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Department of Energy

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

94-RPS-276

JUN 30 1994

Mr. David L. Lundstrom
Nuclear Waste Program
State of Washington
Department of Ecology
P.O. Box 1386 MSIN N1-05
Richland, Washington 99352

Mr. Joseph S. Stohr
Nuclear Waste Project
State of Washington
Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

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Dear Messrs. Lundstrom and Stohr:

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION - 241-AY AND 241-AZ TANK FARMS VENTILATION UPGRADES

Enclosed are the responses to the request for additional information on the 241-AY and 241-AZ Tank Farms Ventilation Upgrades. Comments were received from Mr. R. C. H. King of the State of Washington Department of Ecology in a letter to Mr. S. D. Stites, of the U.S. Department of Energy, Richland Operations Office, and further clarification of those comments was provided via phone conversations between Mr. King and Mr. Stites.

Should you have any questions, please contact me or Mr. S. D. Stites of my staff on (509) 376-8566.

Sincerely,

Robert S. Holt/for
Steven H. Wisness, Acting Program Manager
Office of Environmental Assurance,
Permits, and Policy

EAP:SDS

Enclosure

cc w/encl:
Administrative Records
R. C. King, Ecology

cc w/o encl:
W. T. Dixon, WHC
K. A. Colosi, WHC
J. J. Luke, WHC

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Response to Comments
241-AY, 241-AZ Ventilation Upgrades

Following are the response to comments received from Mr. R. C. H. King of the State of Washington Department of Ecology. For clarity, Mr. King's comments are paraphrased prior to the response to each comment.

Comment 1: Are the hours of operation listed on page 3 of the application normal or maximum duration?

Response: The ventilation system will operate 24 hours a day, 365 days a year. These are both normal and maximum hours. The hours listed for mixer pump operation are the expected normal hours of operation. Both normal hours (as stated in the application) and maximum hours for each year are included in the following table. As stated in the application, these durations and estimated dates of occurrence are approximate.

Fiscal Year	Normal Mixer Pump Hours	Maximum Mixer Pump Hours
1997	1,136	1,300
1998	336	400
1999	636	750

Comment 2: Please provide abated emissions estimates for toxics and criteria pollutants.

Response: The following table presents the abated toxic emissions in the same format that the application presented unabated emissions, for ease in comparison. The final column refers to the physical form of the toxic air pollutant (TAPs). Please refer to the response to Comment 3 for removal efficiency used to determine abated emissions.

Abated Emissions Estimate

	With Mixer Pumps			Physical Form
	Abated Emissions			
	lbs/min	lbs/hr	lbs/yr	
AlO2- [Aluminum, as Al soluble salts]	1.0E-12	6.0E-11		Soluble Particulate
F- [Flourides, as F]	8.2E-14	4.9E-12		Soluble Particulate
Fe(OH)3 [Iron salts, soluble as Fe]	2.4E-13	1.4E-11		Insoluble Particulate
Cr(OH)3 [Chromium (III), as Cr]	4.9E-14	2.9E-12		Insoluble Particulate
Ag [Silver, soluble compounds as Ag]	2.3E-16	1.4E-14		Soluble Particulate
Ba [Barium, soluble compounds Ba]	7.8E-17	4.7E-15		Soluble Particulate
Ca [Calcium hydroxide]	6.5E-16	3.9E-14		Insoluble Particulate
Cu [Copper, dusts and mists, as Cu]	1.4E-16	8.4E-15		Insoluble Particulate
Sb [Antimony and compounds as Sb]	5.9E-16	3.5E-14		Insoluble Particulate
Se [Selenium compounds, as Se]	3.1E-16	1.9E-14		Soluble Particulate
1-Butanol	6.50E-07	3.90E-05		Soluble Organic Aerosol
Methylene Chloride	7.68E-10		4.04E-04	Insoluble Organic Aerosol
Acetone	4.64E-07	2.78E-05		Soluble Organic Aerosol
Carbon Disulfide	5.60E-11	3.36E-09		Insoluble Organic Aerosol
1,2-Dichloroethane	1.78E-11		9.36E-06	Insoluble Organic Aerosol
Trichlorofluoromethane	6.19E-10	3.71E-08		Insoluble Organic Aerosol
Bromomethane [Methyl bromide]	6.88E-12	4.13E-10		Insoluble Organic Aerosol
1,1,1-Trichloroethane [Methyl chloroform]	9.60E-11	5.76E-09		Insoluble Organic Aerosol
Carbon tetrachloride	4.11E-12		2.16E-06	Insoluble Organic Aerosol
Benzene	5.44E-10		2.86E-04	Insoluble Organic Aerosol
1,1,2-Trichloroethane	3.85E-11	2.31E-09		Insoluble Organic Aerosol
Vinyl Acetate	3.83E-10	2.30E-08		Insoluble Organic Aerosol
2-Butanone (MEK)	7.58E-08	4.55E-06		Soluble Organic Aerosol
Trichloroethylene	1.24E-11		6.52E-06	Insoluble Organic Aerosol

