

**A Job Analysis at Shenango LLC: Plant Engineer**

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## **Introduction**

When an organization is attempting to tackle the daunting task of describing and understanding what an employee does in their position, a job analysis is a valuable tool to utilize. A job analysis, also known as a work analysis, is an analytical approach to human resources activities that center around the development and understanding of preferred employee knowledge, skills, abilities, and other specifications (KSAOs), as well as employee tasks. As such, a job analysis is typically conducted to address any number of purposes including creating job descriptions, classifying jobs, evaluating jobs, designing teams, etc. (Morgeson et al., 2019, p. 3). Through the collection of data via interviews, surveys, questionnaires, observations and performance measures, a job analysis can provide a detailed understanding of the different facets of a job position (Morgeson et al., 2019, p. 15). This is due to methodical approach of job analysis which preferably attempt to take qualitative data and convert it to quantitative data that can be used in an analysis. Consequently, this approach is much more comprehensive and effective than the traditional approach to human resources work which focus primarily on assessing raw qualitative data. It is important to understand the features and benefits of a job analysis, therefore, this paper recounts a real-world analysis of a position for a small manufacturing company as an alternative HR approach to traditional company practices.

This particular analysis focuses on a unique situation, within a small company (Shenango LLC), in which a new position (Plant Engineer) was made for an incoming employee. However, when the position was established, no documentation was created or recorded to determine the duties, responsibilities, task statements, KSAOs, or job description involved with the job in question. Therefore, a preliminary discussion of the exact function of this job analysis is necessary to understand the particular approach that was taken. As discussed earlier, a job

analysis can serve many purposes. Thus, it is up to the employer to determine the usefulness of conducting an analysis to ensure that company resources are not wasted, and that the analysis is effective in accomplishing its goal. In this instance, there was no existing documentation to support the position in question. Therefore, the employer described the primary purpose of this job analysis in what can be most clearly stated as defining a job description. A job description is generally defined as a summary of a collection of characteristics that are needed to perform a job satisfactorily. Such characteristics can include duties, tasks, responsibilities, and KSAOs (Morgeson et al., 2019, p. 3). The use of developing a job description for this employer was to create clarity for the employee about the existing characteristics of their current position, not to propose or alter characteristics. Altering characteristics of the position would encompass a job redesign which was not the stated goal of the employer (Morgeson et al., 2019, p. 4). Strictly speaking, the employer requested that the existing job characteristics be defined based upon the current, but unlisted duties, tasks, responsibilities, and KSAOs of the position. As such, it was imperative to ensure that a thorough approach to data collection was taken in this analysis, so that the development of a job description would not inaccurately depict or exclude existing characteristics.

Additionally, there are a number of factors to consider when conducting a job analysis that vary significantly based upon the circumstances at hand. Such factors are discussed below to demonstrate that company needs were met during the analysis.

### ***Legal Considerations***

Due to the limited size of the company in question, legal considerations are not very impactful in the larger scale of this analysis. Standard legal regulations such as the Equal Pay Act or Title VII are considered valid under all employers and are not unique to the position being

discussed (Morgeson et al., 2019, p. 172). However, some specific environmental regulations are involved in the responsibilities of the position, and so some deliberation on the implementation of those regulations is essential.

As discussed in the following section, Shenango LLC is a manufacturing facility that specializes in the production of industrial components via centrifugal casting. This process involves the smelting of large quantities of metals which produces hazardous waste and air pollutants. Naturally, the presence of hazardous materials in any industry facilitates regulation by the Environmental Protection Agency (EPA). Consequently, Shenango LLC must adhere to the standards of the EPA which also encompass the policies of the local community. The federal EPA policy for iron and steel foundries is known as NESHAP which stands for National Emissions Standards for Hazardous Air Pollutants. NESHAP is included as a part of the Clean Air Act which was enacted by Congress in 1990 to protect and improve national air quality (EPA, 2022). While the guidelines of NESHAP are not necessarily important on a daily basis, understanding and adhering to them is an essential responsibility of the Plant Engineer in the long term. Failing to ensure that the facility adheres to NESHAP regulations could result in a complete shutdown of operations and substantial fines. And so, a necessary legal consideration for this job position is an understanding of the proper procedure involved in assuring adherence to NESHAP regulations.

### ***Shenango LLC***

Located in Terre Haute, IN, Shenango LLC is one of only two manufacturing facilities in the United States that specialize in centrifugal casting. This scarcity means that Shenango faces little to no domestic market competition and therefore, the company has a handful of long-standing customers that result in a continuous stream of orders. Additionally, Shenango takes on

mostly made-to-spec orders and is considered a low-volume facility when compared to foreign manufacturers. The industrial components that are produced by the facility are typically used in industries such as textiles, food, OEM manufacturing, oil, paper, steel, and tobacco. The mission statement of Shenango LLC reads as following from their official website; “To provide overall customer satisfaction through a quality product, while ensuring exceptional technical and sales support” (Shenango LLC, 2004).

Shenango LLC employs 13 total individuals within the confines of the manufacturing facility. These people include a Vice President, a Director of Operations, a Plant Engineer, and ten Foundrymen. By traditional standards, a company as small as Shenango LLC would not typically have the resources or need for a thorough job analysis. However, this job analysis project provides a unique opportunity in which resources are not relevant and thoroughness can be completely explored. Additionally, the absence of any documentation regarding the existing position of Plant Engineer represents an opportunity in which Shenango can benefit directly from the results of a job analysis.

### ***The Position of Plant Engineer***

When attempting to identify a position within the company that could be subject to a job analysis, the plant engineer was immediately chosen as there was no existing job description. Initial questioning prior to any official discussions made it clear that the plant engineer came upon his current set of duties and responsibilities by simply working where he was needed at the time of hiring. As a result, the plant engineer’s duties encompassed a lot of tasks and his responsibilities were fairly vague. However, the plant engineer’s responsibility was clearly stated as critical by both the plant engineer and the vice president. If such a position was considered a critical role, one could wonder what the consequences might be if some duties and

responsibilities of the role were disregarded. And so, the necessity of a job analysis was clearly presented at the beginning of questioning.

