Internal Letter **Rockwell International**

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No

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SUBJECT: RADIOACTIVE SOURCES IN ROCKY FLATS SANITARY LANDFILL

IDENTIFICATION OF RADIOACTIVE PROBLEMS IN LANDFILL

On September 30, 1973 tritium and strontium were detected at the drainage of the Rocky Flats sanitary landfill by the Lawrence Livermore Laboratories (LLL). Because of this finding, monitoring wells (called at the time environmental test holes) were installed in the landfilled waste to try to identify the sources of tritium and strontium.

STRONTIUM STUDY RESULTS

From September through January of 1973 the results for strontium showed large variations in concentration. The LLL sample that had been thought to be greatly elevated in strontium (34 pCi/L) was re-evaluated and found to be less concentrated (16 pCi/L) but above background levels. Background levels are considered to be approximately 1 - 2.5 pCi/L for strontium in water, based upon water samples taken in that time period from Rock Creek. Samples of groundwater/leachate from boreholes in the landfill were analyzed for strontium, and only one sample (from TH-4) appeared elevated in strontium at 7 pCi/L. All other samples of groundwater/leachate had strontium concentrations of less than 1

pCi/L. The detection limits of the method used to analyze for strontium at the time was 0.1 pCi/L. Strontium was analyzed in the landill ponds, drainages, and groundwater intercept system, and generally found at background levels. A table of strontium results is attached with strontium results from the landfill ponds in the period of 1973 - 1984. The data do not appear to indicate a problem with migration of strontium.

TRITIUM STUDY RESULTS

Results for tritium were more consistent. Monitoring wells were installed a number of different times resulting in approximately 57 wells installed directly in the landfilled waste or directly below the saturated waste materials by the end of the investigation. Elevated tritium readings were followed until the source of tritium had been fairly well identified. The tritium concentrations in the water near the tritium source were as high as 301,609 pCi/L at (TH-46).

The location of this tritium source is approximate Rocky Flats coordinates E:20,015; N:39535. The depth of the tritium source, total activity, configuration, and container, if any, are unknown. It was estimated in 1974 that the volume of waste containing the tritium source was dumped in approximately 1970.

The wells nearing the eastern end of the landfill exhibited decreasing tritium concentrations. Seeps of leachate at the eastern end of the landfill had tritium concentrations of 5,000 - 7,000 pCi/L in 1973/1974.

The current Derived Concentration Guide (DCG) (based on a DOE August 5, 1985 memorandum using DOE dose limit of 0.1 mrem/yr to members of the public from all pathways, dose conversion factors given in the memorandum, and intake rates of 2.0 L/dy for water) for tritium is 2,000,000 pCi/L. The proposed EPA drinking water standard (based on a Sept. 30, 1986 Advanced Notice of Proposed Rulemaking and a risk equal to that from a dose rate of 4 mrem/yr) for tritium is 90,000 pCi/L. These criteria indicate that the leachate that was found downgradient of the sanitary landfill never exceeded the proposed drinking water standard. The leachate in the immediate area of the tritium source never exceeded the DCG, and are only approximately 3.5 times the proposed drinking water standard. These tritium levels which are found in the immediate area of the tritium source do not appear to represent a threat to human health or the environment unless tritium is found migrating out of the landfill.

CORRECTIVE ACTIONS OF 1974 AND MONITORING RESULTS

A number of options were evaluated in late 1973 and early 1974 for correction of the identified problems, including excavation of the tritium source. The selected action was the construction of the groundwater intercept system (or the "horseshoe system") around the landfill. The purpose of this system was to isolate the tritium source from the surrounding environment, and to drain as much groundwater out of the landfill as possible. This was accomplished by the construction of a clay wall to prevent the migration of

uncontaminated groundwater into the landfill. This clay wall redirected the groundwater to a perforated pipe for collection. This pipe was provided with a slope, and at the eastern limits of the expected fill the pipe became a solid wall sewer pipe. There were three options, depending on which valves were open, for drainage of this intercepted groundwater: to drain the water into a western pond, to drain the water into an eastern pond, or to have the water daylight below the dam for the eastern pond. The eastern pond is the pond that still exists. The western pond was intended for the management of leachate or contaminated groundwater. The intercepted groundwater was found to not be contaminated with tritium in early 1974 (tritium concentrations of 500 - 1,000 pCi/L, compared to background values of approximately 500 pCi/L). This water was therefore allowed to daylight below the dam for the eastern pond. Extensive monitoring of this water continued from 1974 to 1981 and identified no migration of contaminants.

