Value Stream Analysis in Nuclear Materials Management Program at SNL

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Abstract

The main goals of Value Stream Analysis (VSA) are to improve process or production quality, cost, and delivery by eliminating waste. VSA and Value Stream Mapping (VSM) are most often used in the industrial world to evaluate and optimize existing processes. Sandia National Laboratories (SNL) however, is applying the VSA approach to standup a new nuclear materials management organization. We anticipate that the VSA methodology will allow streamlining of the processes involved in dealing with overlapping management, safety, security, and regulatory requirements, while minimizing risks by dealing with nuclear materials issues in a structured mannered. VSA works by getting the program team together with VSA facilitators, as needed, and flow diagramming the various phases and requirements, from beginning to end, into a VSM. The planning steps begin by defining the boundaries, defining the value or importance of the various functions, defining the desired outcome, and getting a good understanding of the process flow and accompanying data requirements. The next step is to map the process envisioned by the program team. This often begins with present-state process steps written on sticky notes pasted on the wall and connected by preliminary flow diagrams. The sticky notes and flow diagrams often move from place to place until participants agree that it represents "right" process flow. The team is then able to develop an "ideal state" VSM by assuming no constraints on resources or intervening corporate policies – a "perfect world" scenario. Incorporation of constraints on resources and intervening corporate policies into the "ideal state" map will result in a realistic and optimized "future state." The method provides an opportunity for team members to see how their individual processes links into the overall process, and how they could be tailored to optimize the overall process. Management of nuclear material involves many critical processes and issues relating to human health, safety, storage, security, and regulatory requirements that must be properly addressed. We believe that VSA will allow us to stand up an effective nuclear materials management program right from the start. In this paper, we present the results of our VSA and plans for their implementation.

Introduction

Sandia National Laboratory's Lean/Six Sigma program is modeled after Lockheed Martin's LM21 (Lockheed Martin - 21st Century Program). Lean/Six Sigma consists of a set of methodologies for process improvement focusing on reducing waste, improving performance, improving productivity, and delivering more value to the customer. These methodologies have been successfully applied to improvement of transactional processes, including strategic planning, as well as to manufacturing processes.

The tools used in Lean Six Sigma (LSS) are very much the same as those used in other quality initiatives. However, it's the methodology that is different. By applying Lean/Six Sigma

methodologies, a sense of urgency is created, opportunities for improvement are identified, data is gathered, and changes are implemented. Since data is gathered, the changes are easily measured and tracked, and results can easily be demonstrated. And, unlike other quality programs, LSS practitioners (Black Belts and Green Belts) are regular employees that work in all areas of the corporation, not in the quality department.

Lean is based on five principles: 1) Value from the customer's perspective. 2) The Value Stream, which is a series of activities/tasks which make up a process, 3) Flow or getting the product to move without stopping. 4) Pull - supplying the customer only when they need it. And 5) Perfection - this is an iterative cycle of continuous improvement.

By applying these 5 principles, a process can be made more efficient, more effective, and can increase the quality of the product being delivered to the customer.

The Six Sigma part is based on a statistical methodology which focuses on reducing variation and defects, and mistake-proofing a process. Six Sigma has several meanings: it can be defined as a method or tool set using the Define, Measure, Analyze, Improve, Control (DMAIC) technique to make improvements and it can describe the number of defects the result from process variation in a product or process.

Six Sigma is a data driven approach to reduce the number of defects in a process or reduce costs in a product of process as measured by Six Standard Deviations between the mean and the nearest specification limit. Six sigma quantitatively means a process that produces less than 3.4 defects per million units (or opportunities).