The goal of the job analysis would be to clearly identify the duties, responsibilities, and KSAOs of the plant engineer, so that 1) The current plant engineer could ensure that he was fulfilling those standards and 2) A new plant engineer could be hired in the event of a vacancy of the position. The intended result of this analysis would be a job description that comprises a complete summary of the position, a list of KSAOs, and a list of tasks/responsibilities. Clearly defining these factors would have the potential to resolve the ambiguity of not only the current plant engineer's duties and responsibilities, but also the ambiguity of the eventual hiring process. Additionally, a clearly defined job description has the potential to attract qualified job candidates during the selection process.

### ***Potential Issues***

As previously mentioned, there were a host of issues with the current state of documentation that presented some challenges during the job analysis process. Firstly, the lack of any supporting documentation meant that the entire analysis would be conducted solely on the basis of collected data and external resources. Secondly, the nature of the creation of the position, as one in which the employee does any task of which they are needed, meant that this position would also likely encompass a range of duties from various job titles. Lastly, the inconsistencies in daily activities meant that observations were not likely to be a useful metric by which to collect data and therefore interviews would have to be the primary data collection method. The outcome of this combination of potential issues is primarily a lack confidence in the validity of the data. For example, a lack of internal documentation about position duties meant that instances where duties were not mentioned could only be amended by the potential for

external job descriptions to contain the existing position's duties. Therefore, if the external information search was not sufficiently thorough, it could have resulted in a misrepresentation of the position through overlooked duties. Similarly, this situation then also required that the interviews were sufficiently thorough in the recollection of information specific to tasks and KSAOs. Thankfully, the subject matter experts (SMEs) were available for this sort of thorough interview.

### ***Approval and Support***

Familiarity with the plant engineer and the vice president was the primary beneficial factor regarding the approval of the job analysis. Considering that the vice president and plant engineer are both my family members, discussion for approval of the job analysis did not take much convincing and was done in an informal setting. Due to the nature of our relationship, the vice president agreed that the job analysis could be conducted almost immediately and outside of the workplace. Understanding that observations were not to be included in the analysis meant that the data could be collected efficiently under the proposed setting. Additionally, this meant that company time and resources were not being used to conduct the job analysis and so no budgetary constraints were present. Consequently, I was granted approval by the vice president to conduct a job analysis of the plant engineer with the goal of clearly identifying the duties, responsibilities, and KSAOs relating to the position to develop a job description.

### **Content Analysis**

The beginning of the job analysis process starts with a review of the available resources. This is an important step to complete before collecting other forms of data as it can help to inform your information collecting process in interviews, questionnaires, or surveys.

Additionally, starting with a review of internal resources has the benefit of informing your search for what external resources may be needed.

### ***Internal Resources***

As mentioned previously, there was no existing documentation within the company in regard to the position of plant engineer. This meant that the initial baseline for the job analysis would have to be conducted directly from the information that was collected during the interview process.

### ***External Resources***

Due to the lack of internal resources, the search for external resources had no basis. Therefore, this search was conducted after the interviews so that it would be possible to search for positions that contained similar characteristics to the ones mentioned in the interviews. The purpose of the search for external resources was to aid in the creation of KSAOs and task statements that matched the descriptions of the job position provided by the interviews with the SMEs.

To conduct this search, I went to the Occupation Informational Network, also known as ONET. From my search on ONET, I was able to find four different job positions that contained similar task statements and KSAOs to some of the information collected in the interviews. These positions included general and operations manager, industrial engineer, manufacturing engineer, and molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic. References to these positions are available in Appendix A and links to the full job descriptions of each position are available in the references.

The above positions were selected because they encompassed facets of the plant engineer position in one way or another. The general and operations manager contained many KSAOs and



task statements that were relative to the administrative work that the plant engineer was responsible for. Such examples included financial responsibilities and communication capabilities. The other three positions encompassed more specified facets of the plant engineer. For example, both manufacturing and industrial engineering contained KSAOs and task statements that were related to critical thinking and machine maintenance. The molding and coremaking position on the other hand related more closely to the KSAOs and task statements involved in the use of industrial smelting equipment.

Overall, the search from ONET provided a good reference point for the creation of initial task statements and KSAOs to be ranked by the SMEs. Additionally, the use of this information on ONET limited the potential of SMEs to accidentally exclude specific job information during the interview process.

### **Subject Matter Expert Selection**

Subject matter experts (SMEs) are a key resource in job analysis. They bring to the table a mix of knowledge and experience that cannot easily be found from any other source regarding the job position. Additionally, SMEs provide contextual information regarding job positions that may have unique circumstances within a specific company setting. For example, the SMEs at Shenango LLC provided specific contextual information about the unique casting involved their manufacturing process. While a typical selection of SMEs at a larger company would be subject to a large selection pool, there were only two available SMEs with at Shenango who were knowledgeable of the plant engineer position. As mentioned earlier, these positions were the plant engineer (SME 1) and the vice president (SME 2). SME 1 was qualified to provide information about the plant engineer position as he performed the job on a daily basis.

Additionally, SME 2 was qualified to provide information about the plant engineer position since he was responsible for the current duties of plant engineer prior to the hiring of SME 1.

According to the text, multiple SMEs who are knowledgeable about the job position should be used in a thorough job analysis (Morgeson et al., 2019, p. 90). Thankfully, both SMEs were shown to be qualified enough to provide valuable insight about the plant engineer position. SME 1 had a few years of experience as the plant engineer while SME 2 had a few decades of experience in industrial steel manufacturing. Therefore, the credentials of the SMEs were considered sufficient to gain a valid and useful understanding of the position.

