SUMMARY REPORT

D&D Knowledge Management through Contributions in Wikipedia

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FLORIDA INTERNATIONAL UNIVERSITY

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INTRODUCTION

ARC has developed a knowledge management information tool (KM-IT) framework applied to the area of deactivation and decommissioning (D&D) in collaboration with DOE, EFCOG and the former ALARA centers at Hanford and Savannah River. The objectives of knowledge management in the context of the DOE are: 1) to prevent the loss of a unique knowledge base and expertise that has been gained over the years by employees and contractors of DOE for the future workforce; 2) to collect, consolidate and share this valuable knowledge in a universally available and usable system; and 3) to provide single-point access into the collective knowledge-base of a community of practice within and outside of the U.S. Department of Energy. The long-term strategic vision for the D&D Knowledge Management Information Tool (D&D KM-IT), developed for DOE's D&D community of practice, is that *it will continue to grow and mature into a self-sustaining system through the active participation of the D&D community it was designed to serve.*

In late 2011 and early 2012, FIU developed a white paper titled "Leveraging Wikipedia and Wiki-Based Technologies: Significance to D&D Knowledge Management." One of the conclusions of this paper indicated that there is an excellent opportunity for FIU to improve the depth of information available for specific D&D-related terms on Wikipedia. FIU could contribute to and augment Wikipedia by building a stronger presence via adding to its collection on knowledge management and specifically on D&D related topics. In this way, FIU would build a stronger web presence, which in turn has the potential of helping to leverage the D&D KM-IT work, while adding value to Wikipedia that will, in the long run, benefit the D&D community by adding content on high-value D&D topics.

Since 2014, DOE Fellows from the DOE-FIU Science and Technology Workforce Development Program as well as other FIU graduate students working at ARC as research assistants have researched and targeted D&D information on Wikipedia where D&D KM-IT could provide additional relevant information while citing the source of the original information on D&D KM-IT. The results of these effort are documented each year in a summary report titled, "D&D Knowledge Management through Contributions in Wikipedia."

METHODOLOGY

D&D knowledge management through contributions in Wikipedia was included as a part of the outreach and training (D&D community support) subtask included in the D&D Knowledge Management Information Tool task in the Project Technical Plan (ARC 2015). The general D&D knowledge which has been gained through this project offers an opportunity to expand access to a broad audience via Wikipedia, which has a significant presence on the web, thereby offering greater opportunities for collaboration on D&D knowledge. ARC researched and targeted D&D information on Wikipedia where D&D KM-IT could provide additional relevant information while citing the source of the original information on D&D KM-IT.

The objective of this effort is to share relevant D&D information on Wikipedia without re-writing D&D KM-IT on it. By becoming collaborators on Wikipedia, more users may be drawn to the D&D KM-IT since D&D knowledge management is core to the project.

ARC staff and the DOE Fellow supporting this effort completed the following steps in the performance of this task:

a) Discussed task and approach during a D&D KM-IT team and meeting.
b) Reviewed the report on this effort from the previous year.
c) Reviewed the Wikipedia guidelines and restrictions for editing, including "Wikipedia: Best practices for editors with close associations" and "Wikipedia: Conflict of interest."
d) Reviewed information published on D&D KM-IT.
e) Searched on Wikipedia for articles where information from published on D&D KM-IT could add relevant and significant information to the Wikipedia article.
f) Developed draft additional text and made notation of the related reference for the identified Wikipedia article. Performed internal review of draft text by ARC staff. Once approved, edited the Wikipedia article with the additional text, adding reference to source of information on D&D KM-IT.
g) Performed of internal review by ARC staff for edited Wikipedia article. Completed revisions as needed.