The leachate and runoff water collected in the western leachate pond was found to contain 1800 - 7922 pCi/L of tritium in 1974. The tritium concentrations in this pond decreased with time (922 - 1365 pCi/L in 1977 and 490 - 886 pCi/L in 1980). Table 2, attached, contains the tritium concentrations found in the western pond. The western landfill pond was removed for expansion of the landfill in May/June of 1981.

The above data indicated that the tritium source was effectively separated from the environment and causing no environmental degradation beyond the immediate area of the tritium source.

IMPLICATIONS FOR 1987 AND LANDFILL CLOSURE

It is suggested that the tritium source be left in place and that long-term monitoring and maintenance of the landfill be committed to in the Closure Plan. These long-term activities at the landfill would include the construction of a sloped low permeability landfill cap, a small leachate collection system, and groundwater monitoring activities.

No benefits can be identified from excavation and disposal offsite of the tritium source unless all other potential sources of radioactivity and hazardous waste were also removed. This would include the excavation of all portions of the landfill used from 1968 until November 1986. If this were accomplished then the landfill could conceivably be closed as a non-RCRA regulated landfill.

The removal of the tritium source would be most effective if all potential sources of radioactivity were also removed. The removal of all potential sources of radioactivity from the landfill would include excavation of large sections of the landfill. The sanitary landfill was never intended for disposal of radioactive substances, but the criteria for identification of these materials has changed through the passage of time. Levels of radioactivity that were essentially undetectable in the mid 1970's are now quantifiable with our improved technology. Current indications are that the 1000 kg of sanitary sewage sludge deposited in the landfill from

August 1968 through February 1970 would be considered radioactive by today's standard. This material and would also require excavation in an attempt to rid the landfill of all sources of radioactivity. These activities would also need to be supplemented with a leachate collection system to drain all leachate from the landfill and treat it since the leachate is also potentially radioactive. After the effort and cost associated with the above activities, the landfill portions used from 1970 through November 1986 would still require long-term monitoring and maintenance due to the presence of RCRA defined hazardous wastes. These long-term monitoring and maintenance activities would probably be no different for a strictly hazardous waste regulated landfill as they would be for a hazardous waste landfill with some radioactive sources contained in it.

Based on currently available data and information, there appears to be no technical problems for leaving the potential sources of radioactivity in place. To date no migration of radioactivity has been identified downgradient or laterally from the landfill. This indicates that the potential radioactive sources are effectively contained in the landfill and that the landfill groundwater intercept system is apparently effective. The degradation of water quality within the landfilled waste is typical of landfills and should not represent a technical or regulatory problem as long as migration of contaminated groundwater out of the landfill is not identified. The drilling program currently underway will identify any migration of contaminated groundwater out of the landfill and

will help determine the effectiveness of the landfill groundwater intercept system in redirecting uncontaminated groundwater around the landfill. It is suggested that during closure activities a leachate collection system of modest design be installed in the eastern portion of the landfill to collect leachate for removal and treatment. This leachate collection system will prevent the build-up of a leachate head in the landfill that would force leachate out of the landfill final cover or cause leachate contamination of groundwater.

SUMMARY

The Colorado Department of Health (CDH) is not currently aware of the tritium source in the landfill or of the potentially radioactive sewage sludge contained in the landfill. All closure activities will be contingent upon CDH's approval. It is suggested that all discussions and plans submitted to the CDH pursue leaving these materials in the landfill and long-term monitoring and maintanence. This solution to the landfill closure problem will protect human health and the environment and should be acceptable to CDH.

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