### **Data Collection and Methodology**

The data collection stage of a job analysis is one that can be approached in handful of ways. Typical methodology includes data collection methods such as interviews, questionnaires, surveys, observations, ect. (Morgeson et al., 2019, p. 15). While a combination of approaches is generally considered best practice, there were some limitations with company circumstances which prevented a combined approach from being conducted. Due to the small size of the company and limited number of SMEs, surveys and questionnaires were not considered to be useful methods of data collection. Additionally, the nature of the plant engineer position meant that duties and responsibilities varied greatly day to day, so observations were considered to be an unreliable representation of the job position. Therefore, the primary method of data collection was separate interviews with each of the SMEs.

#### ***Data Collection Method One: Interviews***

The interview process was conducted with the goal of obtaining initial information about the plant engineer position so that there would be a baseline for the construction of KSAOs and task statements. Therefore, it was important to align the interview questions with this goal so that

the collected information would be useful later in the job analysis. Thus, the questions in the interview contained prompts related to job responsibilities, requirements and skills required of the position.

Each interview was scheduled with the SMEs separately and featured the same series of questions. The interview with SME 1 lasted approximately 1 hour while the interview with SME 2 last approximately 30 minutes. Additionally, the interviews were conducted at the home residencies of the SMEs. The interview questions were written specifically for this job analysis and attempted to focus on the key building blocks of job analysis as described in the text from *Job and Work Analysis* (Morgeson et al., 2019, p. 9). During the interviews, notes were taken via laptop and best practices were used to summarize the information provided by the SMEs. While the interviews were extensive, attempts at recording the conversation word for word would have interfered in the purpose of the job analysis as not all provided information was relevant. For example, SME 1's description of the skill of "Jack of all trades" is too unspecified to be useful in any real scenario. In situations such as these, I interceded with prompts for clarification about the meaning of the statements in question. The full responses of each interview are available in Appendices B and C.

The first interview with SME 1, the plant engineer, took a bit longer due to the need for clarification on most questions. SME 1 seemed to approach the plant engineer position from a holistic point of view that was more casual than the view of SME 2. It could be that this is due to the comfortability that SME 1 had with the position after a few years of experience with it. It could also be related to the supervisory position of SME 2 over SME 1. Simply put, SME 2 might expect a more professional approach to SME 1's responsibilities since SME 1 directly reports to SME 2 on a regular basis. In both interviews, the SMEs provided similar explanations

of the duties and responsibilities of the plant engineer. However, SME 2 was clear in stating that the educational requirements of the plant engineer are required to be at least a bachelor's degree while SME 1 stated that a bachelor's degree was not necessary, but preferred. Again, these differences seemed to be related to the greater expectations that SME 2 placed on the position of plant engineer. Greater expectations for the plant engineer by SME 2 are also consistent with answers from the combination job analysis as will be discussed in the following section.

***Data Collection Method Two: Combination Job Analysis***

The second data collection method consisted of a combination job analysis method (C-JAM) which aimed to compile the existing collection of data and followed the interview process. The combination job analysis combines the task statement ratings of the functional job analysis method with the KSAO inventory ratings of job element methodology (Morgeson et al., 2019, p. 98). Immediately following the SME interviews, KSAOs and task statements were developed by cross-referencing interview responses with similar job positions on ONET. This was the most appropriate available method by which to construct KSAOs and task statements since no documentation existed for the plant engineer position. Additionally, meetings were held with both SMEs to aid in the development of task statements and KSAOs. In such meetings I quickly recounted the information provided by each SME in their interview responses and we compared it to similar KSAOs and task statements from the four job positions listed on ONET. Following the meetings, a comprehensive list of 36 individual task statements were created which each fell under one of six general responsibilities. These responsibilities included the following:

- Management of Sales and Production Schedules
- Oversight of Plant Operations and Staff
- Management of Financial Responsibilities

- Maintenance of Plant Facilities and Equipment
- Oversight of Hazardous Waste Disposal
- Oversight of Supply Chain Operations

In addition to the task statements, a list of 32 KSAOs were created through the same methods.

The C-JAM method consists of a few steps which attempt to collect data, categorize it, rank it, and compare it across a matrix. After the collection of data via interviews and the construction of KSAO and task statement inventories, each SME was provided with a task statement ratings matrix and a KSAO ratings matrix. Prior to the disbursement of each matrix, I met with the SMEs to explain the ratings process to ensure that the responses were being ranked appropriately. Additionally, SMEs were instructed to complete their ratings sheets independently to avoid influence towards specific ratings from each other. Task statements were to be ranked on a scale of 1 to 7 based on frequency, criticality, and difficulty of the task in question. This method is based on task statement ratings from Levine (1983) to generate a task importance value which is used to give an overall ranking of a task. KSAOs were then rated in 4 separate categories based upon:

- 1) Necessity for a newly hired employee to have the KSAO (yes or no)
- 2) Practicality of the presence of the KSAO in the labor market (yes or no)
- 3) Likelihood of work issues if the KSAO was ignored in the selection process (1 to 5)
- 4) Presence of the KSAO in an ideal employee (1 to 5)

The purpose of both the KSAO and task statement ratings was to exclude nonsignificant requirements from the task and KSAO inventories. This was accomplished by averaging the responses from each SME into a final rating which would determine both KSAO and task

statement significance. Additionally, the KSAO ratings that relied upon yes or no answers were averaged to “yes” unless both SMEs rated the KSAO as “no.”

As mentioned earlier, task statements were rated based on frequency, criticality, and difficulty to determine a task importance value. However, frequency ratings were rated very highly across the board, so the frequency metric was excluded from the total task importance value to avoid inflation of numbers. Therefore, the total task importance value for each statement was calculated by adding the criticality and difficulty ratings together to get a value between one and fourteen. Task Statements were excluded from the combined analysis if they scored a total task importance value of less than five. Consequently, only one task statement was excluded from the original 36, leaving 35 valid task statements.