As noted in the FIU white paper on leveraging Wikipedia (Phillips 2011), one restriction with Wikipedia is conflict of interest (COI) editing. Wikipedia discourages COI editing, describing it as "Changing pages to promote your own interests or those of other people, companies, or groups, is a COI. Where outside goals are more important to a user than building Wikipedia, that person has a conflict of interest." Generally, a user who is suspected of COI editing will have their changes reviewed for self-praise and false information. If the user appears to be utilizing Wikipedia for their own self-promotion, their changes could be removed or, in some cases, the user banned from contributing to Wikipedia.

In the performance of this task, FIU kept these restrictions in mind and focused on locations where relevant and significant information on D&D could be added to existing Wikipedia articles, specifically building on the information available in Wikipedia.

RESULTS

During the completion of this task, the following Wikipedia articles were edited. For each of these articles, relevant and significant text was added to the body of the article and a reference to the information source on D&D KM-IT was included. Before and after screenshots for each of the edited Wikipedia articles are included in the Appendix.

1. **Nuclear Decommissioning – Cost Section** with information from the best practice titled, "SRS P and R Reactor Disassembly Basin *In Situ* Decommissioning."

   http://en.wikipedia.org/wiki/Nuclear_decommissioning

   The article was edited with the following additional text:

   New methods for decommissioning have been developed in order to minimize the usual high decommissioning costs. One of these methods is *in situ* decommissioning (ISD), which was implemented at the U.S. Department of Energy Savannah River Site in South Carolina for the closures of the P and R Reactors. With this tactic, the cost of decommissioning both reactors was $73 million. In comparison, the decommissioning of each reactor using traditional methods would have been an estimated $250 million. This results in a 71% decrease in cost by using ISD.

2. **Occupational Safety and Health – Hazard Identification Section** with information from the following best practice: "Historical Hazard Identification Process for D&D." The reference linking back to the best practice document on D&D KM-IT was subsequently removed by another Wikipedia editor. It is important to note that the information available on wikis is continually evolving and may be further edited by other participants at any time. FIU has further edited the entry to add the title and link to the best practice under the Further Reading section of the Wikipedia entry.

   http://en.wikipedia.org/wiki/Occupational_safety_and_health

   The article was edited with the following additional text:

   The information that needs to be gathered from sources should apply to the specific type of work from which the hazards can come from. As mentioned previously, examples of these sources include interviews with people who have worked in the field of the hazard, history and analysis of past incidents, and official reports of work and the hazards encountered. Of these, the personnel interviews may be the most critical in identifying undocumented practices, events, releases, hazards and other relevant information. Once the information is gathered from a collection of sources, it is recommended for these to be digitally archived (to allow for quick searching) and to have a physical set of the same information in order for it to be more accessible. One innovative way to display the complex historical hazard information is with a historical hazards identification map, which distills the hazard information into an easy to use graphical format.

3. **Robotics – Applications Section** with information about the use of robotics for D&D.

   http://en.wikipedia.org/wiki/Robotics
   .
   The article was edited with the following additional text:

   Another application area for robotics that is receiving increased interest is in the effort to deactivate and decommission (D&D) unnecessary and/or unusable facilities across the U.S. Department of Energy (DOE) complex. Many of these facilities pose hazards which prevent the use of traditional industrial demolition techniques. Such hazards include radiological, chemical, and hazardous materials contamination and structural instability. Efficient and safe D&D of the facilities will almost certainly require the use of remotely operated technologies to protect personnel and the environment during potentially hazardous D&D activities and operations. One database, developed by DOE, contains information on almost 500 existing robotic technologies and can be found on the D&D Knowledge Management Information Tool.

