MIXED WASTE CHARACTERIZATION AND PROCESSING

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ABSTRACT

Waste that is both radioactive and hazardous is regulated by both the NRC and the EPA. Since there are few treatment, storage, or disposal facilities licensed by both these agencies, mixed waste generated at Duke Power Company facilities is stored at the generation site. Processing methods for eliminating this inventory of stored mixed waste are being developed using the limited options available to facilities not possessing a hazardous waste treatment permit. In order to ensure that the above storage and processing is in compliance with EPA requirements, periodic characterization of these mixed wastes is necessary. This paper describes Duke Power Company's mixed waste characterization and processing programs and outlines the results achieved to date.

INTRODUCTION

Mixed waste is low-level radioactive waste (LLW), as defined in the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA), that also contains constituents that are either a listed hazardous waste or exhibit hazardous characteristics as described in Environmental Protection Agency (EPA) regulation 40CFR Part 261. Prior to 1985, mixed waste was generally disposed of just like LLW with the Nuclear Regulatory Commission having regulatory authority. However, during formulation of the LLRWPAA, questions arose as to which agency, the EPA or the NRC, should have regulatory authority over mixed waste. Congress directed these two agencies to administratively resolve the problem. As a result, the NRC and the EPA issued a joint guidance document that stated the NRC had jurisdiction over the radionuclide portion of the mixed waste while the EPA had authority over the hazardous constituents. With the issuance of the NRC-EPA joint guidance document, a mixed waste treatment, storage, and disposal facility (TSDF) was required to conform to both NRC and EPA regulations. EPA regulations require that a mixed waste TSDF obtain an EPA permit and that they characterize their mixed waste to ensure that it can be treated, stored, or disposed of in compliance with the storage permit and EPA regulations. Due to the projected high costs associated with TSDF permits, Duke Power Company has implemented mixed waste characterization and processing programs whose goal is to eliminate any need to maintain these permits by eliminating mixed waste inventories.

The general strategy of the mixed waste processing program is to reduce the concentration of listed hazardous constituents in a mixed waste prior to submitting a delisting petition and to eliminate the hazardous characteristics of a mixed waste (ignitability, toxicity, reactivity, or corrosivity). Testing has begun on the limited processing options available to facilities not possessing an EPA treatment permit. Since these options are not fully developed, Duke Power has obtained hazardous waste storage permits and continues to accumulate mixed wastes at its generation sites.

The characterization program ensures that the storage of mixed waste is done in compliance with the respective facility's storage permit and EPA regulations. In addition, this program provides information necessary to the proper development of the company's mixed waste processing programs.

DISCUSSION

Characterization Program

The mixed waste characterization program began with the formation of mixed waste working groups at the Catawba, McGuire, and Oconee Nuclear Stations. These three sites produce all the mixed wastes generated by Duke Power Company. Each working group was comprised of chemistry, radiation protection, and environmental personnel from the stations and the corporate office. The mixed waste working groups were assigned the responsibility for identifying all mixed waste generated at their respective facility and for implementing a characterization program that fulfilled the requirements of 40CFR Part 265.

Each working group's initial action was to identify all LLW generated at their station. Next, each LLW stream was placed into one of the following general classifications:

- LLW known to be mixed waste because it contains or has contacted a listed hazardous solvent
- LLW which could be mixed waste because it has the potential to exhibit hazardous characteristics
- LLW which is not and should never become mixed waste because there is not a reasonable potential that it will become hazardous

Waste Analysis Plan (WAP) was then developed which outlined the procedures necessary to ensure that each known or potential mixed waste was characterized as per-

the requirements of 40CFR Part 265. This WAP provides the following information for each of these waste streams:

- the parameters for which the waste will be analyzed
- the rationale for the selection of these parameters
- the sampling methods which will be used to ensure a representative sample of the waste is collected
- the test methods which will be used to analyze for the selected parameters
- the frequency with which the analysis of the waste will be repeated
- the test acceptance criteria

After development of the WAP, the known or potential mixed wastes were characterized. The initial characterization results for these known or potential mixed waste streams are shown in Table I and II respectively. Table III lists the LLW which is not and should never become mixed waste. After completion of the above initial characterizations, process development began for the LLW determined to be mixed waste. These processes are described in the Processing Program section of this paper. Periodic analysis continues on the LLW listed in Tables I and II at the frequency specified in the WAP.

Processing Program

The initial characterization of LLW generated at Duke Power facilities identified the mixed waste currently being generated at Duke Power facilities. Next, development began on methods to process this mixed waste using the limited techniques available to facilities not possessing an EPA treatment permit. The goal of this process program is

TABLE I

Initial Characterization Results for LLW Known to be Mixed Waste Because They Contain or Have Contacted a Listed Hazardous Solvent

Waste Stream	Parameter (See Note 1)	Result
dry cleaner filters, paper portion	freon	200 - 2200 ppm
	ignitability	non-ignitable
	toxicity	toxic, up to 2.0 ppm Cd and 16.0 ppm Pb
dry cleaner filters, carbon portion	freon	120 - 350,000 ppm
	ignitability	non-ignitable
	toxicity	non-toxic
dry cleaner bottoms	freon	58,000 - 330,000 ppm
	ignitability	non-ignitable
	toxicity	toxic, up to 5.9 ppm Pb
scintillation cocktail	See Note 2	
acetone based cleaning solutions	See Note 2	
waste oil/solvent mixtures	See Note 2	
tool decon unit filters	See Note 3	
tool decon unit bottoms	See Note 3	

Notes: 1) Waste streams were analyzed for both the concentration of the applicable listed constituent and the parameters which caused that constituent to be listed.