In contrast to task statements, KSAOs were rated on four separate metrics and analyzed separately to determine KSAO significance. KSAOs were excluded from the list and combined analysis if they received a “No” for “Necessity for a newly hired employee to have the KSAO” or a total rating in both numbered categories of less than two. For “practicality of the presence of the KSAO in the labor market” every KSAO was ranked yes and so this factor was excluded from determination of KSAO significance. The result of the analysis of KSAOs was the exclusion of 12 KSAOs from the original 32 leaving 20 valid KSAOs to be used in the combined analysis.

The last step of CJAM consists of the combined analysis in which the remaining KSAOs are ranked in terms of importance of performing the task statement in question. This process of cross-analyzing KSAOs with task statements helps to provide some validity to the presence of the KSAOs as a KSAO which was not important in performing any of the task statements would be considered redundant. The ratings for importance in the combined analysis were ranked from

0 to 4 with 0 being not important at all and 4 being extremely important. Just as the results of the KSAO and task statements were averaged, the results of the combined analyses were averaged between the two SMEs. The results of the combined analysis supported each of the 35 task statements in that multiple links to some of the 20 KSAOs were ranked as having some level of importance. This process confirmed the validity of our task statements and KSAOs. The results of the combined analysis can be found in appendix F.

### **Discussion**

The results of the overall job analysis were effective in establishing a list of linked task statements and KSAOs by which I was able to construct an accurate job description. Due to the extensive list of KSAOs and task statements, some deliberation had to be made when writing the job description as a list of every KSAO and task statement would be too overbearing for a job posting. Therefore, one last meeting was held with the vice president to write up a job description which would most accurately encompass the KSAOs and task statements that were discovered within the job analysis. The job description contained a general summary of the position of plant engineer, as well as job responsibilities, education requirements, skill requirements, and preferred knowledge. The full job description can be found in appendix G.

Earlier in this analysis, a goal was determined to clearly identify the duties, responsibilities, and KSAOs relating to the position of plant engineer to develop a job description. Based upon the results of the job analysis which includes a comprehensive list of task statements and KSAOs as well as a job description, it can be said that the goal of the job analysis was fulfilled to the standards of the vice president. Future plans of Shenango LLC include the eventual recruitment of a new plant engineer in the coming year. Therefore, it is

likely that the job description will be used in place of the non-existent documents relating to the position of plant engineer.

Additionally, the comprehensive list of task statements and KSAOs provides some opportunities within the company for future progress. One use of the difficulty ratings of task statements could be to identify weaknesses within the current plant engineer's skillset. If the plant engineer rated a task more difficult than the vice president, it could be an opportunity for training or sharing knowledge related to the specific task statement. Such an analysis could benefit the skillset and overall operations of the plant engineer. Another potential use of the task statements and KSAOs could be the eventual development of a training program for the plant engineer position, so that there was no ambiguity involved in the training process.

### ***The Experience***

The overall experience of conducting a job analysis was not too cumbersome due to generous timeframe that was allowed to complete the project. Some students prefer to know the exact instructions when it comes to projects, papers, or homework, however I appreciated the hands-off approach that was taken to allow us to learn how to use a job analysis effectively. This type of approach is much more useful than a typical exam or series of homework questions. For instance, this project alone taught me how to conduct interviews in an HR setting, how to construct task statements and KSAOs from interview responses, how to construct rating sheets for task statements and KSAOs, how to analyze responses from task statements and KSAOs, and how to perform a combined analysis and interpret job analysis results. Additionally, this entire series of events serves as relevant experience for the I/O and HR workforces which is much more than I can say about other classes in the program thus far.



In terms of the experience of conducting the analysis, I had the benefit of working with family which made scheduling meetings much more bearable. Unlike the some of the examples from class presentations, I also did not have to worry about uncooperative SMEs who were not interested in participating. Therefore, the collection of data was smooth and if I were to be presented with similar circumstances in the real world, I believe this sort of analysis could be conducted in a single work week. Another unexpected factor I came across was the usefulness of the textbook in understanding the different steps in completing the job analysis. I found myself frequently referencing the textbook as a guide during the job analysis which is also not something I can say about the textbook and materials from other courses. Overall, the experience of conducting a job analysis was an interesting one and I feel confident that I am capable of conducting a future job analysis in a workplace setting.

### ***Limitations***

While the immediate goal of the job analysis was accomplished, there were some limitations present within the overall methodology of the process. Firstly, the analysis was conducted with only one source of data collection (interviews). The information from said data collection is valid, however it can be prone to bias as there is little to no diversity in the origin of the responses. Such bias is also amplified by the limited number of SMEs that were available within the company. For example, SME 2 rated every KSAO as being available in the job market which may have resulted in an increase of KSAOs that otherwise could have been excluded from the combined analysis.

Another limitation of this analysis was the lack of existing documentation regarding the position of plant engineer. Without a set list of duties that is directly related to the company, the baseline for establishing the task statements and KSAOs of the position was completely reliant

on the word of either SME who may be prone to forgetting tasks or responsibilities. While information on ONET was useful in constructing the task statements and KSAOs for the job analysis, it might also be stated that there is the possibility of inferring tasks or responsibilities that the SMEs otherwise would not have considered. As such, it could be said that the use of ONET disrupts the validity of the statements and rankings made by the SMEs. Would the SMEs have answered differently given that they had not been exposed to any of the four job listings from ONET? I think that possibility may be very likely. Nevertheless, the job analysis as a whole accomplished all of its goals it will be used in the future business of the company.

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## **Appendices**

### *Appendix A*

#### KSAO and Task Statement Data Sourced from O\*NET

\*Disclaimer – For the purposes of this job analysis, data was consulted from O\*NET regarding the KSAOs and Task Statements of the following postings:

- General and Operations Manager
- Industrial Engineers
- Manufacturing Engineers
- Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic

While data was consulted from these postings, the exact information is not presented in this job analysis as it was considerably extensive due to use of four separate positions. Links to the postings can be found in the references section.