4. **Radioactive Contamination – Decontamination** with information about fixatives and other contamination control products.

   http://en.wikipedia.org/wiki/Radioactive_contamination

   The article was edited with the following additional text:

   Contamination control products have been used by the U.S. Department of Energy (DOE) and the commercial nuclear industry for decades to minimize contamination on radioactive equipment and surfaces and fix contamination in place. "Contamination control products" is a broad term that includes fixatives, strippable coatings, and decontamination gels. A fixative product functions as a permanent coating to stabilize residual loose/transferrable radioactive contamination by fixing it in place; this aids in preventing the spread of contamination and reduces the possibility of the contamination becoming airborne, reducing workforce exposure and facilitating future deactivation and decommissioning (D&D) activities. Strippable coating products are loosely adhered paint-like films and are used for their decontamination abilities. They are applied to surfaces with loose/transferrable radioactive contamination and then, once dried, are peeled off, which removes the loose/transferrable contamination along with the product. The residual radioactive contamination on the surface is significantly reduced once the strippable coating is removed. Modern strippable coatings show high decontamination efficiencies and can rival traditional mechanical and chemical decontamination methods. Decontamination gels work in much the same way as other strippable coatings. The results obtained through the use of contamination control products is variable and depends on the type of substrate, the selected contamination control product, the contaminants, and the environmental conditions (e.g., temperature, humidity, etc.).

5. **D&D KM-IT**

   https://en.wikipedia.org/wiki/D%26D_KM-IT

   The D&D KM-IT entry in Wikipedia was also reviewed and the most recent link to the D&D KM-IT Fact Sheet on the DOE website was updated under the External Links section.

CONCLUSIONS AND FUTURE WORK

It should be noted that by its very nature, Wikipedia is a work in progress. The information available on this web resource is continually evolving. As of the date of this report, the text added by FIU to Wikipedia on D&D related topics is available on the stated Wikipedia article pages. The text may be further edited by other Wikipedia participants at any time but the information recently added to D&D KM-IT currently remains intact. FIU will continue to look for opportunities in the future to add valuable content to Wikipedia, which will enrich the D&D community and D&D KM-IT's knowledge management resources.

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APPENDIX: BEFORE AND AFTER SCREENSHOTS

Nuclear Decommissioning – Cost Section

Before:

Cost

In USA many utility estimates now average $325 million per reactor all-up (1998 $).

In France, decommissioning of Brennilis Nuclear Power Plant, a fairly small 70 MW power plant, already cost €480 million (20x the estimate costs) and is still pending after 20 years. Despite the huge investments in securing the dismantlement, radioactive elements such as plutonium, caesium-137 and cobalt-60 leaked out into the surrounding lake.[120][121]

In the UK, decommissioning of the Windscale Advanced Gas Cooled Reactor (WAGR), a 32 MW prototype power plant, cost €117 million.

In Germany, decommissioning of Niederaichbach nuclear power plant, a 100 MW power plant, amounted to more than €143 million.

Decommissioning funds

In Europe there is considerable concern over the funds necessary to finance final decommissioning. In many countries either the funds do not appear sufficient to cover decommissioning and in other countries decommissioning funds are used for other activities, putting decommissioning at risk, and distorting competition with parties who do not have such funds available.[122]

In 2016 the European Commission assessed that Europena Union's nuclear decommissioning liabilities were seriously underfunded by about 118 billion euros, with only 150 billion euros of earmarked assets to cover 268 billion euros of expected decommissioning costs covering both dismantling of nuclear plants and storage of radioactive parts and waste. France had the largest shortfall with only 23 billion euros of earmarked assets to cover 74 billion euros of expected costs.[123]

Similar concerns exist in the United States, where the U.S. Nuclear Regulatory Commission has located apparent decommissioning funding assurance shortfalls and requested 18 power plants to address that issue.[124]

International collaboration

Organizations that promote the international sharing of information, knowledge, and experiences related to nuclear decommissioning include the International Atomic Energy Agency, the Organization for Economic Co-operation and Development's Nuclear Energy Agency and the European Atomic Energy Community.[10] In addition, an online system called the Deactivation and Decommissioning Knowledge Management Information Tool was developed under the United States Department of Energy and made available to the international community to support the exchange of ideas and information. The goals of international collaboration in nuclear decommissioning are to reduce decommissioning costs and improve worker safety.[10]

After:

impacts decommissioning – planned disposal and accidental release – will have on the environment, i.e. water, soil or airspace, of the EU Member States.[119] On the basis of these general data, the Commission must be in a position to assess the exposure of reference groups of the population in the nearest neighbouring states.

