We identified 920 individuals who were classified as ETWs. Of these, 212 individuals recorded 569 absences and 754 diagnoses (during their careers). The largest percentage of ETWs we identified worked at the Hanford Site (Table 1), and Crafts Workers recorded the most absences (Table 2). Respiratory diagnoses were the number one reported condition, and most of these diagnoses were reported by Technical Workers (Figure 2). The distribution of diagnoses in this subgroup was similar to the rest of the IISP population. The majority of all health events in this group (73%) were reported before employees were classified as ETWs. This cohort reported 16,725 career days lost. Overall, the median of the total days absent was significantly different (p<0.0001) between men and women (Table 3), and the median days lost before being classified as an ETW was 13 days, while median days lost afterwards was 17; this difference is also statistically significant (p=0.05) and may be attenuated after age-adjustment, but our current sample size is too small to adequately address this question.

As with any new technology, the earliest and most extensive exposure to hazards is most likely to occur in the workplace. Workers within nanotechnology-related industries have the potential to be exposed to uniquely engineered materials with novel sizes, shapes, and physical and chemical properties. Recent literature suggests that exposure to engineered nanomaterials may result in adverse health effects in many organ systems plus genotoxic effects, although the long-term human health effects are still unknown. As a major user of engineered nanoparticles, the U.S. Department of Energy (DOE) uses various methods to monitor the health of emergent technologies workers (ETW) who handle or could potentially be exposed to unbound engineered nanoparticles (UNP).

Using data from DOE’s Illness and Injury Surveillance Program (IISP) (Figure 1), Oak Ridge Associated Universities (ORAU) created a registry of ETWs. IISP currently tracks 125,000 workers at 14 DOE facilities. Workers in IISP, who were classified as ETWs, were placed in a separate database using Microsoft Access. Using SAS (Version 9.2; Cary, NC), the health status of this cohort was analyzed by a variety of different variables such as age, gender, occupation, years of employment, number of years classified as an ETW, and site.

### Methods

Figure 1. Active IISP Sites by States

**Figure 1. Active IISP Sites by States**

*Represents sites with ETWs used in this analysis*
Engineered nanomaterials are used in over 1,000 commercial products in a variety of industries; however, limited information exists on likely exposure pathways, safe working levels, material toxicity, and adverse health outcomes that may be related to exposure. Understanding some of the potential health effects associated with exposure to UNP, we looked for significant increases in the diagnostic categories thought likely to be associated with exposure to engineered nanomaterials. A useful tool in the surveillance of a new or perceived hazard, especially when the risks to workers are not well defined, is an exposure registry that provides documentation of who is working with which materials, when, and where in a facility (Trout and Schulte, 2010). As a result of evaluating these data, we wanted to see if any statistically significant differences existed among workers before and after they were classified as ETWs.

## Conclusion and Next Steps

Despite some challenges, our data provided an insightful baseline measurement for this particular cohort. Based on our analysis, we conclude that an exposure registry for UNP can be a practical tool for monitoring the health of ETWs. If some of the limitations mentioned can be overcome, future data will become an even greater asset to predicting the overall health of ETWs. Much research is still needed to understand the impact of nanotechnology on health and how to determine appropriate monitoring and control strategies; registries and surveillance programs such as IISP are an invaluable tool for determining risk and crafting policy. We recommend that this cohort continue to be monitored and that data are reported and analyzed periodically, perhaps on an annual basis. Additionally, we suggest that future analyses should include modeling and a case-crossover study.

## References

1. Trout, DB and Schulte, PA. 2010. Medical surveillance, exposure registries, and epidemiologic research for workers exposed to nanomaterials. Toxicology. 269, 128-135.