**1. Comprehensive Project Report**

**Project Title:** *Wolf Cola Production Line Efficiency Analysis*  
**Department:** Manufacturing – Bottling Line, Philadelphia

**Executive Summary**

The bottling production line at Wolf Cola was analyzed to evaluate operational efficiency and identify key downtime drivers.  
Overall, **line efficiency was measured at 64%**, indicating substantial room for improvement.  
Analysis revealed that **machine adjustment issues** and **operator-related batch changes** were the most significant downtime causes.  
Training and preventive maintenance initiatives are recommended to raise efficiency and reduce avoidable downtime.

**Key Findings**

* Average Line Efficiency: **64%**
* Lowest-performing operator: **Mac**
* Top 5 downtime factors contributed to **80% of total downtime**
* **3 out of 5** top downtime factors were operator-related

**Background & Objectives**

Frank, the former Production Manager, initiated a productivity improvement project for the bottling line and collected relevant performance and downtime data.   
As his successor, my objective was to analyze the existing data to:

1. Calculate and visualize line efficiency
2. Identify key downtime factors using a Pareto approach
3. Evaluate downtime by operator and factor to guide improvement efforts

**Data Sources**

* **Line Productivity tab:** Production start/end times, operators, and product information
* **Products tab:** Standard “Minimum Batch Time” for each product
* **Line Downtime tab:** Timestamped records of downtime events, reasons, and durations
* **Downtime Factors tab:** Mapping of factors and total downtime aggregations

**Objective 1 – Calculate Line Efficiency**

**Steps Performed:**

1. Added a Batch Time column = End Time − Start Time (in minutes)
2. Added a Min Batch Time column from the *Products* lookup
3. Calculated efficiency per operator as:

Efficiency=Sum of Min Batch Time / Sum of Batch Time

1. Visualized results using a bar chart by operator

**Findings & Recommendation:**

* Overall line efficiency: **64%**
* Operator **Mac** showed significantly lower efficiency than others  
  **→ Recommendation:** Focus improvement efforts on Mac’s training and process consistency

**Objective 2 – Identify Main Downtime Factors (Pareto Analysis)**

**Steps Performed:**

1. Created a Downtime column summing durations for each factor
2. Sorted factors by descending downtime
3. Added a cumulative percentage column (Pareto)
4. Created a **Pareto chart** to visualize cumulative downtime distribution

**Findings & Recommendation:**

* **Top 5 downtime factors = 80% of total downtime**
* Lower-ranked causes have negligible contribution  
  **→ Recommendation:** Prioritize improvement actions on these top 5 factors

**Objective 3 – Downtime by Operator and Factor**

**Steps Performed:**

1. Added Operator column to the *Line Downtime* tab via lookup
2. Created a matrix: rows = Operators, columns = Main downtime factors
3. Calculated total downtime by operator-factor combination
4. Applied conditional formatting to highlight critical intersections

**Findings & Recommendation:**

* **3 of the 5 main downtime causes are operator-related**
* **Machine adjustment** is a universal issue across operators
* **Batch change** downtime is concentrated with **Mac**  
  **→ Recommendation:**
  + Provide all operators with **machine adjustment training**
  + Conduct **specialized batch change training** for Mac

**Overall Recommendations**

1. **Implement machine adjustment training** for all operators
2. **Provide batch change retraining** for operator Mac
3. **Introduce preventive maintenance routines** to minimize machine downtime
4. Monitor efficiency monthly and expand analysis to include **OEE (Overall Equipment Effectiveness)** in the future