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HEPA Filter Disposal Write-Up 10/19/16

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Disclaimer

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LLNL Process Knowledge Collection

Process knowledge (PK) collection on HEPA filters, is handled via the same process as other waste streams at LLNL. The Field technician or Characterization point of contact creates an information gathering document (IGD) in the IGD database, with input provided from the generator, and submits it for electronic approval. This document is essentially a waste generation profile, detailing the physical, chemical as well as radiological characteristics, and hazards, of a waste stream. It will typically contain a general, but sometimes detailed, description of the work processes which generated the waste. It will contain PK as well as radiological, and industrial hygiene analytical swipe results, and any other analytical or other supporting knowledge related to characterization. The IGD goes through an electronic approval process to formalize the characterization and to ensure the waste has an appropriate disposal path. The waste generator is responsible for providing initial process knowledge information, and approves the IGD before it routed to chemical and radiological waste characterization professionals. This is the standard characterization process for LLNL generated HEPA Filters.

LLNL Characterization

A graded approach is used to characterize a HEPA filter or population of HEPA filters from the same source. PK is used in conjunction with sampling and analysis, to arrive at a final HEPA filter characterization. PK is initially reviewed to determine critical characterization parameters, whether sampling is to be done, and, if so, what type of sampling should occur. It is also used to generate a list of radionuclides which could be present on a HEPA filter from a particular location and activity. Conservative estimates of the activity in the HEPA filter are made when relying primarily on PK. From a hazardous waste standpoint, PK is reviewed to determine the likelihood that the HEPA filters contacted hazardous materials, and whether they have the potential to be considered a federal or state regulated hazardous waste.

In most cases, screening sampling is performed on each unique population of HEPA filters, in the form of tab swipe samples. This consists of inlet swipes for total alpha, beta and tritium (LSC), and in many cases industrial hygiene (IH) metals or SW-846 method 6010 total metals. IH metals consist of those metals considered by the LLNL Health & Safety Group to pose particular health threats to workers involved in handling or sampling activities. Beryllium, is an example of one of the IH metals sampled to determine the safety protocol for further sampling or handling. In addition to radiological and IH metals swipes, where PK suggests that hazardous metals could be present, inlet swipes are taken for total metals. The swipes are typically taken directly from the face of the first HEPA filter in line. The number of samples are determined by the total population of HEPA filters to be disposed of as well as the configuration of the filter array and number of filters in each bank. Barring any anticipated dose risks, swipes will be duplicated across banks to provide an adequate representation for the population of HEPA's in a system.

Where PK indicates that gamma emitting radionuclides could be present, field gamma spectroscopy is applied.

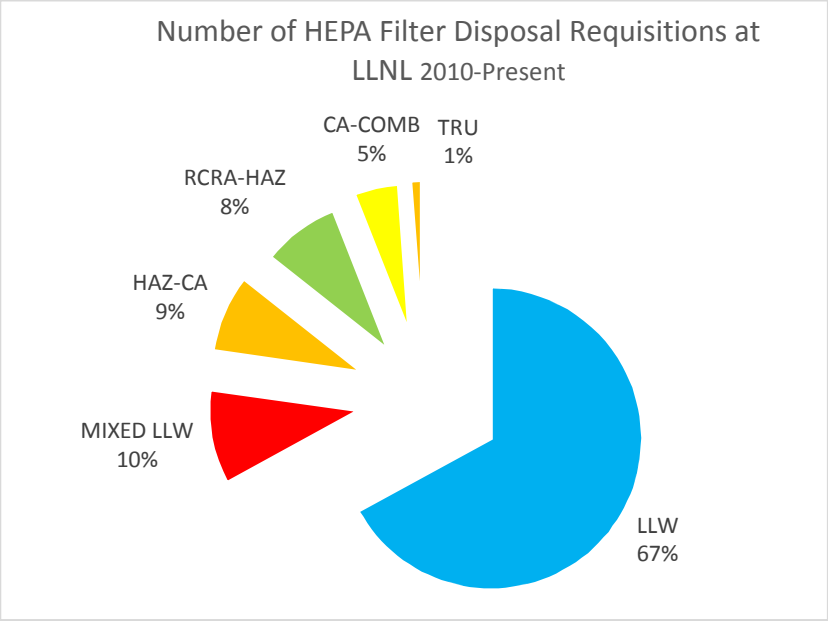
When inlet swipe data, gamma spectroscopy, along with PK, do not provide clear enough information, destructive sampling and analysis will be performed. This sampling consists of cutting some of the filter media out of the inlet side of the HEPA filter. This type of sampling may be performed for radiological as well as hazardous characterization. The final and most intrusive level of sampling on HEPA filters at LLNL, is core sampling. There are provisions for taking core samples of HEPA filters at LLNL, however, due to the health and safety risks associated with this method, problems with representative sampling and analysis, as well as the adequacy of conservative estimation, core sampling is rarely a method used for sampling of HEPA filter media at LLNL.

