INCINERATION OF VERY LOW RADIOACTIVITY OIL/SOLVENT MIXTURES AT AN OFF-SITE FOSSIL STATION

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ABSTRACT

In the fall of 1990, Duke Power received permission and burned approximately 17,000 gallons of a waste oil/solvent/water mixture which contained very low levels of radioactivity from its Oconee Nuclear Station at a nearby fossil station. Historically, Oconee had been burning this mixture in an on-site auxiliary boiler. Due to this practice, minimum segregation of oil and solvents or clean oil and radioactive oil occurred. Strict operational limits and regulatory restrictions on burning in the auxiliary boiler created a large backlog of oil to be burned. Even with a strict segregation program, we expected this backlog to take a minimum of two years to dispose of in the auxiliary boiler. During a major overhaul of the Auxiliary boiler in 1989, two major problems were discovered in this method of disposal. Burning this mixture in the auxiliary boiler was causing some premature degradation of the boiler and the residue from burning this waste oil was a potentially hazardous waste. Due to these problems a decision was made to cease this method of disposal

Several disposal options were considered -among them long term storage on-site, storage at a mixed waste storage facility until a permitted disposal facility became available, and incineration at a company owned fossil station. Some variations of these options were discussed and investigated. Most of these involved some method to separate the solvent and the radioactivity from the mixture thereby reducing the volume for disposal. Both from an economical and from a practical standpoint, incineration at a fossil station was clearly the preferred method of disposal. However, a multitude of obstacles had to be surmounted to achieve this goal. Some of the obstacles included internal agreement, the myriad group of agencies which had to be consulted, and the coordination of multi-departments within our own company.

A high level of cooperation and coordination was ultimately achieved and through good working relationships with regulatory agencies, a precedent-setting result was achieved. Not only was this method of disposal environmentally sound , it also resulted in cost savings to the company of between 300,000 and $800,000.

INTRODUCTION

During the week of October 8-12, 1990, Duke Power burned approximately 17,000 gallons of slightly contaminated waste oil mixed with an oil/solvent/water mixture. This action was the culmination of over eighteen months of work on the part of a multitude of individuals from many areas within our company and with the cooperation of many individuals from several agencies of the State of South Carolina.

In light of the current difficulties involved in disposing of this type of mixed waste, one might ask how did Oconee Nuclear Station end up with such a large volume of mixed waste. Oconee has been very fortunate to have an auxiliary boiler and even more fortunate to have obtained permission early to amend the technical specifications to allow on site incineration of spent oil/solvents in this boiler. However, this set of circumstances is one of the reasons that Oconee had this large volume of mixed waste. Duke Power operates two other nuclear facilities, both of which have used a strict segregation program for oils and solvents since initial operation. Neither of these facilities have any significant amounts of oil/solvent mixture. In fact, these two stations aggressively segregate "clean" and contaminated oil to the point where the vast bulk of waste oil is released as clean to be recycled for energy conservation at one of our fossil stations. Because of the auxiliary boiler, Oconee had not felt the need for these measures until recently. In the first quarter of 1990 Oconee did implement the same segregation policy for oil and solvents.

DECISION PROCESS AND FACTORS CONSIDERED

Early in 1989, Duke Power made a decision to try to pursue the disposal of contaminated waste oil by incineration at one of its fossil units in South Carolina. At the time this decision was made, our intentions were to burn the Oconee contaminated oil/solvent/water mixture in the Auxiliary boiler at the station. Because of the large volume of the mixture and the operational and regulatory restrictions on burning in this fashion, we projected that two years would be needed to dispose of the oil in this fashion. Lee Steam Station, a three unit fossil station, in South Carolina was selected as the site to burn contaminated oil in South Carolina. We chose Lee for several reasons - not the least of which is that Lee is Duke's only fossil station in South Carolina. For our initial attempt at getting this permission, we did not want to transport the oil from one state to

another. Another factor considered was that Lee was already permitted by the state Of South Carolina to burn non-contaminated waste oil. This meant that procedures were already in place for transportation and burning waste oil. All we had to do was to ensure that the levels of radioactivity in the oil did not require us to significantly change our transportation or handling procedures. In October, 1989, we submitted an application for permission to burn no more than 10,000 gallons of waste oil from Duke's Oconee and Catawba Nuclear stations at Lee Steam Station. In January, 1990, we received permission from The Radiological section of South Carolina Department of Health and Environmental control to burn this amount of contaminated oil.