Cost [edit]

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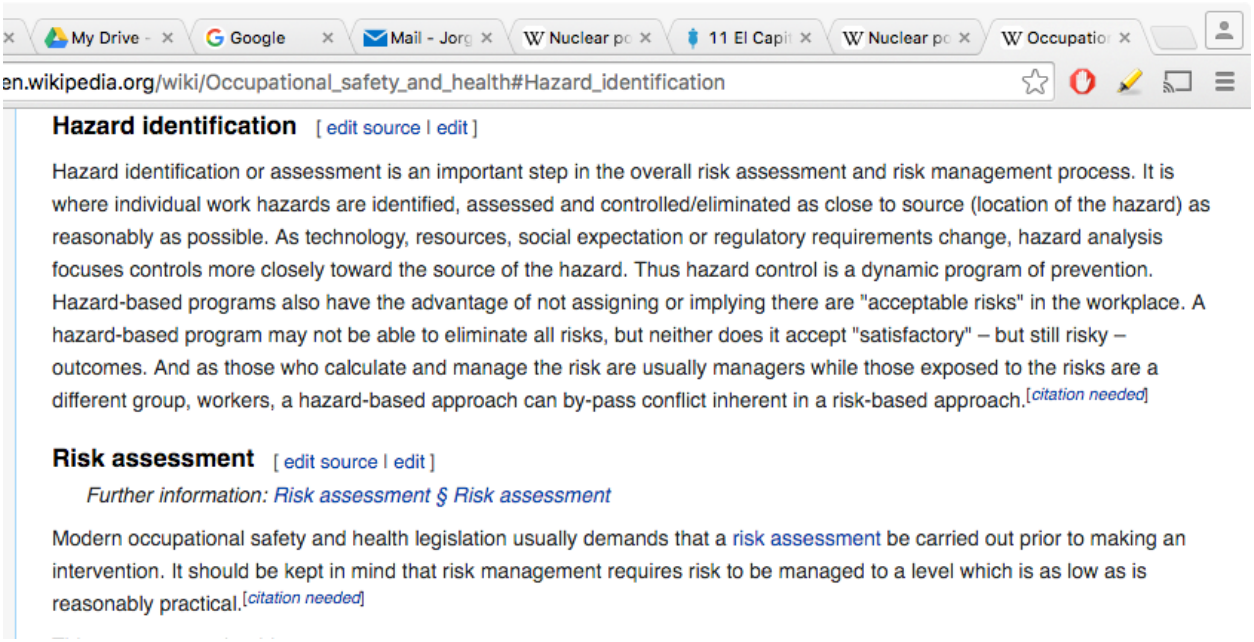
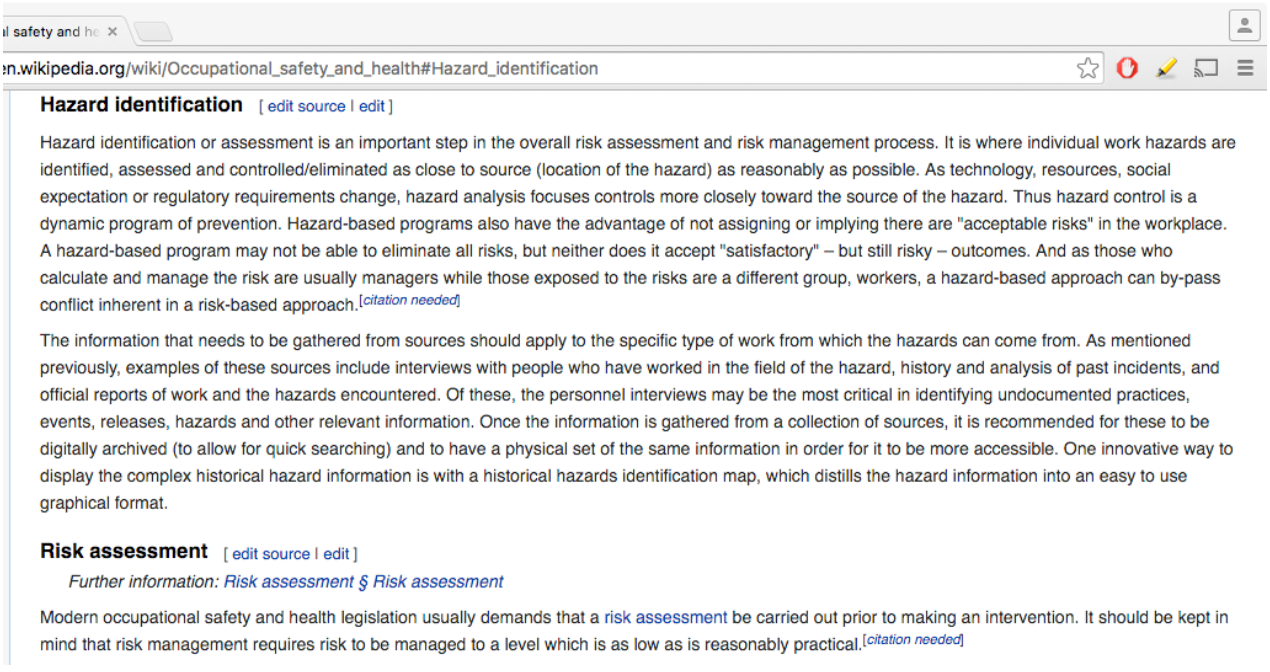
Occupational Safety and Health – Hazard Identification Section