Value Stream Analysis (VSA) is a method by which lean principles are applied in the examination of business processes [1]. The method focuses on development tasks which add value to a final product; and are efficiently linked together to form a continuous flow of value. Value Stream Mapping (VSM) is a tool to support its associated analysis. VSM thus can be simply stated as *the method by which the outcomes of Value Stream Analysis are depicted or illustrated* [1]. VSA works by getting the program team together with VSA facilitators, as needed, and flow diagramming the various phases and requirements, from beginning to end, into a VSM. The planning steps begin by defining the boundaries, defining the value or importance of the various functions, defining the desired outcome, and getting a good understanding of the process flow and accompanying data requirements. The next step is to map the process envisioned by the program team. This often begins with present-state process steps written on sticky notes pasted on the wall and connected by preliminary flow diagrams. The sticky notes and flow diagrams often move from place to place until participants agree that it represents “right” process flow. The team is then able to develop an “ideal state” VSM by assuming no constraints on resources or intervening corporate policies – a “perfect world” scenario. Incorporation of constraints on resources and intervening corporate policies into the “ideal state” map will result in a realistic and optimized “future state.” The method provides an opportunity for team members to see how their individual processes links into the overall process, and how they could be tailored to optimize the overall process.

Value Stream Analysis happens in 10 steps which can be grouped in four blocks:

Preparation: The most important part of preparing is to define the boundaries of the analysis. Value Stream Analysis involves many people with many creative ideas. This energy must be focused. Choose your boundaries clearly (who are the customers, what are the outputs, who are the suppliers, what are the inputs, what are the expected outcomes).

Current state: Developing the current conditions Value Stream Map is the foundation of Value Stream Analysis. It keeps the effort grounded in a clear understanding of "reality". It summarizes this reality in a visual Value Stream Map that allows the whole organization to see waste and opportunity. This Map is not a Logical Process Map. The level of steps and data should be considerably higher than that used in a typical Kaizen event.

Vision: In this phase the current state is analyzed and the ideal state - the "perfect world" scenario – is developed. With guidance from the "Black Belt" LSS practitioners, the team analyzes the current conditions in terms of the Lean Principles. To get into the vision, the team pretends they are a very small business operating on very lean resources. The team must be very creative, assuming that it has a very low volume of customer demand and almost no cash. It is to develop an "absolute minimum" sized Value Stream that can deliver the same quality as its largest, wealthiest competitor. Staying creative, but become a bit more practical, the team continues the brainstorming on the components of an ideal state, if resources were not limited. The team may not know how to accomplish this yet, but it continues to develop it. This approach guides the vision and creates a few important R&D projects.

Plans: Fourth, the team develops a practical future state Value Stream Map for what it wants to have in the near future. The target time frame for this future state will vary from 6 to 24 months, based on the needs of the customer and organization. This map should move the organization towards the ideal state in logical steps. From the future state map, the team develops practical action plans for the next 3-6 months.

Application of VSA to Nuclear Materials Management Program at SNL

Management of nuclear material involves many critical processes and issues relating to human health, safety, storage, security, and regulatory requirements that must be properly addressed. Lifecycle planning and processes assuring cradle-to-grave accountability of materials that pose risk (radioactive) are required to protect the corporation, the environment, the workers, and the public. The corporately-accountable Nuclear Materials Management Department (NMMD) at SNL is a newly created department that serves as an independent gate-keeper for new acquisitions of radioactive and nuclear materials and assures appropriate lifecycle planning (justification of procurement, acceptance, packaging, transportation, storage, periodic re-justification of continued retention, inspection, characterization, and eventual disposition) and implementation is applied to the management of such material. This department provides cohesive regulatory responsiveness and serves as the corporate resource assisting line organizations in the planning and compliant implementation of radioactive and nuclear material lifecycle activities, and prioritizes and plans downsizing of the radioactive and nuclear inventory.

The Sandia National Laboratories (SNL) Nuclear Material Management Program (NMMP) has been a part of SNL operations for many years. The SNL NMMP previously functioned under the Material Control & Accountability (MC&A) Department. During the 2005 – 2008, the SNL NMMP has successfully dispositioned all it No-Defined-Use (NDU) cat 1 and 2 radioactive material. However, the use of radioactive and nuclear materials remains essential for SNL missions. SNL has acquired an extensive inventory of legacy nuclear materials over the past five decades; disposition of legacy material is a large focus of the NMMD.