An effort was made in the mid 1990's, at LLNL, to correlate core sampling of HEPA filters with inlet swipe data. Scores of HEPA filter core samples were taken at the same time swipes were pulled from the inlets of the same filters. The results were widely varied and no correlations were able to be drawn from this activity.

Field gamma spectroscopy, in conjunction with the inlet swipes and PK is the primary method for radiological characterization of HEPA filters at LLNL. Hazardous determinations are primarily made using a conservative PK approach. In many cases, if the PK indicates that processes involving hazardous materials were performed upstream of the HEPA filters, or RCRA metals are detected on inlet swipes, a RCRA hazardous characterization will be applied to the filter.

LLNL Characterization Results

LLNL's waste tracking database was reviewed from 1/1/2010 to present. Over that time period, one hundred and sixty-seven waste requisitions were generated on HEPA filters identified for disposal. A requisition could represent a single HEPA filter or an entire population of HEPA filters from a buildings exhaust filter bank, so generally, a requisition is representative of a waste stream from a specific area of activity rather than a tally of individual HEPA filters. The following chart is a breakdown of the waste types which HEPA filters were categorized into over that time period. Note that HAZ-CA is waste characterized as hazardous by California waste regulations but does not meet the federal definition of hazardous. CA-COMB is the California only version of Mixed-LLW, and generally includes metals such as nickel, that are not within the Federal toxicity characteristic (i.e., D004-D011 metals). Of the 167 HEPA waste stream requisitions, 147 of those have been characterized, certified for disposal, and shipped to the disposal site. The chart below depicts all of the HEPA filter waste disposal requisitions which were characterized over the identified time period. The majority of the HEPA filter requisitions were characterized as low level waste.

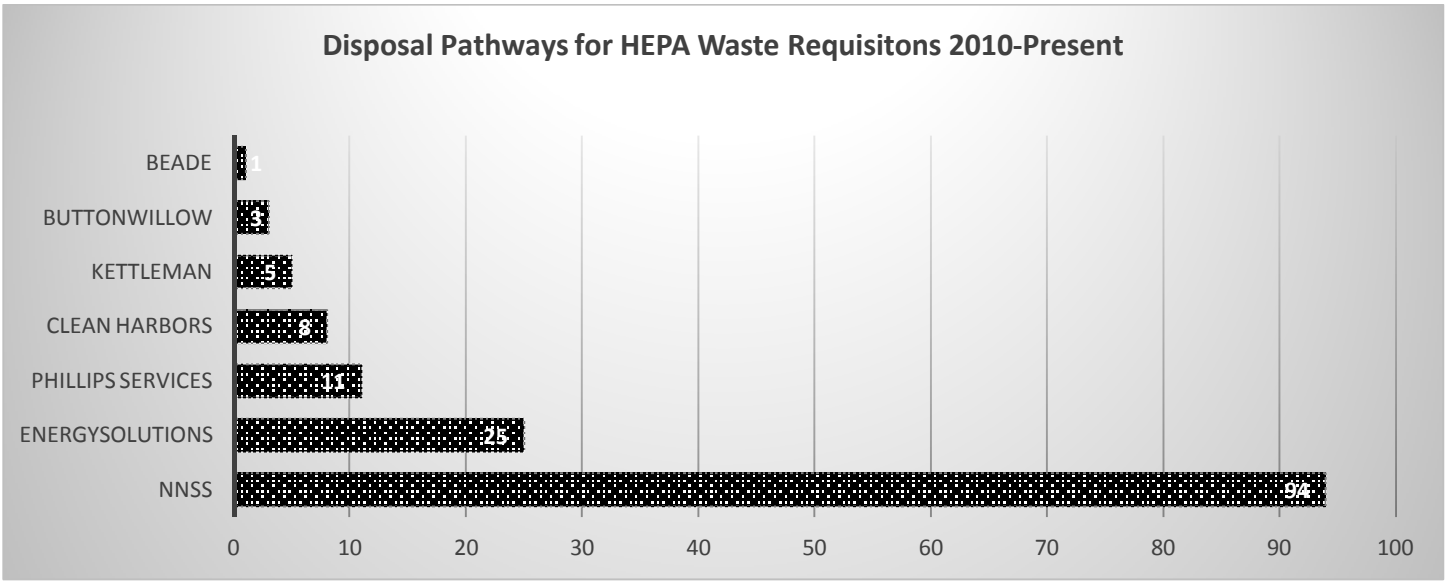


Dose rate data on the majority of HEPA filters characterized and disposed of during this time frame was not readily accessible.

