

# **Safety and Health in Biomass Production, Transportation and Storage**

A commentary based on the Biomass and Biofuels session at the 2013 North American Agricultural Safety Summit

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## **Scope of Biomass Production Systems Across the United States**

As a result of federal research, policy and funding, significant research has begun on many aspects of the biomass industry by universities, national laboratories, businesses and other institutions.<sup>1</sup> An update of the One-Billion Ton study was completed in August 2011, and confirmed the predictions of the original 2005 study, while providing more specific estimates of production by the mid-21st century.<sup>1</sup>

Biomass includes organic materials that are plant or animal-based, such as energy crops, agricultural crops, trees, food, feed, and fiber crop residues as detailed in American Society of Agricultural and Biological Engineers (ASABE) Standard S593.1.<sup>2</sup> In 2011 the United States obtained 4.5% of its total energy from biomass according to the US Energy Information Administration Report.<sup>3</sup> This represented a 47% increase in biomass energy production since 2000. About half of biomass consumption comes from forest and crop residues and half comes from fuel ethanol. As of 2011, biomass crops accounted for 49% of renewable energy produced in the United States.

The projected volume of material needed to meet these goals has the potential to lead to a wide range of safety and health issues.

## **Safety and Health in Biomass Production, Transportation and Storage**

A systematic review of national and international literature regarding biomass systems has been conducted to identify processes where hazards could be present.<sup>4</sup> Using information from the biomass industry and other agricultural industries with similar processes and equipment, a list of possible health and safety hazards was compiled and methods of hazard analysis are being investigated. Three reports on this topic were also presented at the 2013 North American Agricultural Safety Summit.<sup>5-7</sup> A brief summary is provided below.

## **International Literature search**

It was found that the European Union (EU) and particularly Western Europe, had a large and well-established biomass production system with a research system in place.<sup>8</sup> A representative of Centro Nacional de Energias Renovables (CENER), a biomass research center in Navarra, Spain, was contacted and interviewed in-person to gather safety and health information on their operations, and a list of possible sources on safety in the biomass industry of the UE was obtained. The results of the international research revealed that countries with established biomass systems have not researched safety hazards unique to the biomass industry nor

developed any specific safety programs to address safety in any areas of the biomass industry. Several common hazards such as fires in storage, dust explosions, and falls have been identified, but little research has been done to mitigate these hazards as detailed by the Combustion Engineering Association.<sup>9</sup>

The most recent publication identified was from May 2013 and addresses health and safety aspects of solid biomass storage, transportation and feeding.<sup>10</sup> However, no international safety protocols were found that addressed farm-level biomass production.

### **US Literature Search**

Thirty papers were identified through the Google search engine, Penn State University Library, and the ASABE archives. No papers were found that specifically addressed the range of hazards associated with planting, production, and pre-plant processing of biomass. Four publications were found that identified individual hazards.<sup>11-14</sup> Two publications were identified that should have included hazard information but did not.<sup>2, 15</sup>

### **Tracking Injuries in Biomass Production Systems**

Current literature does not group injuries related to biomass systems by industry codes or other methods to easily identify biomass cases.<sup>4</sup> There are several possible reasons for this. With all the different sources of biomass, the industry classifications are segmented over several different industries. In the North American Industry Classification System (NAICS) there are several industry codes for biomass crops.<sup>16</sup> For instance, switchgrass and miscanthus production best fits in NAICS 111940 – Hay Farming, but short rotation (less than 10 years per cycle) willow production fits under NAICS 111421 – Nursery and Tree Production. Yet another biomass feedstock, wood chips, could come from the NAICS 113310 – Logging industry. This leads to segmented injury and illness data that can be difficult to capture, especially for someone that may not understand all the potential biomass crops.

Another way of identifying biomass production related injuries is using Source of Injury and Type of Event codes used by the Bureau of Labor Statistics (BLS) within the industries identified as producing biomass. Both of these codes are part of the BLS – Occupational Injury and Illness Classification System (OIICS).<sup>17</sup>

Both of these systems need to be used to create a more effective surveillance system for biomass related injuries and illnesses.

### **Safety and Health Regulations**

Industry codes in biomass production are also important with regard to safety and health regulations. For instance, small scale production agriculture is exempt from most Occupational Safety and Health Administration (OSHA) regulations. However, if a farm or ranch employees 11 or more workers, more safety and health regulations apply. If a biomass producer of any size processes biomass material, e.g., bags and sells biomass seed, OSHA may consider this part of the operation as no longer production agriculture, and can apply all safety and health regulations to that operation even if there is only one non-family employee.

### **Biomass Production, Transportation and Storage Systems**

It is important to understand the processes and equipment involved in biomass production to identify the potential safety and health hazards associated with biomass.<sup>4</sup> The use of traditional agricultural machinery in addition to unique biomass machinery in these systems presents the opportunity for non-traditional hazards.

### **Minimizing Biomass Production Hazards and Risks**

There are several risk analysis methods that either can be or have been applied to agricultural production systems, i.e., Haddon Matrix, Risk Score and Fault Tree Analysis. These same methods should be explored for hazard and risk reduction in biomass production.

## Summary

With the rapid expansion of the biomass production and storage on farms and ranches, now is the time to integrate injury and illness surveillance, safe design of new systems and injury prevention programs.

Future reviews and studies are encouraged to contribute to the body of knowledge related to this important topic, including injury surveillance, identification of unique or modified equipment, processes and hazards, application of safety and health regulations, etc.

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