In preparation for developing the processes to meet its stated mission and to standup the new nuclear materials management organization, the SNL NMMD conducted a VSA and VSM of the previously employed nuclear material management and disposition processes. The objectives of the exercise were to 1) Identify and map existing processes; 2) Improve existing processes; 3) Develop and map ideal and future states processes; 4) Identify gaps in the existing processes resources; and 5) Identify and plan the actions to reach the future state.

The first step in conducting the exercise was to develop the exercise charter. The charter included statements of exercise description, preliminary objectives, customer demands and constraints, process information, project dates, team members, return on investment, and the value stream tie and/or business objective tie. Key requirements in developing the charter included identification of the business demand that includes the ability to meet the current commitments while improving the management practices and processes, and selection of a team that represents all the customers and stakeholders. We defined the customers as the agencies who provide the financial resources to operate the NMMD and the supporting facilities. The stakeholders are those organizations, internal and external to SNL, who support the NMMD in its mission.

The next step was to develop the Input/Output Diagram (IOD). The major current inputs into the NMM processes are the requests for new nuclear material, and the status and make up of current inventory. The major current processes include review of material acquisition requests to ensure a lifecycle plan from entry of material into SNL until its disposition is developed prior to bringing the material on site; a continuous assessment is performed to update the current ownership, utilization, and storage status of the material in the inventory. However, planning for disposition and disposition of the legacy material have accounted for more 75% of the NMMD efforts over the past few years, and will continue to be the core process for the next 8-10 years. The outputs from these processes are the decision on the use of the SNM material and, therefore, the update of disposition plans, maintenance of inventory status, and submission of assessment and disposition reports to the customers and stakeholders.

Results of the VSA and VSM

The VSA and VSM exercise required four days of extensive brainstorming and discussions. The team was able to meet the objectives of the exercise by producing maps of the current, ideal, and future states for the NMMD processes. A list of action items with deliverables for the next 12 months was developed and prioritized. Some of these action items have been completed.

Lessons Learned

A review of the exercise and its outcomes revealed many important lessons that not only pointed out the requirements for additional resources to meet the NMMD mission, but also considerations for potential improvement of the future exercises. Some of these lessons would

impact the expectations from conducting similar VSA exercises. Listed below are the most noticeable lessons-learned from this exercise:

- VSA and VSM exercise may take longer that expected – It took four (4) days for the SNL NMMD processes - we had expected it to take three (3) days;
- A facilitator is absolutely necessary to keep the team on track;
- We had strong processes but they just weren't documented (A lot of tribal knowledge);
- Single point failure – only one-person deep in every area of expertise (if one of them wins the lottery we are in trouble!);
- We are very compliance driven and to get "lean and mean" is going to be difficult;
- Personnel from our interfacing organizations should be included on the team – especially those with close linkages in their operations (MC&A, Material Processing, Transportation, Security);
- Value stream analysis (color coded as red, yellow, green) is very educational in distinguishing between WASTE and REQUIRED WASTE!!!

Conclusions

SNL NMMD team conducted a VSA and VSM exercise using the LSS five principles to map out current state of NMM Processes. The team identified waste and constraints, most of which were compliance driven, developed and mapped a Future State, and identified early opportunities for data collection in order to prevent/reduce rework. A list of action items, and plans and deliverables were developed, and assigned to the staff. The team recommended that another exercise be conducted in four years to asses and evaluate the effectiveness of the Future State processes.

Acknowledgement - the SNL NMMD VSA / VSM team members were: Warren Strong, Chris Barth, John Miller, Todd Erenstein, Nancy Collins, Sue Moy, Ming Moy, Andy Rogulich, Anthony Aragon, Chris Madigan, and Mike Spoerner. Their hard work and contributions to the exercise is sincerely acknowledged and appreciated.

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