	With Mixer Pumps Abated Emissions			Physical Form
	lbs/min	lbs/hr	lbs/yr	
2-Hexanone (MBK)	2.04E-08	1.22E-06		Insoluble Organic Aerosol
Tetrachloroethylene	1.14E-10		5.99E-05	Insoluble Organic Aerosol
Toluene	9.71E-10	5.83E-08		Insoluble Organic Aerosol
Chlorobenzene	8.21E-12	4.93E-10		Insoluble Organic Aerosol
4-Methyl-2-Pentanone (MIBK)	7.09E-09	4.25E-07		Insoluble Organic Aerosol
Ethyl Benzene	1.37E-12	8.22E-11		Insoluble Organic Aerosol
1,1,2,2-Tetrachloroethane	1.91E-10	1.15E-08		Insoluble Organic Aerosol
o-Xylene	2.97E-08	1.78E-06		Insoluble Organic Aerosol
TBP	4.76E-14	2.86E-12		Insoluble Organic Aerosol
Ammonia	8.20E-04	4.92E-02		Soluble Organic Aerosol

Abated Emissions
Class A Toxics with no Small Quantity Emission Rate

	With Mixer Pumps Abated Emissions		Physical Form
	lbs/min	$\mu g/m^3$	
1,2-Dichloropropane	6.88E-12	1.40E-4	Insoluble Organic Aerosol
As [Arsenic and inorganic arsenic compounds]	1.5E-14	3.1E-7	Soluble Particulate

Flow at 788 actual cubic feet per minute

Abated Criteria Pollutant Emissions

	tons/yr
Total particulate emissions	2.9 E-9
Ozone (as Total Volatile Organic Compounds)	4.9 E-3
Sulfur Dioxide	None Expected
Carbon Monoxide	None Expected
Nitrogen Dioxide	1.1 E-9
Lead	None Expected

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Comment 3: Provide removal efficiencies for each piece of equipment in the ventilation system for each type of air pollutant.

Response: The control system consists of a high efficiency mist elimination (HEME), gas adsorber, high efficiency particulate air (HEPA) filters, and condenser. The control equipment effectiveness for each piece of control equipment is included in the following table. The physical form of the TAPs is included in the response to Comment 2.

Control Equipment Effectiveness

Equipment	Decontamination Factor	Contaminate
HEME	15	Soluble and insoluble particulates
gas adsorber	5	Organic vapors
HEPA filters	3,000,000	Particulates
Condenser	5	Soluble aerosols and particulates
	3	Insoluble aerosols and particulates

Comment 4: Provide demonstration of arsenic abated emissions.

Response: Please refer to the abated emissions tables and the table of control equipment efficiencies provided in the response to Comments 2 and 3.

Comment 5: Absorption for inorganic compounds should be considered technically feasible.

Response: Absorption will be considered in the impact analysis.

Comment 6: Revise the impact analysis to include additional detail and supporting calculations.

Response: Economic, energy, and environmental impact analyses are performed for all technically feasible control options. Technically feasible options are included in the following table, for each class of pollutant discussed.

