301 – Managing the Chemical Crusher

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Improving Processes. Instilling Expertise.

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Recap of the Brutal Facts

- **Normal has changed!**
  - **Old Normal**
    - ✓ **Want to control our product cost.**
  - **New Normal**
    - ✓ **Need to control our product cost.**
  - **The traditional approach to Drill Blast may *help control* but not necessarily help to lower your product cost.**

QUARRY ACADEMY

Lessons Learned – Chemical Crushing

- **A properly designed and built Chemical Crusher can relieve work done by the primary crusher and improve its efficiency.**

- **As is the case with a mechanical crusher, tight tolerances and high quality are a necessity when building the Chemical Crusher.**

- **Implementing drill and blast programs based on the chemical crusher approach, can yield quarry process stream cost savings (product cost reductions) that are better measured in dollars per ton than in cents per ton.**

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Process Control

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Total Product Cost

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Solution

- **Utilizing the Chemical Crusher approach in Drill Blast offers the best opportunity to help control your product cost.**

✓ **Requires a change in management mindset**

  - Focus on Total Product Cost
  - Focus on Process Control

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Focus on Total Product Cost

- **Shift in market emphasis begs a shift in internal methods of economic and operations management.**
- **Break down the silos – create a dynamic cost model that tracks true $/ton by batch.**
- **Tons/man-hour and $/man- hour is meaningless until operations are optomized.**

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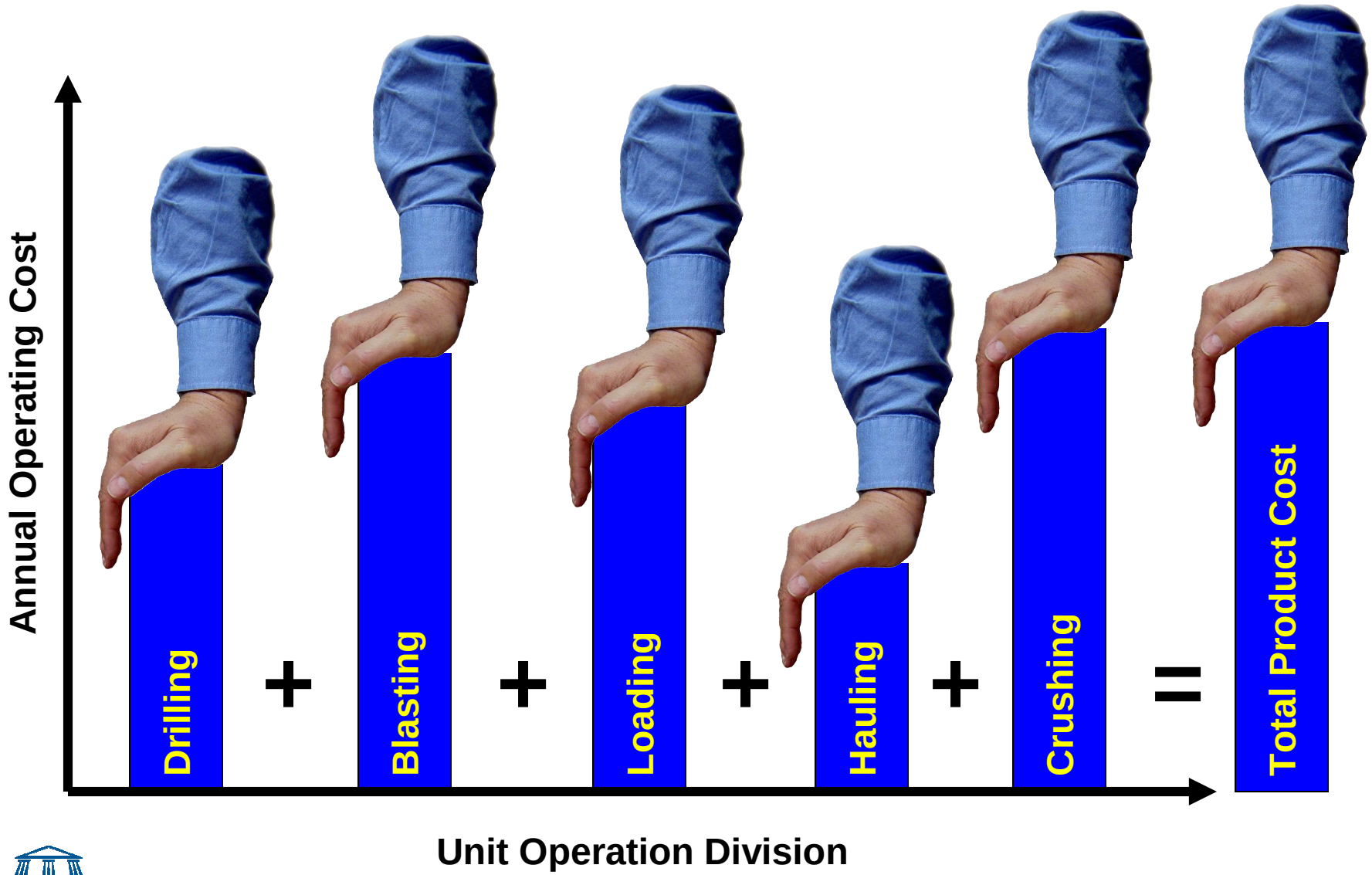
The “Silo” Old Normal Costing Approach