*Appendix B*

Interview One Questions

SME 1: Plant Engineer

Date: 3/4/22

1. What is the title of your job?

I believe it is Plant Engineer.

2. Do you currently have a job description?

There is no job description, I had to make up the duties as I went along.

3. What are your daily responsibilities?

I will usually check my email (looking for quotes on business offers), drink my coffee. Monday is prep day for production, so I do more on Mondays. I will check on staff routinely throughout the day. I plan out maintenance schedules. As far as management goes I help with supply chain management, business management, and I assess production and feedback from plant. I also work with sales (quote and process orders) and purchase supplies. Sometimes I'll help weighing/washing/loading semi-trucks. I operate plant machinery and perform maintenance testing and scheduling.

4. What are your most important responsibilities?

I would say babysitting is important (Director of foundrymen), also scheduling for production and maintenance of equipment are very important.

5. What is your job position responsible for overseeing?

I oversee the machine shop, general maintenance, and smelting directly. Overall, I oversee 10 total people.

6. What type of educational background should be required for the job?

Bachelor's degree preferred although I don't really use it, at least an associate's degree or vocational school as an electrician.

7. Would a new hire need previous related job experience?

Not to my knowledge. I learned almost everything on the job.

8. What skills are required to complete the job?

Jack of all trades, work ethic, willing to get dirty, excel/business skills, organizational skills, people skills, intermediate mathematical skills, materials knowledge, writing skills, time management, communication, financial skills.

*Appendix C*

Interview Two Questions

SME 2: Vice President

Date: 3/4/22

1. What is the title of the job?

Plant Engineer.

2. Do you currently have a job description?

No, he was the first person to fill the position, we had to make it up for him on the spot.

3. What are his daily responsibilities?

Oh, let's see, quoting customers and giving them invoices, scheduling production, ordering materials, scheduling/monitoring maintenance, babysitting, environmental permits/reports, oversight of hazardous waste disposal, supply chain scheduling, financial oversight, budget formatting.

4. What are his most important responsibilities?

Definitely customer communication. Also, maintenance of equipment. Directing work, safety oversight, quoting margins for profitability.

5. What is his job position responsible for overseeing?

Ten employees and in general, the foundry as a whole.

6. What type of educational background should be required for the job?

Bachelor's degree for sure. Specifically, an engineering degree with a background in finance/business.

7. Would a new hire need previous related job experience?

Not required, but beneficial.

8. What skills are required to complete the job?

Definitely mathematical knowledge, interpersonal skills, critical thinking, planning skills, business/finance related skills.



*Appendix D*

## Task Statements and Ratings

\*Highlighted tasks were marked as insignificant and not included in combined analysis

<b>General Responsibility 1: Manage sales and production schedules</b>				
<b>Task Statements</b>	<b>Frequency</b>	<b>Criticality</b>	<b>Difficulty</b>	<b>Task Importance Value</b>
Work with customers to offer sales quotes and invoices	7	6	3	9
Convert customer orders to production schedules	7	6	2.5	8.5
Modify production schedules to satisfy customer needs	6	5	4.5	9.5
Process customer orders	7	6.5	2.5	9
Hold meetings with staff to inform them of production schedules	6	5.5	2.5	8
Plan order-flow of production in case of multiple customers	5.5	5.5	5.5	11
<b>General Responsibility 2: Oversight of plant operations and staff</b>				
<b>Task Statements</b>	<b>Frequency</b>	<b>Criticality</b>	<b>Difficulty</b>	<b>Task Importance Value</b>
Direct staff on correct operational procedure of equipment	5	7	3.5	10.5
Ensure a cooperative employee atmosphere	6.5	5	4.5	9.5
Engage in facility walk-arounds	7	4.5	1	5.5
Aid staff in production of castings	5.5	4	1.5	5.5
Advise staff on proper safety practices	6	7	2.5	9.5
Apply proper pressure/temp adjustments to equipment to meet customer specifications	5.5	7	2	9
Ensure quality of production meets industry standards	6.5	6.5	3.5	10

<b>General Responsibility 3: Management of financial responsibilities</b>				
<b>Task Statements</b>	Frequency	Criticality	Difficulty	Task Importance Value
File and manage financial records	5.5	7	4	11
Assess production to determine financial needs	6.5	7	3.5	10.5
Alter existing production to meet financial needs	6	5.5	4	9.5
Manage third-party expenditures	6	5.5	4	9.5
Allocate funds to various parts of the budget	5	6	3	9
Integrate cost-saving methods for various facility operations	4	4.5	5.5	10
<b>General Responsibility 4: Maintenance of plant facilities and equipment</b>				
<b>Task Statements</b>	Frequency	Criticality	Difficulty	Task Importance Value
Assess operational status of industrial equipment	5.5	4.5	4	8.5
Conduct safety tests of industrial equipment	4	7	3.5	10.5
Determine nature of equipment faults and errors	6.5	6	4.5	10.5
Repair faulty and/or damaged equipment	5	5.5	5.5	11
Clean, lubricate and/or adjust equipment	5	5.5	3.5	9
Contact professional repair companies to assess and repair equipment	5.5	5	3	8
Maintain record of maintenance and repairs	5	2.5	2.5	5
Program computer-controlled equipment	2	3	1.5	4.5
<b>General Responsibility 5: Oversight of hazardous waste disposal</b>				
<b>Task Statements</b>	Frequency	Criticality	Difficulty	Task Importance Value
Educate staff about proper waste disposal practices	3	4.5	2	6.5