During this same time frame, the auxiliary boiler at Oconee was undergoing some major maintenance. During this maintenance, several discoveries were made. The first was that while we had permission to burn waste oil in this boiler, this operation was causing the boiler to undergo some premature degradation. The second was that, due to some incomplete combustion, the residue left in the boiler after burning the oil/solvent/water mixture was also a potential hazardous waste. For these reasons, in November, 1989, Duke Power made a decision to cease the practice of burning waste oil in the auxiliary boiler. Now we had approximately 17,000 gallons of contaminated oil/solvent/water mixture and no approved method of disposal.

Several options were investigated at this point. The major options that we looked at included on site storage, off-site storage, and incineration at Lee Steam Station. We did investigate some other options in conjunction with these main methods. These variations mostly revolved around separation and purification of the oil to reduce the volume of mixed waste, thereby reducing the cost of storage. Most of these variations involved some technology that was not readily available or were very labor intensive.

A purely economic analysis was conducted to compare the three main options. The results of this analysis showed that incineration at our fossil station was clearly the economic choice for disposal. In addition, incineration provided a final solution. There would be no increases in storage costs, no increases in regulatory requirements, and no doubts about the future for disposal.

In February,1990, Duke Power's Nuclear Production Department approached Lee Steam and Fossil Production management about the possibility of conducting a one time burn of this oil/solvent/water mixture at Lee. All parties agreed that if this method of disposal could be conducted in an environmentally sound manner, it was our best course of action.

RADIOLOGICAL PERMIT APPLICATION

Since some of the radioactive levels were slightly higher in this mixture than in the previous permit application for strictly contaminated oil, Radiation protection personnel recalculated dose rates for the various exposure pathways and determined that no significant exposure hazard existed.

In early March, Radiation Protection met with personnel from the S. C. Bureau of Radiological Health to discuss a possible application to burn the oil/solvent/water mixture at Lee Steam Station. We received some assurance from them that from a radiological standpoint, we should be able to burn this mixture. They also provided some suggestions as to what other state agencies needed to be approached for permission and how this permit application should be submitted. Similar meetings were conducted with both the Bureau of Solid and Hazardous Waste Management and with the Bureau of Air Quality Control. In late July, 1990, Duke Power submitted formal requests to all three agencies for approval to burn the oil/solvent/water mixture at Lee Steam Station.

The most detailed of these applications was the radiological permit application. This application described in detail the waste source, the maximum volume to be burned, the method of transport, and evaluated the various radiation exposure pathways by which both workers and the public could receive exposure. The pathways which were evaluated included:

(1) Exposure to the contaminated oil during preparation and shipment.

(2) Ingestion dose due to the consumption of vegetation grown in the vicinity of the ash pond

(3) External dose received while remaining in the area of the ash pond

(4) Internal exposure due to water runoff from the ash pond

(5) Exposure to stack effluent

Using some extremely conservative worse case scenarios, we calculated the maximum activity to be released or the highest dose rate via these pathways. We included these worse case scenarios in our application. Using these maximum activities and dose rates, we estimated the theoretical maximum doses would be:

Driver of the oil transport truck	less than 5 mrem
Plant worker	less than 4 mrem
Public	less than 1 mrem

To ensure that we limited the exposures to the maximum estimates given in our permit application we established a three tiered activity limit. The first of these limits (10 millicuries) was for the total amount of activity to be

burned. This amount was based on the total amount of activity which was contained in the mixture. The second limit (5.0 E-4 uCi/ml) was established to ensure that individual radionuclides did not exceed the values that were used in our dose projections. An additional limit of 1.5 E-3 uCi/ml was established for total activity concentration per shipment. This limit made transportation much simpler and ensured that placarding the vehicle would not be required. Listing these limits in this fashion did create some measure of confusion with the application permit. The key point about these limits was that none of them would be exceeded and that they were not necessarily related.