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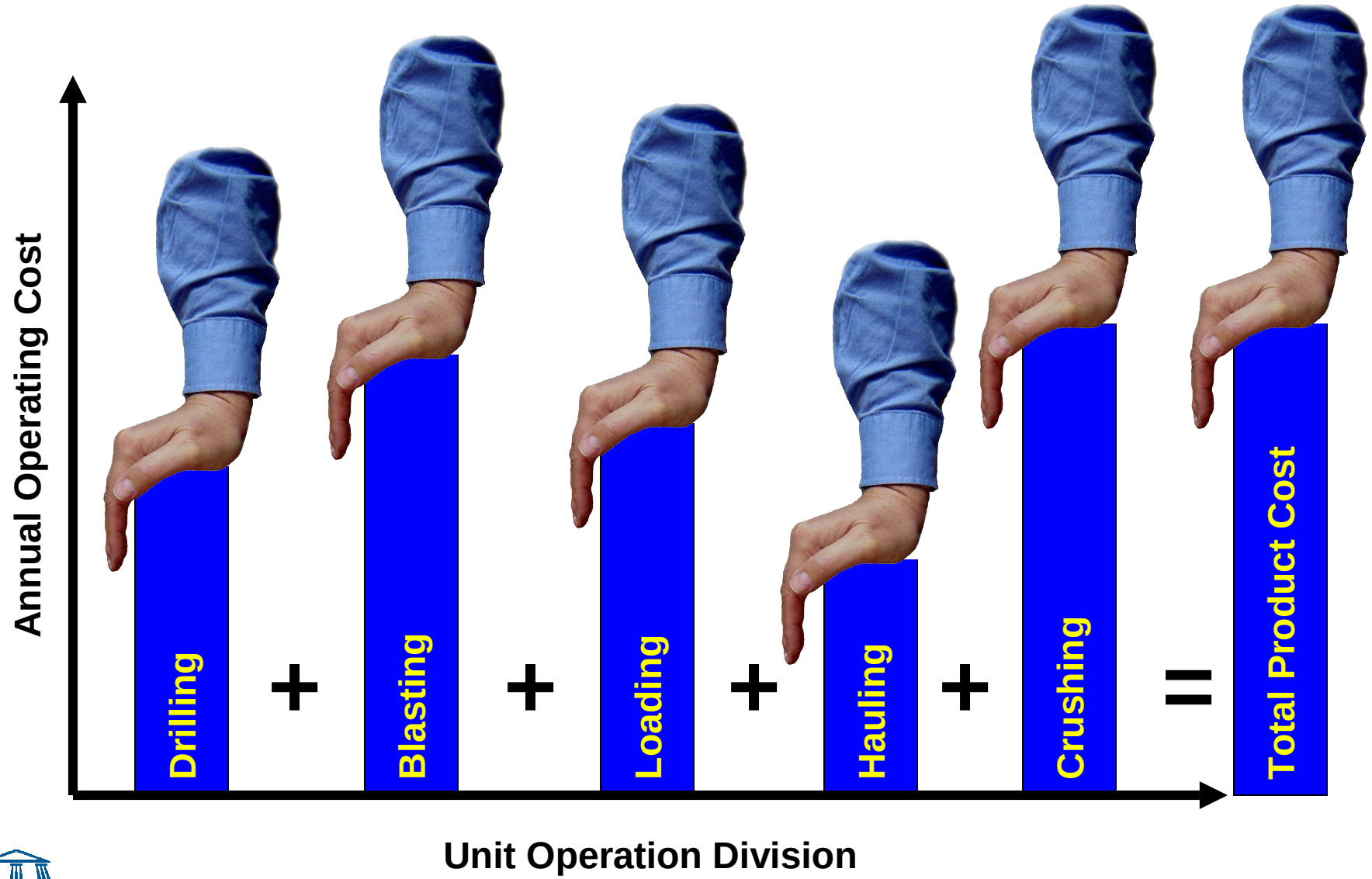
The “Process” New Normal Approach



