on food prices and cannot scale to address the 20+ billion gallon targets of the Renewable Fuel Standard (RFS). Solazyme's algal based biofuel process, in contrast, utilizes carbohydrate feedstocks, which may consist of agricultural residues and wastes, municipal green waste, and dedicated energy crops that can be grown on land not suited for conventional agriculture. Whereas the supply of vegetable oils is constrained, the potential supply of cellulosic feedstocks is highly scalable.
- Photosynthetic algae — These approaches are not even close to being economically viable. A full discussion of the hurdles they confront is beyond the scope of this proposal. In brief, however, it's important to realize that while several companies around the world do profitably grow algae in outdoor ponds, they make specialty nutraceutical products that typically fetch from thirty to hundreds of dollars per kilogram, not commodities like fuels that must sell for less than a dollar per kilogram.
- Pyrolysis, thermal depolymerization, catalytic depolymerization, etc. — These approaches have never been shown to be technically and economically viable, and this is especially true for scalable feedstocks such as biomass (as opposed to high-value inputs that are not scalable). Solazyme's biofuel process, in contrast, is based on credible technical and economic performance data. (See PEP Section 3 and BCP Section 2.)
- Fischer-Tropsch synthesis from biomass — These approaches are technically sound but expensive and extremely energy intensive, and therefore suffer from a poor carbon footprint. Solazyme's process, in contrast, offers competitive economics and has a very favorable greenhouse gas footprint. (BCP 5.0.)

Section 3.10 discusses advantages compared with competing processes that yield different products.

2.2.2. Technical Advancement

Solazyme's technology represents the first and only

- economically viable algal biofuel platform,
- platform utilizing any microbe that produces biofuels fully equivalent to petroleum products,
- biotechnology approach that leverages organisms that can already prolifically produce, sequester and tolerate oil-based biofuels (the difficult problem), and modifies them to utilize multiple carbon substrates (an easier problem) rather than traditional approaches that attempt to import the former capabilities, which aren't even understood yet, into model organisms.

2.2.3. Advancement of National Energy Goals

See BCP Section 1.4.

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