LLNL WASTE PACKAGING AND DISPOSITION PATHWAYS

As there are many sizes and varieties of HEPA filters onsite the packaging will depend on those specifications as well as the radionuclides and the activity it contains. Smaller HEPA filters such as those taken off fume hoods, some glove boxes or small, portable HEPA systems are typically disposed of in drums. Often these types of spent HEPA filters are generated as a result of a specific activity or project and will be disposed of as part of the debris waste stream which is characterized from that activity. Larger HEPA filters such as those found in facility exhaust systems (e.g., 24"x24"x11 ½"metal or wood frame filters) are typically double bagged and packaged into 96ft^3 or 112ft^3, Type 1A boxes for disposal.

The chart below identifies the final disposition pathway for HEPA filters which have been shipped for disposal from LLNL since 2010.



LLNL PROBLEMS AND SUCCESS STORIES

The B695 Shredder Incident, stands as an infamous incident in the waste management history of LLNL, and is an important reminder of the importance of good characterization practices for the disposition of waste HEPA filters. From April through July of 1997, Hazardous Waste Management (HWM) personnel were performing shredding operations, using an hydraulic industrial shredder, of debris generated from the cleanup of B-251, the Heavy Element Facility, which was no longer in operation.

Several specific waste streams within this campaign consisted of HEPA filters which were to be shredded for size reduction as well as to facilitate sampling of the filter media. Upon exit from a buffer area, one of the technicians performing the operation, set off a hand and foot counter. Subsequent personnel surveys indicated that all five workers had various levels of contamination on their PPE and the external surface of their respirator cartridges and several of the employees received internal contamination. Following comprehensive bioassay monitoring of all the involved employees, it was initially estimated that that the most effected employee received between 15 and 30 rem of committed effective dose equivalent (CEDE). While the ensuing Type B accident investigation identified a number of contributing causes, mischaracterization and a failure to perform verification of original characterization information were two of the most significant factors. The waste HEPA filters had originally been characterized as building and room HEPA filters containing <1 μCi of Am-241. They were ultimately found to be HEPA filters removed from gloveboxes which were estimated to contain well in excess of 100 mCi of Cm-244. The failure to perform verification of the PK was partly attributed to the fact that this was an ongoing campaign, and HEPA filters from the same building which had previously been shredded, were found to be in line with the characterization information provided. In addition, part of the purpose for the HEPA shredding was in order to facilitate sampling of the filter media, which is typically difficult to obtain otherwise. This brief synopsis of this incident highlights the importance of obtaining good, accurate PK for spent HEPA filters, and following that up with some form of verification sampling and/or surveying.

In contrast to the example listed above, the recent successful characterization and disposal of the “AVLIS” HEPA filters is an example of sound characterization, followed by good verification, which led to the successful, safe disposal of HEPA filters in 2015. In 2013, the Radioactive and Hazardous Waste Management (RHWM) division was chartered with cleaning up a corporate boneyard identified as the IMF WAA (Institutionally Managed Facilities Waste Accumulation Area). One of the largest components in this boneyard consisted of the HEPA filters and housings removed from a building which housed the Atomic Vapor Laser Isotope Separation (AVLIS) project. These filters were removed from building 490, and moved to the IMF WAA, where they were being stored.

Based on good PK regarding the activities in the AVLIS project, the plenum containing the filters was characterized as radioactive low level waste. To verify this and to gain a better idea of the activity contained in the filters, a sampling plan was executed to take a series of radiological swipes from the plenum inlets and interior surfaces, the HEPA filter framing, as well as the front surface of the HEPA filter media. Hazardous constituents were not suspected to be associated with this project, but RCRA metals swipes were taken upstream of the plenum inlet ducts to verify this.

Field gamma spectroscopy of the HEPA filters themselves was also performed. Based on PK, the only radionuclide present in the filters was depU. The final activity of the filters was estimated by adding the activity from the swipe results to the activity from direct reading instruments and then applying a conservative safety factor. It was determined that the HEPA plenum with filters met SCO-1 requirements and this equipment was successfully certified for disposal and shipped to Nevada Test Site (NNSS) in August, 2015.

REFERENCES

Reference 1, DOE/OAK-504, Rev. 0

Reference 2, Radioactive and Hazardous Waste Management Procedure, WIC 110, Sampling Solid Waste, Revision 6