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Focus on Process Control

- **Implementation of the Chemical Crusher concept requires a pseudo mechanical crusher mentality. That is the Drill Blast process needs to be managed like the design, building and operation of a machine. (one-time use machine)**

✓ **Close tolerance and minimum variance**

✓ **High quality**

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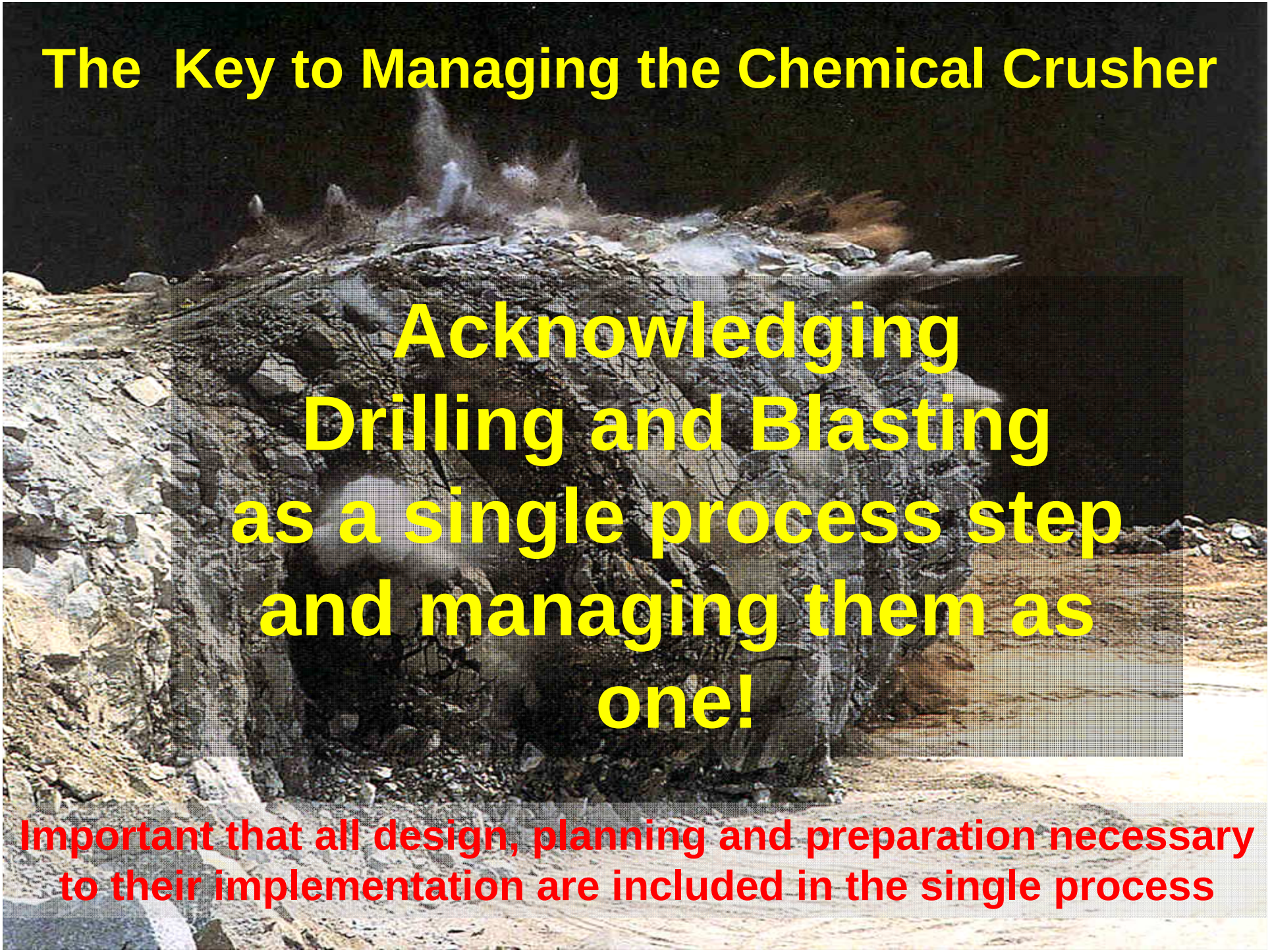
The Key to Managing the Chemical Crusher