File periodical hazardous waste disposal reports	3.5	7	2.5	9.5
Apply for permits and certifications regarding hazardous waste disposal	1	7	3.5	10.5
Ensure facility practices meet regulatory standards regarding hazardous waste	3	7	3	10
<b>General Responsibility 6: Oversight of Supply Chain Operations</b>				
<b>Task Statements</b>	<b>Frequency</b>	<b>Criticality</b>	<b>Difficulty</b>	<b>Task Importance Value</b>
Assess material needs for customer orders	6	6.5	3.5	10
Order materials for production	6.5	7	2	9
Ensure proper transport-in of materials	6.5	6.5	3	9.5
Ensure proper transport-out of materials	7	6.5	3.5	10
Perform quality assurance practices prior to product departure	5.5	7	1.5	8.5

Frequency Rating:	Criticality Rating:	Difficulty Rating:
1- Annually	1 - Consequences of error are not at all important	1 - One of the easiest of all tasks
2 - Once	2 - Consequences of error are of little importance	2 - Considerably easier than most tasks
3 - Several times	3 - Consequences are of some importance	3 - Easier than most tasks performed
4 - Monthly	4 - Consequences are moderately important	4 - Approximately half of tasks are more difficult, half less
5 - Several times per month	5 - Consequences are important	5 - Harder than most tasks performed
6 - Weekly	6 - Consequences are very important	6 - Considerably harder than most tasks performed
7 - Several times per week	7 - Consequences are extremely important	7 - One of the most difficult of all tasks

*Appendix E*

## KSAOs and Ratings

\*Highlighted KSAOs were marked as insignificant and not included in combined analysis

<b>KSAs and Other Employee Specifications</b>	<b>Necessary for Newly Hired Employee? (yes or no)</b>	<b>Practical to Expect in Labor Market? (yes or no)</b>	<b>To what extent is trouble likely if this KSAO is ignored in selection? (1 to 5)</b>	<b>To what extent do different levels of the KSAO distinguish the superior from the average worker? (1 to 5)</b>
Ability to become accustomed to an industrial setting	y	y	5	3
Ability to communicate effectively with employees	y	y	3.5	4.5
Ability to communicate information to customers verbally	y	y	4	5
Ability to communicate information to customers effectively in writing	y	y	3.5	4
Ability to be on feet for multiple hours of a day	y	y	3.5	1
Ability to work extra hours if required to complete a job	y	y	1.5	1.5
Ability to use deductive reasoning to solve problems	y	y	3	4
Ability to approach a variety of problems with an open mind	y	y	2.5	4.5
Knowledge - Bachelor's degree in a related field	y	y	2.5	3.5
Knowledge - Some education in business/finance	y	y	2.5	3.5
Knowledge of centrifugal casting processes	n	y	1	1
Knowledge of general manufacturing processes	n	y	1.5	4.5
Knowledge of standard safety protocols related to industrial settings	n	y	2	4
Knowledge of intermediate-level mathematics (up to pre-calculus)	y	y	4.5	4

Knowledge of high-level mathematics (calculus and beyond)	n	y	1.5	3.5
Knowledge of materials science and general thermodynamics	n	y	1.5	3.5
Knowledge of general repair workflow for industrial equipment	y	y	2	4
Knowledge of legal requirements such as industry permits and reports	n	y	1	3.5
Other - Previous work experience in a related field	n	y	1	4.5
Other - Previous work experience in business management	n	y	1	3.5
Other - Previous work experience in an engineering position	n	y	1	3
Skills - Proficient in industrial control software	n	y	1	3
Skills - Capable of negotiating quotes with customers for the most profitable deal	y	y	3	4.5
Skills - Capable of balancing work time between a variety of tasks	y	y	3	2.5
Skills - Proficient in financial budgeting software (excel)	y	y	4	4
Skills - Capable of advanced critical thinking and problem solving	y	y	3.5	4.5
Skills - Proficient in leadership and the delegation of tasks to employees	y	y	4	4.5
Skills - Proficient in recognizing safety risks on the production floor	y	y	5	4.5
Skills - Proficient in operations monitoring of equipment	y	y	3	4
Skills - Proficient in systems and equipment evaluation	n	y	2.5	3.5
Skills - Proficient in maintenance practices of industrial equipment	n	y	2	3
Skills - Proficient in managing facility production schedules	y	y	4.5	4

*Appendix F*

## Combined Analysis – KSAO Ratings to Task Statement Ratings

How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Ability to become accustomed to an industrial setting	Ability to communicate effectively with employees	Ability to communicate information to customers verbally	Ability to communicate information to customers effectively in writing	Ability to be on feet for multiple hours of a day	Ability to work extra hours if required to complete a job
Work with customers to offer sales quotes and invoices	0	0	3	3	0	0
Convert customer orders to production schedules	1	4	3	3	0	0
Modify production schedules to satisfy customer needs	2	4	3	4	0	0
Process customer orders	0	4	3	3	0	0
Hold meetings with staff to inform them of production schedules	4	4	0	0	0	0
Plan order-flow of production in case of multiple customers	2	4	0	0	0	0
Direct staff on correct operational procedure of equipment	4	4	0	0	2	0
Ensure a cooperative employee atmosphere	4	4	0	0	2	2
Engage in facility walk-arounds	4	4	0	0	4	0
Aid staff in production of castings	4	4	0	0	4	2
Advise staff on proper safety practices	4	4	0	0	4	2
Apply proper pressure/temp adjustments to equipment to meet customer specifications	4	4	0	0	0	2