Technically Feasible Control Options

Pollutant Type	Control Option	Removal Efficiency
Volatile Organic Compounds	Adsorption	80 percent
	Partial Vapor Condensation/ Condensate Removal	up to 80 percent
	No Controls	0 percent
Inorganic Compounds	Absorption	99 percent
	Adsorption	up to 99 percent
	Partial Vapor Condensation/ Condensate Removal	up to 80 percent
	No Controls	0 percent

Adsorption of Organic Compounds: A small activated carbon filter can be obtained to fit in the housing with the HEPA filters. It will require replacement approximately twice a year. This is based on the post condenser emissions, because the condenser will be used to minimize the absolute humidity of the exhaust stream. The adsorption system is being installed to control radioactive iodine emissions and the best method for abating iodine also provides abatement for organic compounds. The system would be installed regardless of the impact on organic compounds. Consequently, there are no direct environmental, energy, or economic impacts resulting from the use of adsorption for the control of organic compounds.

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Partial Vapor Condensation/Condensate Removal of Organic Compounds: The condenser system will be used to provide a reduction in absolute humidity of the air stream. For HEPA filters to function properly, the air stream cannot be saturated with vapor. There are two ways to reduce the relative humidity in an air stream, remove water or increase temperature. The temperature of the air stream entering the ventilation system is 100°F and raising the temperature presents numerous safety concerns. Removing the water from the air stream via condensation to 40°F, and then heating the air stream to 70°F reduces the absolute humidity while maintaining operating temperatures in a safe zone. The vapor condensation/condensate removal portions of the ventilation system are required for the safe operation of other required systems and would be installed regardless of the impact on other compounds. Consequently, there are no direct environmental, energy, or economic impacts resulting from the use of partial vapor condensation/condensate removal for the control of organic compounds.

Absorption of Inorganic Compounds: A packed bed scrubber utilizing 35 percent sulfuric acid designed to operate in a batch mode to remove ammonia is evaluated. The scrubbing solution of 159 gallons per batch, which would require replacement approximately four times a year. This is based on the post condenser emissions, because the condenser will be used to minimize the absolute humidity of the exhaust stream.

Environmental Impacts: This scrubber design minimizes the amount of secondary waste produced. Approximately 640 gallons per year of 21 percent ammonium sulfate will require disposal. The costs for this disposal are not included in the economic impact section, however the environmental impacts from this option are not adverse.

Energy Impacts: A ten horsepower pump is required to circulate the scrubbing solution through the packed bed. This requires approximately 65,350 kilowatt-hours (kW-hr) per year of electricity, not a significant adverse energy impact.

Economic Impacts: The economic impacts of the scrubber, as summarized in the following table, are estimated to be approximately $30,246 per year. Approximately 99 percent of the 430 pounds per year (lbs/yr) of the post condenser ammonia (0.21 tons per year) would be removed by this system. Therefore, the cost effectiveness of this control technology is $142,000 per ton.

There are no guidelines currently available for acceptable costs for ammonia removal, but costs for removal of other air pollutants considered may be applied for comparison. Results of prior Best Available Control Technology analyses indicate that criteria pollutant emission control costs greater than $1,000 to $10,000 per ton removed are considered cost prohibitive. These

significant costs coupled with the low potential emissions, no adverse ambient air impacts expected (as emphasized by emissions being below small quantity emission rates without controls), and the generation of another waste stream for treatment, support the conclusion that the option of ammonia removal using the packed bed scrubber is considered adverse, and this option is removed from consideration.

Estimated Costs for Inorganic Absorption	
Capital Costs	Cost
Equipment cost (1 unit @ 13,800)	13,800
Installation (50 percent of equipment cost)	6,900
Instrumentation/Controls (30 percent of equipment cost)	4,140
Engineering/supervision (30 percent of equipment cost)	4,140
Subtotal	15,180
Contingency (15 percent of subtotal)	2,277
Startup (10 percent of subtotal)	1,518
Total Capital Cost	18,975
Capital Recovery Cost (18,975 x 0.131) (Based on 15 year operating life, 10 percent interest)	2,486/yr
Operating and Maintenance Costs	
Replacement chemical (3000 lb x $85/2,000 lb)	130/yr
Electricity (65,530 kW-hr @ $0.06/kW-hr)	3,920/yr
Operating labor (1 hr/day; 365 day/yr; $50/hr)	18,250/yr
Supervisory labor (15 percent of operating labor)	2,700/yr
Maintenance/repairs (20 percent of equipment cost)	2,760/yr
Total O&M Costs	27,760/yr
Total Annualized Cost	30,246/yr

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Adsorption of Inorganic Compounds: Ammonia vapors would be removed by flowing through a vessel containing impregnated activated carbon. The removal efficiency is highly dependent on air flow rate, concentration, moisture content, and temperature, in addition to the properties of the carbon used. For this estimate, 98 percent removal efficiency is used. The carbon canister would contain approximately 1,000 pounds of carbon and would require replacement approximately every two months.