Acknowledging Drilling and Blasting as a single process step and managing them as one!

Important that all design, planning and preparation necessary to their implementation are included in the single process

Managing the Chemical Crusher
- Challenges -

- **Process Control**
  - **Source of Resources**
    - In House
    - Contracted
  - **Process Components**
    - Design, Plan and Layout
    - Drilling
    - Blasting

The more complex the source of resources are, the more challenging the control.

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Managing the Chemical Crusher

- **No matter where the resources for the process are sourced from, the expectation of each are the same.**
  - **Safety**
  - **Integrated Communication**
  - **Engineering Control**
  - **Efficiency**
  - **Quality**
  - **Performance**

Where contractors are utilized, these expectations need to be specified in contractual agreements.

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Managing the Chemical Crusher

- **Again each resource, no matter where it is sourced from, must be aware of:**
  - **The desired output of the process**
  - **It's role and responsibilities as a component in the process**
  - **Dependency of each resource on one another throughout the process.**

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Managing the Chemical Crusher

- **Where resources for the Chemical Crusher process are to be contracted.**
  - **Clearly identify the entire process, components, dependencies and specify all expectations in Request For Quotation (RFQ).**
  - **Contractual agreements for process components should be aligned.**

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Managing the Chemical Crusher
- Challenges -

- **Process Control**
  - **Source of Resources**
    - In House
    - Sub Contracted
  - **Process Components**
    - Design, Plan and Layout
    - Drilling
    - Blasting

Where resources share work activities within a process component, they must be managed together with each's responsibilities and dependencies clearly defined.

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Managing the Chemical Crusher
- Process Components -

- **Design, Plan and Layout**
  - **Design**
- Bench height
- Size of blast
- Drill hole diameter. depth, subdrill, drill pattern/configuration, number of holes per row, number of rows.
- Blast Loading. (type explosive, primer type and location, decking, stemming.)
- Blast timing – intra hole, inter hole and inter row
- Log (document) in blast plan.

Designs should be based on producing a desired rock gradation

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Responsibilities?

Managing the Chemical Crusher - Process Components -

- **Design, Plan and Layout**
  - **Plan**
- Location of Blast
- Blast design
- Bench Preparation
  - Access
  - Scaling
  - Berms
- Delivery of stemming materials

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Responsibilities?