2) Note that analysis of most of the Table I wastes was not necessary since their characteristics were already known. Analysis was performed only on the freon related wastes because a knowledge of the actualconcentration of the listed constituent in these wastes was important for process development. In addition, there was sufficient doubt as to whether the freon waste actually exhibited the characteristics that caused its hazardous constituent to be EPA listed.

3) Tool decon unit freon waste analysis has yet to be performed.

TABLE II
Initial characterization results for LLW which could be mixed characteristics

Waste Stream	Potential Characteristics	Result
paint solids	ignitability	non-ignitable
chromate analysis waste	toxicity	toxic, up to 240 ppm Cr
reactor coolant pump decon solution	toxicity	toxic, up to 3560 ppm Cr
sludge lance filters/sludge	toxicity	non-toxic
chloride analysis waste	toxicity	toxic, up to 780 ppm Hg
liquid radwaste filter (laundry system)	toxicity	non-toxic
liquid radwaste filter (floor drain system)	toxicity	non-toxic
laundry liquids	toxicity	non-toxic
	corrosivity	non-corrosive PH = 7.2
floor drain liquids	toxicity	non-toxic
	corrosivity	non-corrosive PH = 6.9
wet blast decon unit grit/filters	toxicity	toxic, up to 28 ppm Cd and 30 ppm Pb
lead batteries/ shielding	See Note 1	

Notes: 1) Lead batteries and shielding are decontaminated. Consequently, no analysis has been performed on this waste.

to eliminate the need to maintain any EPA related storage permits by eliminating mixed waste inventories.

Two general strategies are being employed to achieve this goal:

Strategy #1 - involves the submittal of delisting petitions for mixed waste streams that contain or have contacted a listed hazardous solvent. Prior to petition submittal, the concentration of the hazardous solvent in the mixed waste will be reduced as low as possible.

Strategy #2 - is applicable to a mixed waste that exhibits a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity). These wastes will be treated in-container to eliminate their hazardous characteristics.

Table IV lists the mixed wastes that are currently being generated at Duke Power facilities, as identified by the characterization program. In addition, their hazardous properties and the general processing strategies to be applied to these mixed wastes are provided.

Application of Strategy #1 to the applicable wastes required an investigation into effective methods for reducing the listed solvent concentrations of these wastes. At this time, no testing has been performed on methods for reduc-

TABLE III
LLW Which is Not and Should Never Become Mixed
Waste Because There Is Not a Reasonable Potential That It Will Become Hazardous

primary system filters/resins
process equipment
tools
unused non-solvent commercial products
HVAC filters/carbon
dry cell batteries
oil/greases
empty scintillation vials *
empty solvent containers *
absorbents containing solvents **
equipment and sump sludges

* Per EPA regulations, empty solvent containers are not subject to regulation as a hazardous waste.

** At the time of the working group's initial classification, non-soaked absorbents were classified as non-hazardous. However, because of a recently issued EPA regulation, solvent containing absorbents are now classified as hazardous. The characterization of these absorbents has yet to be performed.

ing the listed solvent concentration of the waste oil/solvent mixtures. For the freon related wastes, two methods have been tested - distillation and drying using the heat cycle of the dry cleaners. Neither of these two methods of reclaiming freon require a hazardous waste treatment permit. Strategy #2 is being employed to eliminate the hazardous characteristics associated with any of the identified mixed wastes. Generally, these wastes are being solidified with a gypsum based solidification agent. Again, a treatment permit is not required as long as the solidifications are performed in the original waste container within 90 days of the waste generation date.

At this time, the only full scale application of the above process strategies has been on the scintillation cocktail and the reactor coolant pump decon solution. Full scale processing of the remaining mixed wastes was delayed pending the results of bench scale processing of these wastes. The mixed waste processing results achieved thus far are shown in Table V. Testing is in progress for the identified mixed waste streams for which no results are shown.

SUMMARY AND CONCLUSION

The Duke Power characterization program has identified all mixed waste currently being generated at Duke Power facilities. This program provides for the periodic characterization of these wastes and ensures that they continue to be stored and processed in accordance with the requirements of 40CFR Part 265.

The Duke Power processing program has eliminated two of the identified mixed wastes from the companies hazardous waste storage permits - scintillation cocktail and reactor coolant pump decon solution. The processing of the remaining mixed waste is in progress and the preliminary results are satisfactory. Based upon these results, there is a reasonable possibility that all Duke Power mixed waste inventories and hazardous waste storage permits can be eliminated.

