A meeting with Mill Street Brewery has indicated that the current dust filtration system is not as sophisticated as the client desires. The current system cannot preemptively detect the amount of dust in the process, and thus the dust remover is not able to adjust its operating conditions efficiently. This report serves to introduce the needs and problems the client is facing.

With respect to client needs, six have been identified as the mainstays of this project. They are, in decreasing order of importance: sophisticated monitoring of dust, easy maintenance and operation, cost-effectiveness, handleability of all encountered dust, maintained safety standards, and retained dust transportation systems. Monitoring, as the primary function of our device, involves the systematic notification of dust buildup prior to there becoming a process-wide blockage or similar issue. Maintenance and operation refer to the cleaning of dust from the monitor and/or vent fan and the education and training an employee would need to efficiently operate the device. Cost-effectiveness emphasizes keeping within the design budget needs. Dust handleability indicates that the system must be able to detect dust of both forms—sedimentary and organic. In reference to safety, the current brewery safety policies and procedures will not be undermined. Finally, dust transportation is the process of dust movement throughout the piping system, which will not be compromised. These needs combine to form the backbone of the user's requirements and will be a guide in the entire design procedure.

First, as the key issue is detecting high concentrations of dust levels before they reach the filter, monitoring the amount of dust being processed is crucial. The system must be able to preemptively and accurately read and relay information so the filter can react accordingly. Without this priority, the system designed will be ineffective and useless for the client.

Second, many brewery jobs on Indeed do not require education, therefore the system must be operable without extensive background knowledge. Further, it must not make a mess, as that stops production and requires employees to clean, causing further delays in production. Additionally, the client has an alarm system in their process line that indicates when there is a problem—this designed product must therefore easily operate in conjunction with that system; otherwise, the product would be difficult for the client to use.

Third, the client indicated that the price of the dust sensor system is important, as their budget is not unlimited. The product and its installation must therefore be affordable to the client. Most dust sensors fall within the price range of $10,000–$20,000. Therefore, the designed product must be within this range, ideally on its lower end.

Fourth, many issues the clients were having were caused by the inability to process high quantities of dust grouped together. Thus, the system must handle these large quantities of dust to properly deal with the issue. This dust will be both organic and sedimentary in nature and hence

the product should be able to detect both. However, this is less important than dust monitoring, easy maintenance, and cost because it is not the main problem indicated by the client.

Fifth, safety is maintained at an equal level to the current system. As this product is, for the most part, a programmable instrument, safety is unlikely to be adversely affected. As no other requirements are being altered other than the preemptive nature of the monitoring system, the safety features of individual components will not be changed. Further, as the brewery has already met safety standards, this is a relatively unimportant latent need—such is the reason for its ranking position.

Last, the brewery is already constructed with current transportation systems. Therefore, in order for the designed product to be desirable, it must be easily installed and operate with the current process and not require reconstruction of the brewery. Otherwise, the installation of the product would shut down production during the installation period and could regress the production speed. However, the nature of the design of a dust sensor should not change the processing system, and thus it is of the least importance.

At this time, an issue may arise in the future in regards to accommodating the changing mass percent of the dust. Presently, the filter must be able to process 3% dust mass to total mass concentration. However, during periods of high friability, which is dependent on crop harvest time, this may be too low. Therefore, after further investigation and technical benchmarking, an appropriate “safety factor” as stated above will be implemented for the increased concentration requirement. Therefore, the monitor should be able to deal with, and process, that excess dust.

Finally, through collecting and organizing client needs, a problem statement has been formulated to encapsulate all aspects of the product to be designed. The problem statement is as follows:

> *A need exists for a safe, cost-effective dust detection system that can preemptively measure varying industrial quantities of both organic and sedimentary dust and communicate this information to the dust ejection system. This process should be easily maintained without substantial risks or changes to brewery operations.*