Before:



After:



Robotics – Applications Section

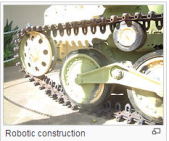
Before:

1948	Simple robots exhibiting biological behaviors[12]	Elsie and Elmer	William Grey Walter
1956	First commercial robot, from the Unimation company founded by George Devol and Joseph Engelberger, based on Devol's patents[13]	Unimate	George Devol
1961	First installed industrial robot.	Unimate	George Devol
1973	First industrial robot with six electromechanically driven axes[14][15]	Famulus	KUKA Robot Group
1974	The world's first microcomputer controlled electric industrial robot, IRB 6 from ASEA, was delivered to a small mechanical engineering company in southern Sweden. The design of this robot had been patented already 1972.	IRB 6	ABB Robot Group
1975	Programmable universal manipulation arm, a Unimation product	PUMA	Victor Scheinman

Robotic aspects

There are many types of robots; they are used in many different environments and for many different uses, although being very diverse in application and form they all share three basic similarities when it comes to their construction:

1. Robots all have some kind of mechanical construction, a frame, form or shape designed to achieve a particular task. For example, a robot designed to travel across heavy dirt or mud, might use caterpillar tracks. The mechanical aspect is mostly the creator's solution to completing the assigned task and dealing with the physics of the environment around it. Form follows function.
2. Robots have electrical components which power and control the machinery. For example, the robot with caterpillar tracks would need some kind of power to move the tracker treads. That power comes in the form of electricity, which will have to travel through a wire and originate from a battery, a basic electrical circuit. Even petrol powered machines that get their power mainly from petrol still require an electric current to start the combustion process which is why most petrol powered machines like cars, have batteries. The electrical aspect of robots is used for movement (through motors), sensing (where electrical signals are used to measure things like heat, sound, position, and energy status) and operation (robots need some level of electrical energy supplied to their motors and sensors in order to activate and perform basic operations)
3. All robots contain some level of computer programming code. A program is how a robot decides when or how to do something. In the caterpillar track example, a robot that needs to move across a muddy road may have the correct mechanical construction, and receive the correct amount of power from its battery, but would not go anywhere without a program telling it to move. Programs are the core essence of a robot, it could have excellent mechanical and electrical construction, but if its program is poorly constructed its performance will be very poor or it may not perform at all. There are three different types of robotic programs: remote control, artificial intelligence and hybrid. A robot with remote control programing has a preexisting set of commands that it will only perform if and when it receives a signal from a control source, typically a human being with a remote control. It is perhaps more appropriate to view devices controlled primarily by human commands as falling in the discipline of automation rather than robotics. Robots that use artificial intelligence interact with their environment on their own without a control source, and can determine reactions to objects and problems they encounter using their preexisting programming. Hybrid is a form of programming that incorporates both AI and RC functions.