REFERENCES

1. Low Level Radioactive Waste Policy Amendments Act,January 1986.
2. Resource Conservation and Recovery Act of 1976, October 1976.
3. Environmental Protection Agency and U.S. Nuclear Regulatory Commission, " Guidance on the Definition and Identification of Commercial Mixed Low-Level Radioactive and Hazardous Waste and Answers to Anticipated Questions", January 8, 1987.
4. Code of Federal Regulations, Title 40, Parts 260 thru 262, and Parts 264 thru 270.
5. Environmental Protection Agency, "Treatment of Hazardous Waste Without a Permit", Federal Register, Vol.51, No. 56, pg 10168, March 24, 1986.

TABLE IV
General Process Strategy For Mixed Waste Streams
Currently Being Generated at Duke Power Facilities

Mixed Waste Stream	Hazardous Properties	Strategy
dry cleaner filters, paper portion	listed waste (freon), toxic (Cd,Pb)	#1 and #2 See Note 1
dry cleaner filters, carbon portion	listed waste (freon)	#1
dry cleaner bottoms	listed waste (freon), toxic (Pb)	#1 and #2
scintillation cocktail	ignitable, See Note 2	#2, See Note 3
acetone based cleaning solutions	listed waste (acetone)	#2, See Note 4
waste oil/solvent mixtures	listed waste (solvents)	#1, See Note 5
tool decon unit filters	listed waste (freon), See Note 6	#1
tool decon unit bottoms	listed waste (freon), See Note 6	#1
chromate analysis waste	toxic (Cr)	#2
reactor coolant pump solution	toxic (Cr)	#2
chloride analysis waste	toxic (Hg)	#2
wet blast decon unit grit/filters	toxic (Cd)	#2

Notes: 1) Strategy #1 - reduce concentration of the listed hazardous constituent and then submit a delisting petition.

Strategy #2 - render non-hazardous by eliminating hazardouscharacteristics.

2) The initial characterization of LLW classified scintillation cocktail as a listed mixed waste since it contains a listed hazardous solvent. However, based upon an EPA regulation, the cocktail is classified only as characteristic mixed waste (ignitability) since it is not used in a solvent application.

3) Cocktail waste containing no gamma-emitting radioactive isotopes was sent to an off site facility for disposal. The remaining cocktail waste was processed using Strategy #2.

4) The acetone based cleaning solution is a listed hazardous waste only because it is ignitable. Based upon an EPA regulation, wastes containing a solvent which is listed solely due to ignitability need only be rendered non-ignitable within 90 days of generation to be declared non-hazardous. Neither removal of the listed solvent from the waste nor a delisting petition is required.

5) An alternative option being pursued for mixed waste comprised of oil and listed hazardous solvents is approval from the applicable regulatory agencies for a one time burn of current inventories. Afterwards,, an oil and solvent segregation program should prevent the generation of additional amounts of this mixed waste.

6) The tool decon unit waste characterization has not been completed.

TABLE V
Current Duke Power Mixed Waste Processing Results

Mixed Waste	Process Description	Pre-processed Properties	Post-processed Properties
dry cleaner filters, paper	dried 4 hours @ 120 degrees F, then solidified	2200 ppm freon, 2 ppm Cd and 16 ppm Pb	1200 ppm, freon, < 0.2 Cd and < 0.3 Pb, See Notes 1 thru 5
dry cleaner filters carbon	dried 8 hours @ 120 degrees F	350,000 ppm freon	18,000 ppm freon, See Note 4
dry cleaner bottoms	distilled, then solidified	330,000 ppm freon, 5.9 ppm Pb	110 ppm freon, < 0.3 Pb, See Notes 2,4,5
scintillation cocktail	solidified	ignitable	non-ignitable, See Notes 4 and 5
chromate analysis waste	solidified	240 ppm Cr	1.01 ppm Cr, See Notes 2, 4, and 5
rx coolant pump decon solution	solidified	3560 ppm Cr	4.97 ppm Cr, See notes 2,4, and 5
chloride analysis waste	solidified	780 ppm Hg	0.023 ppm Hg, See Notes 2,4, and 5
wet blast grit/filters	solidified	2.3 ppm Cd, See Note 4	0.23 ppm Cd, See Notes 2,4, 5, and 6

Notes: 1) Freon analysis of dried or distilled dry cleaner wastes was performed prior to any solidification of these wastes.

2) All post-processed toxic metal results are below the allowed maximum. Consequently, these processed wastes are non-toxic.

3) No significant additional reduction was achieved in the dry cleaner filter paper freon concentration by drying the paper longer than 4 hours.

4) The scintillation cocktail and the coolant pump decon solution results were obtained from full scale processing. All other post-processed results were obtained from bench scale process testing.

5) The solidification of the reactor coolant pump decon solution wasdone using cement. All other waste solidifications were performed using a gypsum based solidification agent.

6) This wet blast filters/grit processing was performed on a waste batch that contained only 2.3 ppm Cd. The processing of batches containing Pb and higher levels of Cd is in progress.