<b>How important is this KSAO in performing this task?</b> 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Ability to become accustomed to an industrial setting	Ability to communicate effectively with employees	Ability to communicate information to customers verbally	Ability to communicate information to customers effectively in writing	Ability to be on feet for multiple hours of a day	Ability to work extra hours if required to complete a job
Ensure quality of production meets industry standards	4	4	4	4	2	0
File and manage financial records	1	0	0	0	2	0
Assess production to determine financial needs	3	4	0	0	2	1
Alter existing production to meet financial needs	3	4	0	0	2	2
Manage third-party expenditures	0	0	0	0	0	0
Allocate funds to various parts of the budget	0	0	0	0	0	0
Integrate cost-saving methods for various facility operations	4	4	0	0	2	2
Assess operational status of industrial equipment	4	4	0	0	4	2
Conduct safety tests of industrial equipment	4	4	0	0	2	2
Determine nature of equipment faults and errors	4	4	0	0	4	2
Repair faulty and/or damaged equipment	4	4	0	0	4	2
Clean, lubricate and/or adjust equipment	4	4	0	0	4	0
Contact professional repair companies to assess and repair equipment	4	0	0	0	0	0
Maintain record of maintenance and repairs	4	0	0	0	1	0

<b>How important is this KSAO in performing this task?</b> 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Ability to become accustomed to an industrial setting	Ability to communicate effectively with employees	Ability to communicate information to customers verbally	Ability to communicate information to customers effectively in writing	Ability to be on feet for multiple hours of a day	Ability to work extra hours if required to complete a job
Educate staff about proper waste disposal practices	4	4	0	0	2	0
File periodical hazardous waste disposal reports	4	0	0	0	0	0
Apply for permits and certifications regarding hazardous waste disposal	1	0	0	0	0	0
Ensure facility practices meet regulatory standards regarding hazardous waste	4	4	0	0	2	0
Assess material needs for customer orders	4	4	0	0	2	0
Order materials for production	4	4	0	0	2	0
Ensure proper transport-in of materials	4	4	0	0	2	0
Ensure proper transport-out of materials	4	4	4	4	2	2
Perform quality assurance practices prior to product departure	4	2	4	4	2	0



How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Ability to use deductive reasoning to solve problems	Ability to approach a variety of problems with an open mind	Knowledge - Bachelor's degree in a related field	Knowledge - Some education in business /finance	Knowledge of intermediate -level mathematics (up to pre-calculus)	Knowledge of general repair workflow for industrial equipment
Work with customers to offer sales quotes and invoices	3	3	0	2	3	0
Convert customer orders to production schedules	1	2	0	1	4	1
Modify production schedules to satisfy customer needs	3	2	0	1	2	2
Process customer orders	2	1	0	1	4	1
Hold meetings with staff to inform them of production schedules	2	3	0	1	0	1
Plan order-flow of production in case of multiple customers	2	2	0	1	3	3
Direct staff on correct operational procedure of equipment	2	0	2	1	0	3
Ensure a cooperative employee atmosphere	3	3	2	1	0	0
Engage in facility walk-arounds	3	3	0	1	0	2
Aid staff in production of castings	2	1	0	0	1	0
Advise staff on proper safety practices	2	3	2	1	0	0
Apply proper pressure/temp adjustments to equipment to meet customer specifications	2	0	0	0	4	0
Ensure quality of production meets industry standards	2	0	0	1	3	0
File and manage financial records	2	3	1	3	4	0
Assess production to determine financial needs	3	3	1	2	4	0

<b>How important is this KSAO in performing this task?</b> 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Ability to use deductive reasoning to solve problems	Ability to approach a variety of problems with an open mind	Knowledge - Bachelor's degree in a related field	Knowledge - Some education in business /finance	Knowledge of intermediate-level mathematics (up to pre-calculus)	Knowledge of general repair workflow for industrial equipment
Alter existing production to meet financial needs	3	3	1	2	4	0
Manage third-party expenditures	3	3	1	2	4	3
Allocate funds to various parts of the budget	3	3	1	2	4	2
Integrate cost-saving methods for various facility operations	3	4	1	2	4	2
Assess operational status of industrial equipment	3	0	1	0	1	3
Conduct safety tests of industrial equipment	2	0	0	0	2	3
Determine nature of equipment faults and errors	3	4	1	0	2	3
Repair faulty and/or damaged equipment	3	2	1	0	2	4
Clean, lubricate and/or adjust equipment	2	0	0	0	2	4
Contact professional repair companies to assess and repair equipment	3	2	0	0	0	4
Maintain record of maintenance and repairs	2	0	1	2	0	2
Educate staff about proper waste disposal practices	3	2	0	2	0	0
File periodical hazardous waste disposal reports	2	0	0	2	2	0
Apply for permits and certifications regarding hazardous waste disposal	2	0	0	2	0	0
Ensure facility practices meet regulatory standards regarding hazardous waste	2	0	0	2	2	0

How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Ability to use deductive reasoning to solve problems	Ability to approach a variety of problems with an open mind	Knowledge - Bachelor's degree in a related field	Knowledge - Some education in business /finance	Knowledge of intermediate -level mathematics (up to pre-calculus)	Knowledge of general repair workflow for industrial equipment
Assess material needs for customer orders	3	0	0	1	2	0
Order materials for production	3	0	0	1	2	0
Ensure proper transport-in of materials	3	3	0	1	0	0
Ensure proper transport-out of materials	3	3	0	1	0	0
Perform quality assurance practices prior to product departure	3	0	0	0	2	0

How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Skills - Capable of negotiating quotes with customers for the most profitable deal	Skills - Capable of balancing work time between a variety of tasks	Skills - Proficient in financial budgeting software (excel)	Skills - Capable of advanced critical thinking and problem solving	Skills - Proficient in leadership and the delegation of tasks to employees	Skills - Proficient in recognizing safety risks on the production floor
Work with customers to offer sales quotes and invoices	2	2	4	2	0	0
Convert customer orders to production schedules	1	2	3	2	4	3
Modify production schedules to satisfy customer needs	3	3	3	3	4	3
Process customer orders	3	2	3	2	1	1
Hold meetings with staff to inform them of production schedules	0	3	3	2	4	4
Plan order-flow of production in case of multiple customers	0	4	3	4	4	4
Direct staff on correct operational procedure of equipment	0	1	0	2	4	4