Managing the Chemical Crusher
- Process Components -

- **Design, Plan and Layout**
  - **Layout**
- Prepare the bench.
- Survey of bench
  - Elevations
    - » Upper
    - » Lower
  - Burden Profiles
- Measure and marking of drill hole locations on bench surface. (to plan)
- Log (document) diagram with planned depth of holes. (for driller)
- Bench marks / Set back markers.

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Responsibilities?

Managing the Chemical Crusher - Process Components -

- **Drilling**
  - **Execution**
- Drill holes of planned diameter, at planned location, to planned angle and depth.
- Log (document) hole number, rock conditions, amount of water, angle and depth of hole.
- Protect hole / collar integrity.
- Redrill bad holes.
  - **Quality**
- Accurate location at surface elevation.
- Open hole, stable collar and accurate depth.
- Accurate hole angle and location at bottom elevation

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Responsibilities?

Managing the Chemical Crusher - Process Components -

- **Blasting**
  - **Execution**
- Confirm hole depth, amount water. (recommend redrill)
- Assess burden for drill holes along open face.
- Dewater holes as necessary. Prime and load holes with explosive materials according to blast plan.
- Stem blast holes and unused drill holes.
- Hook up, check / test initiation system.
- Log (document) blast loading.
  - **Quality**
- Explosive materials, load / initiation sequence to blast plan.

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Responsibilities?

Managing the Chemical Crusher - Process Components -

- **Please understand that there are a myriad of other activities and responsibilities critical to drill and blast that have not been detailed in the Chemical Crusher Process Components presentation such as:**
  - **Workplace inspection**
  - **Blast site / Blast area security**
  - **Initiation of the blast**

Interestingly enough these activities are managed well!

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Managing the Chemical Crusher

- **Revise strategy for performance goals and performance rewards to support <u>total process improvement</u> as it relates to cost and efficiency.**
  - **Process Metrics**
    - As built vs planned. (drill and blast)
    - Vibration, flyrock, airblast
    - Rock gradation (Oversize)
    - Load / Haul cycle times
    - Impact hammer time (pit and crusher)
    - Crusher Throughput

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Managing the Chemical Crusher

- **Revise strategy for performance goals and performance rewards to support <u>total process improvement</u> as it relates to cost and efficiency.**
  - **Performance Reviews**
    - Periodic group meetings should be held with representatives of each resource used in Drill and Blast and most importantly operational representatives from the entire rock crush, size and shape process are necessary to: maintain inter communication; review results and performance; discuss issues and opportunities; clarify accountability or responsibility; and agree on path forward.

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Managing the Chemical Crusher

- **The proper management of the Chemical Crusher is not only necessary to leverage Drill & Blast so that it can make a maximum contribution to the rock crush, shape and size process but more importantly to maintain the gains delivered by it.**

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Managing the Chemical Crusher

- **Main Points to Remember:**
  - As is the case with a mechanical crusher, tight tolerances and high quality are a necessity when “building” the Chemical Crusher. The process must be controlled to achieve this.
  - Manage Drilling and Blasting as one process step. Expectations and responsibilities of all resources (in-house and/or contracted) supporting the process must be aligned.
  - Quantifiable metrics must be used to monitor conformation with quality standards and measure performance.

If it matters, it needs metrics.

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Managing the Chemical Crusher

- **Main Points to Do: (Safety above all at all times!)**
  - Ensure that all resources involved in Drill and Blast, no matter where they are sourced from, are clearly aware of: the desired output of the process; their roles and responsibilities as a component in the process; and their dependency on one another throughout the process.
  - Ensure expectations for field controls and quality of execution are included in agreements with all resources (in house or contracted). Align agreements where ever possible with regard to dependencies, responsibilities, terms and conditions.
  - Establish performance goals and performance rewards consistently through the organization to support total process improvement as it relates to cost and efficiency.

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