Robotic construction


Electrical aspect


A level of programming

Components

Power source

Further information: Power supply and Energy storage

At present mostly (lead-acid) batteries are used as a power source. Many different types of batteries can be used as a power source for robots. They range from lead acid batteries which are safe and have relatively long shelf lives but are rather heavy compared to silver cadmium batteries that are much smaller in volume and are currently much more expensive. Designing a battery powered robot needs to take into account factors such as safety, cycle lifetime and weight. Generators, often some type of internal combustion engine, can also be used. However, such designs are often mechanically complex and need fuel, require heat dissipation and are relatively heavy. A tether connecting the robot to a power supply would remove the power supply from the robot entirely. This has the advantage of saving weight and space by moving all power generation and storage components elsewhere. However, this design does come with the drawback of constantly having a cable connected to the robot, which can be difficult to manage (you meant NO mobility?).[16] Potential power sources could be:

- pneumatic (compressed gases)
- Solar power (using the sun's energy and converting it into electrical power)
- hydraulics (liquids)
- flywheel energy storage
- organic garbage (through anaerobic digestion)

After:

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A level of programming

Applications [edit]

As more and more robots are designed for specific tasks this method of classification becomes more relevant. For example, many robots are designed for assembly work, which may not be readily adaptable for other applications. They are termed as 'assembly robots'. For seam welding, some suppliers provide complete welding systems with the robot i.e. the welding equipment along with other material handling facilities like turntables etc. as an integrated unit. Such an integrated robotic system is called a 'welding robot' even though its discrete manipulator unit could be adapted to a variety of tasks. Some robots are specifically designed for heavy load manipulation, and are labelled as 'heavy duty robots.'

- Combat, robot – hobby or sport event where two or more robots fight in an arena to disable each other. This has developed from a hobby in the 1990s to several TV series worldwide.

Another application area for robotics that is receiving increased interest is in the effort to deactivate and decommission (D&D) unnecessary and/or unusable facilities across the U.S. Department of Energy (DOE) complex. Many of these facilities pose hazards which prevent the use of traditional industrial demolition techniques. Such hazards include radiological, chemical, and hazardous materials contamination and structural instability. Efficient and safe D&D of the facilities will almost certainly require the use of remotely operated technologies to protect personnel and the environment during potentially hazardous D&D activities and operations. One database, developed by DOE, contains information on almost 500 existing robotic technologies and can be found on the D&D Knowledge Management Information Tool.

Components [edit]

Power source [edit]

Further information: Power supply and Energy storage

At present mostly (lead-acid) batteries are used as a power source. Many different types of batteries can be used as a power source for robots. They range from lead

Radioactive Contamination – Decontamination

Before:

Decontamination

Cleaning up contamination results in radioactive waste unless the radioactive material can be returned to commercial use by reprocessing. In some cases of large areas of contamination, the contamination may be mitigated by burying and covering the contaminated substances with concrete, soil, or rock to prevent further spread of the contamination to the environment. If a person's body is contaminated by ingestion or by injury and standard cleaning cannot reduce the contamination further, then the person may be permanently contaminated.[*citation needed*]