After the South Carolina Bureau of Radiological Health reviewed the application, some concerns were raised about items such as follow-up monitoring around the Lee site and concerns about spill and leak control. These issues were satisfactorily resolved.

OTHER PERMIT APPLICATIONS

The permit applications to the Bureaus of Solid and Hazardous Waste and Air Quality Control were not as detailed. Several major issues were addressed. The first of these was the need for Lee to be permitted as a Treatment, Storage, and Disposal Facility. This question was satisfactorily resolved by assuring the state that the oil would be burned as soon as possible after arrival at Lee. In actual practice, the oil was transferred directly from the tanker to the boiler. The permit application to the Bureau of Air Quality Control showed that this burning operation would meet all the applicable requirements for emissions. Additional information was requested to ensure that the Lee boilers were able to meet the requirement that all hazardous organic compounds must be destroyed with an efficiency of at least 99.99%. Testing to prove this destruction and removal efficiency could only be performed during the actual burn and would have been extremely costly. Because this was a one time operation and because Oconee would no longer be generating this mixed waste, we requested that data obtained from a test on a virtually identical unit be used in lieu of the actual test on Lee. On August 30, 1990, Duke Power received permission from the State of South Carolina to conduct the burn.

DETAILS REQUIRED TO CONDUCT THE OPERATION

Although we had permission to go ahead with this operation, we really were not "out of the woods" yet. Because Duke Power generates most of its base load with its nuclear units and larger fossil units, we had to work closely with the operations department to ensure that the Lee unit would be allowed to operate at 100% for the period of the burn. Procedures for loading and transferring the oil had to be developed. One major obstacle arose when we inspected the tanker normally used to transport waste oil in South Carolina. Simply stated, the tanker had a multitude of small leaks. Another tanker used in North Carolina was available, but we had not really gotten any of the North Carolina fossil units involved in the discussions on this operation. The original plan was to use a minimum amount of clean fuel oil for an initial flush of the tanker and then let dilution from normal waste oil shipments take care of any remaining levels of activity. Since that oil was also to be burned at Lee, we were assured that all of our projections were adequate. Because the North Carolina tanker was used to transport oil to a North Carolina facility for burning, we had to do a significant amount of flushing and sampling to assure the North Carolina facility that the tanker was clean prior to use in North Carolina.

Because of the sensitive nature of this operation, Duke made a decision to fully inform the employees of Lee Station of the operation, the benefits to the company, and any hazards to them or to the surrounding area. This was accomplished using written newsletters and finally a series of training and information sessions. These sessions generally consisted of a short information presentation on radiation and then a period of questioning. The questions were not limited and covered a wide range of topics. There was, happily, very little hard core resistance to the concept.

Another hurdle was cleared when personnel at Oconee answered a series of questions for the resident NRC inspector. These questions revolved mostly around an incident that occurred in 1984 where Duke had received a violation for burning contaminated oil at Lee under an interpretation of 10CFR30.18 for exempt quantities. As a note, Duke Power had copied the NRC on all correspondence with the state concerning these applications.

CONCLUSIONS

As stated in the opening, during the week of October 8-12, 1990, all these efforts culminated in the disposal by incineration of approximately 17,000 gallons of contaminated oil/solvent/water mixture at Lee Steam Station. The actual burns were anti-climatic. While a few minor problems were experienced, the operation was conducted as scheduled. Initial samples in the boiler have shown small traces of radioactive isotopes in the boiler. We have found no measurable amounts of activity either in the settling pond or the surrounding shoreline. Sampling will continue until no further traces of activity are found.

In closing, Duke Power considers this project as economically desirable and environmentally sound. I must say that the process was not easy. Most of the decisions made during this project were hammered out during some long and sometimes heated discussions. Without a lot of cooperation and compromise within the company and without an exceptional working relationship with the various state agencies and the NRC, we would not have been successful.