<b>How important is this KSAO in performing this task?</b> 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Skills - Capable of negotiating quotes with customers for the most profitable deal	Skills - Capable of balancing work time between a variety of tasks	Skills - Proficient in financial budgeting software (excel)	Skills - Capable of advanced critical thinking and problem solving	Skills - Proficient in leadership and the delegation of tasks to employees	Skills - Proficient in recognizing safety risks on the production floor
Ensure a cooperative employee atmosphere	0	3	0	2	4	4
Engage in facility walk-arounds	0	3	0	4	4	4
Aid staff in production of castings	0	2	0	1	4	4
Advise staff on proper safety practices	0	1	0	2	4	4
Apply proper pressure/temp adjustments to equipment to meet customer specifications	0	1	0	2	4	2
Ensure quality of production meets industry standards	0	2	0	2	1	0
File and manage financial records	0	2	4	2	1	0
Assess production to determine financial needs	0	3	4	4	2	1
Alter existing production to meet financial needs	0	4	4	4	4	2
Manage third-party expenditures	0	2	4	4	2	2
Allocate funds to various parts of the budget	0	2	4	4	2	1
Integrate cost-saving methods for various facility operations	0	4	4	4	4	4
Assess operational status of industrial equipment	0	3	0	4	3	4
Conduct safety tests of industrial equipment	0	2	0	4	2	4
Determine nature of equipment faults and errors	0	3	0	4	2	4

How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Skills - Capable of negotiating quotes with customers for the most profitable deal	Skills - Capable of balancing work time between a variety of tasks	Skills - Proficient in financial budgeting software (excel)	Skills - Capable of advanced critical thinking and problem solving	Skills - Proficient in leadership and the delegation of tasks to employees	Skills - Proficient in recognizing safety risks on the production floor
Repair faulty and/or damaged equipment	0	4	1	4	2	4
Clean, lubricate and/or adjust equipment	0	4	1	2	4	4
Contact professional repair companies to assess and repair equipment	0	4	0	3	4	4
Maintain record of maintenance and repairs	0	2	2	1	1	2
Educate staff about proper waste disposal practices	0	2	0	2	4	4
File periodical hazardous waste disposal reports	0	2	2	2	1	1
Apply for permits and certifications regarding hazardous waste disposal	0	2	0	2	2	1
Ensure facility practices meet regulatory standards regarding hazardous waste	0	2	2	3	4	4
Assess material needs for customer orders	0	4	4	3	2	1
Order materials for production	0	4	4	3	2	0
Ensure proper transport-in of materials	0	4	1	3	2	2
Ensure proper transport-out of materials	0	4	1	2	4	2
Perform quality assurance practices prior to product departure	0	1	1	2	1	0

How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Skills - Proficient in operations monitoring of equipment	Skills - Proficient in managing facility production schedules
Work with customers to offer sales quotes and invoices	0	0
Convert customer orders to production schedules	2	4
Modify production schedules to satisfy customer needs	2	4
Process customer orders	2	4
Hold meetings with staff to inform them of production schedules	1	4
Plan order-flow of production in case of multiple customers	2	4
Direct staff on correct operational procedure of equipment	4	2
Ensure a cooperative employee atmosphere	0	2
Engage in facility walk-arounds	4	2
Aid staff in production of castings	4	2
Advise staff on proper safety practices	1	2
Apply proper pressure/temp adjustments to equipment to meet customer specifications	4	1
Ensure quality of production meets industry standards	2	2
File and manage financial records	0	0
Assess production to determine financial needs	2	1
Alter existing production to meet financial needs	2	1
Manage third-party expenditures	0	1
Allocate funds to various parts of the budget	2	1
Integrate cost-saving methods for various facility operations	2	1
Assess operational status of industrial equipment	4	1
Conduct safety tests of industrial equipment	4	0
Determine nature of equipment faults and errors	4	0

How important is this KSAO in performing this task? 0 = not at all 1 = somewhat important 2 = important 3 = very important 4 = extremely important	Skills - Proficient in operations monitoring of equipment	Skills - Proficient in managing facility production schedules
Repair faulty and/or damaged equipment	4	0
Clean, lubricate and/or adjust equipment	4	1
Contact professional repair companies to assess and repair equipment	4	0
Maintain record of maintenance and repairs	2	0
Educate staff about proper waste disposal practices	0	0
File periodical hazardous waste disposal reports	0	0
Apply for permits and certifications regarding hazardous waste disposal	0	0
Ensure facility practices meet regulatory standards regarding hazardous waste	0	0
Assess material needs for customer orders	0	4
Order materials for production	0	4
Ensure proper transport-in of materials	0	4
Ensure proper transport-out of materials	0	4
Perform quality assurance practices prior to product departure	0	1

*Appendix G*

## Plant Engineer Job Posting

**Plant Engineer**

The position of plant engineer is responsible for the general management of all facility operations, personnel, and financials. As such, a qualified applicant should be capable of the oversight of production, supply chain operations, hazardous waste disposal, safety regulations, and the general maintenance of the facility.

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**Job Responsibilities**

- Develop sales quotes and invoices for customers
- Process customer orders
- Planning and modification of production schedules
- Direct employees through equipment procedure
- Conduct quality assurance practices for products
- Advise employees of proper safety practices
- Determine financial status of company projects
- Manage financial records
- Develop cost-saving methods for facility operations
- Analyze and repair damaged industrial components
- Conduct safety tests of industrial equipment
- Ensure facility practices meet certified industry standards
- Direct general transport of materials and product

**Education Requirements**

- Bachelor's Degree in Engineering or Industrial Manufacturing
- Coursework in business or finance

**Skill Requirements**

- Interpersonal and negotiation expertise
- Time management capability
- Leadership and delegation proficiency
- Advanced critical thinking aptitude
- Knowledgeable financial competence

**A Preferred Candidate Would Have**

- Knowledge of general manufacturing processes
- Knowledge of standard safety protocols in manufacturing environments

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