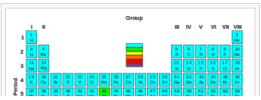
Some of the largest areas committed to be decontaminated are in the Fukushima Prefecture, Japan. The national government is under pressure to clean up radioactivity due to the Fukushima nuclear accident of March 2011 from as much land as possible so that some of the 110,000 displaced people can return. Stripping out the key radioisotope threatening health (caesium-137) from low level waste could also dramatically decrease the volume of waste requiring special disposal. A goal is to find techniques that might be able to strip out 80 to 95% of the caesium from contaminated soil and other materials, efficiently and without destroying the organic content in the soil. One being investigated is termed hydrothermal blasting. The caesium is broken away from soil particles and then precipitated with ferric ferricyanide (Prussian blue). It would be the only component of the waste requiring special burial sites. [9] The aim is to get annual exposure from the contaminated environment down to one millisievert (mSv) above background. The most contaminated area where radiation doses are greater than 50 mSv/year must remain off limits, but some areas that are currently less than 5 mSv/year may be decontaminated allowing 22,000 residents to return.

To help with protection of people living in geographical areas which have been radioactively contaminated the International Commission on Radiological Protection has published a guide: "Publication 111 - Application of the Commission's Recommendations to the Protection of People Living in Long-term Contaminated Areas after a Nuclear Accident or a Radiation Emergency". [10]

Contamination hazards

Low-level contamination

The hazards to people and the environment from radioactive contamination depend on the nature of the radioactive contaminant, the level of contamination, and the extent of the spread of contamination. Low levels of radioactive contamination



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Decontamination [edit]

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SUPPLEMENTAL ATTACHMENT

Contributing to D&D Knowledge Base on Wikipedia

FIU is targeting a minimum 4 edits to existing Wikipedia articles or creation of new articles. The following information will be captured as shown in Table 5:

- Title of edited/new Wikipedia article and direct link to the article
- Date article was edited/created
- Summary of information added
- Location on D&D KM-IT where information was sourced
- Number of visitors to D&D KM-IT from Wikipedia

An example screenshot of one of the Wikipedia entries to which additional information available on D&D KM-IT was provided during FIU's last period of performance is shown in Figure 9.