Environmental Impacts: Environmental impacts for this option are related to the disposal of the spent carbon. Although 6,000 pounds of carbon a year would require disposal, this would not be considered a significant adverse environmental impact based on the potential for regeneration by an offsite vendor. If it is determined that the carbon is a radioactive mixed waste and cannot be shipped offsite for regeneration, the environmental impacts may become significant.

Energy Impacts: Energy requirements would be limited to added suction for drawing the air stream through the carbon canister. This is estimated at approximately 5,700 kW-hr per year, and is not a significant negative energy impact.

Economic Impacts: The economic impacts of the carbon canisters, as summarized in the following table, are estimated to be approximately $54,700 per year. Approximately 98 percent of the 430 lbs/yr of the post condenser ammonia (0.21 tons per yr) would be removed by this system. Therefore, the cost effectiveness of this control technology is $260,000 per ton.

As stated in the economic discussion of the absorption system, there are currently no available guidelines for acceptable costs for ammonia removal. However the economic impacts from inorganic adsorption would be considered adverse and this option is removed from consideration.

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Estimated Costs for Inorganic Adsorption	
Capital Costs	Cost
Equipment cost (1 unit @ 5,735)	5,735
Installation (50 percent of equipment cost)	2,868
Instrumentation/Controls (30 percent of equipment cost)	1,720
Engineering/supervision (30 percent of equipment cost)	1,720
Subtotal	12,044
Contingency (15 percent of subtotal)	1,807
Startup (10 percent of subtotal)	1,204
Total Capital Cost	15,055
Capital Recovery Cost (15,055 x 0.131) (Based on 15 year operating life, 10 percent interest)	1,972/yr
Operating and Maintenance Costs	
Replacement adsorbers (5 x $5,735)	28,675/yr
Electricity (5,700 kW-hr @ $0.06/KW-hr)	342/yr
Operating labor (1 hr/day; 365 days/yr; $50/hr)	18,250/yr
Supervisory labor (15 percent of operating labor)	2,700/yr
Maintenance/repairs (20 percent of equipment cost)	2,760/yr
Total O&M Costs	52,727/yr
Total Annualized Cost	54,700/yr

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Partial Vapor Condensation/Condensate Removal of Inorganic Compounds: As stated in the discussion for adsorption and absorption of inorganic compounds, the condenser system will be used to provide a reduction in absolute humidity of the air stream. For HEPA filters to function properly, the air stream cannot be saturated with vapor. There are two ways to reduce the relative humidity in an air stream, remove water or increase temperature. The temperature of the air stream entering the ventilation system is 100°F and raising the temperature presents numerous safety concerns. Removing the water from the air stream via condensation to 40°F, and then heating the air stream to 70°F reduces the absolute humidity in the air stream while maintaining operating temperatures in a safe zone. The vapor condensation/condensate removal portions of the ventilation system are required for the safe operation of other required systems and would be installed regardless of the impact on other compounds. Consequently, there are no direct environmental, energy, or economic impacts resulting from the use of partial vapor condensation/condensate removal for the control of inorganic compounds.

Comment 7: Submit a copy of the Conceptual Design Report or Engineering Report.

Response: A copy of the May 1992 Engineering Report, is included with this response for submittal to Mr. King, only. Ms. K. A. Colosi of the Westinghouse Hanford Company, should be contacted for additional copies.

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CORRESPONDENCE DISTRIBUTION COVERSHEET

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S. H. Wisness, RL (C. E. Sowa, WHC)	D. L. Lundstrom, Ecology J. S. Stohr, Ecology	Incoming:9403820 Xref:9454082D ✓ 37659

Subject: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION - 241-AY AND 241-AZ TANK FARMS VENTILATION UPGRADES

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