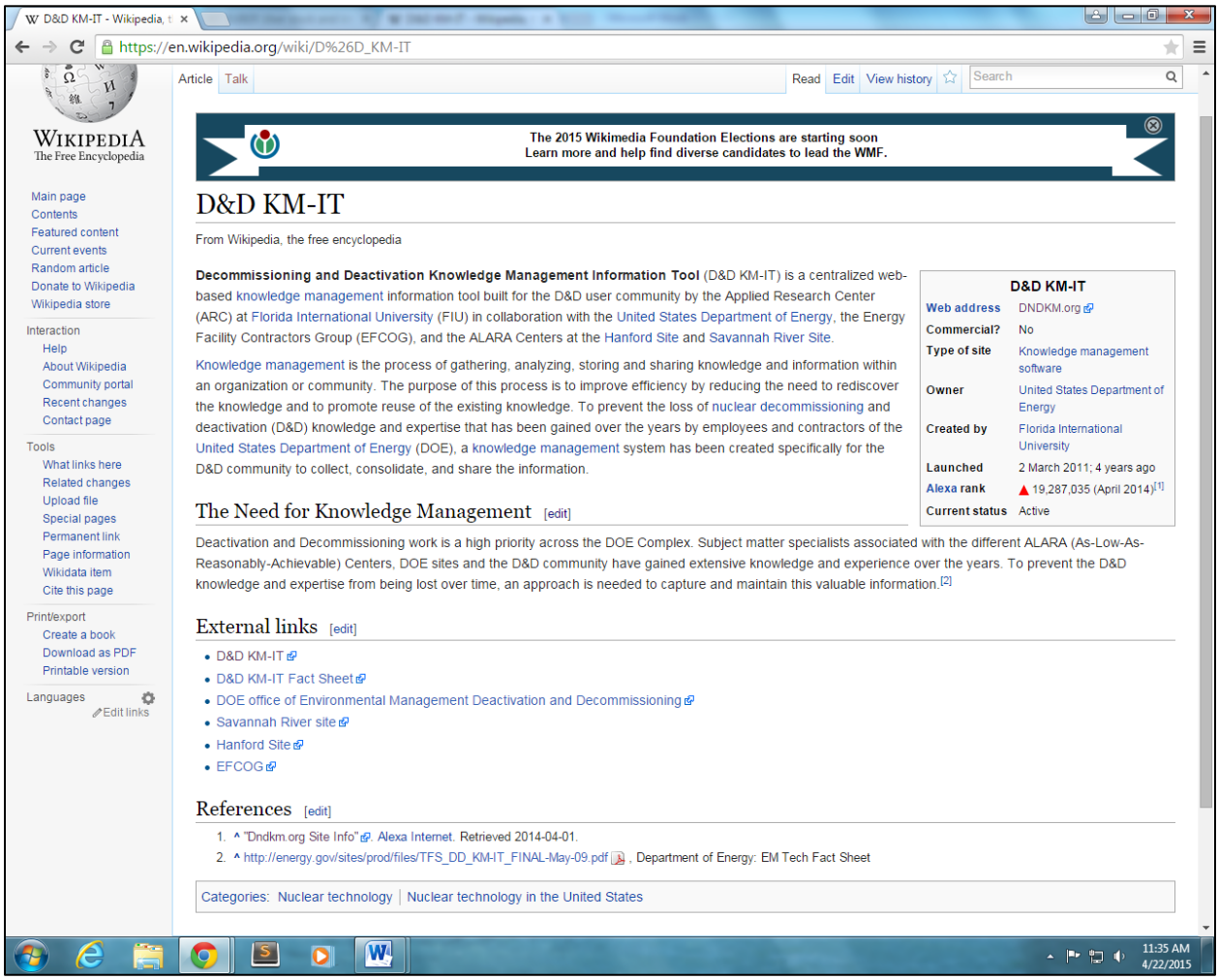

Figure 9. Screenshot of one Wikipedia entry that was edited.

Table 5. D&D KM-IT Outreach and Training Metrics – Contributions to D&D Knowledge via Wikipedia

Title of Article	Date	Information Added	Location on D&D KM-IT	Number of visitors from Wikipedia
D&D KM-IT	April 22, 2015	Article text updated and links to D&D KM-IT Factsheet updated to newest one on DOE EM website.	Homepage	2
Nuclear Power in the United States	May 8, 2015	Plant Decommissioning section: information on *in situ* decommissioning performed at SRS	Best Practice: SRS P and R Reactor Disassembly Basin *In Situ* Decommissioning	12*
Occupational Hygiene	May 8, 2015	Basic Characterization, Hazard Identification and-Walk Through section: information on personnel interviews and development of historical hazards identification maps	Best Practice: Historical Hazard Identification Process for D&D	2*
Asbestos Abatement	May 8, 2015	Removal Procedures section: information on innovative method of asbestos removal (remote controlled track mounted wet cutting saw) was used at LLNL.	Best Practice: Open Air Demolition of Asbestos Gunite by Using Track Mounted Wet Cutting Saw	5*

* Between May 8 and December 31, 2015.

Table 6 captures the total number of sessions and new users that come to D&D KM-IT from Wikipedia and the Wiki.energy.gov websites.

Table 6. D&D KM-IT Outreach and Training Metrics – Sessions and Users from Wikipedia and Wiki.Energy.Gov

Source	Sessions*	New Users*
En.wikipedia.org	100	94
En.m.wikipedia.org	16	14
Wiki.energy.gov	8	0

* Between May 8 and December 31, 2015.

(Source: Progress Report – Metrics Progress for D&D KM-IT Outreach & Training- submitted February 29, 2016)