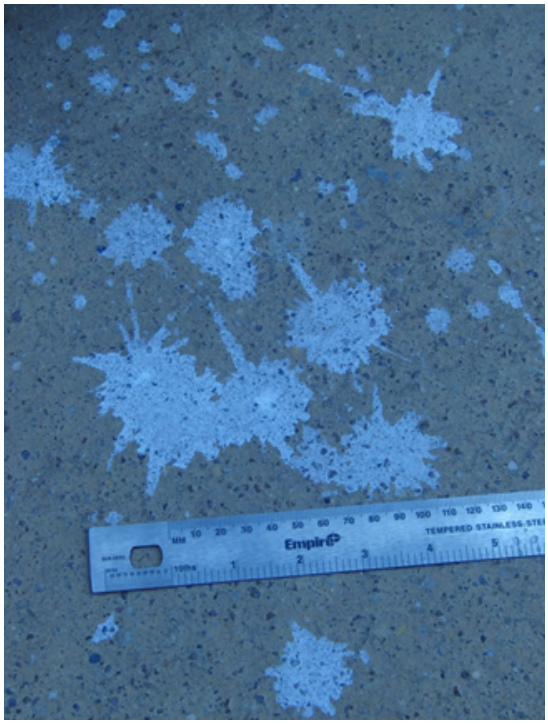
THE IMPORTANCE OF LIQUID COLLECTORS IN A WET STACK SYSTEM

A critical component of the design process for any new or converted wet stack is the wet stack study, a process that includes the modeling of an LCS. This system is designed to mitigate stack liquid discharge (SLD), often called rainout. The design of liquid collectors is very specific to the gas and liquid patterns that are unique to each wet stack. There is no one size fits all, and per the EPRI Revised Wet Stack Design Guide, this process is critical to ensuring an optimized liquid collection system; without it, you are at high risk for duct flooding, corrosion in the liner system, and erosion of the stack shell.



Close-up of Stack Liquid Discharge Near Chimney

> Alden has successfully performed over 40 wet stack studies for retrofitted liquid collection systems found in plants in Europe and China.

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The following case study was originally published by DynaFlow. DynaFlow began teaming with Alden in 1997 and officially became part of Alden in 2001, bringing with them years of Wet Stack design experience.

Case study client: Intermountain Power Service Corp.,
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When the US initially started flue gas scrubbing, the required amount of SO2 removal was low enough that the plants were able to reheat the saturated flue gas leaving the scrubbers by bypassing 15 to 20% of the hot flue gas around the scrubber and back into the stack. When regulation changes required scrubbing of 100% of the flue gas, these plants could not increase the stack temperature above the saturation point without the installation of gas to gas heat exchangers. The poor reliability and high cost to install and operate these systems was unfavorable, so plants sought another solution.

Working with the Electric Power Research Institute (EPRI), Alden-DynaFlow evaluated the process of flue gas condensation within stacks and subsequently developed wet stack liquid collection technology for the elimination of stack rainout. The installation of liquid collection systems and drains within the absorber outlet ducting and stack liner is now the standard approach to managing wet stack operation in the US plants that utilize WFGD.

To properly develop a liquid collection system, a wet stack study (WSS) is performed. It consists of three components: an analytical assessment of the amount of liquid condensation expected downstream of the WFGD absorber; a physical flow model study of the absorber outlet ducting and stack liner for the development and optimization of the liquid collector and drain systems; and a plume downwash study to protect the chimney from damage associated with acid corrosion and/or icing issues.

Rainout Approximately 100m from Chimney

Staining Due to Acid Corrosion

Depending upon the location of the plant, surrounding parties, and utility management, the potential for acid droplet fallout can become a major concern. The amount of stack fallout may be quantified through stack droplet testing.

The Los Angeles Department of Water and Power performed stack droplet tests at the Intermountain Generating Station (IGS) to determine the effect of eliminating reheat at that plant. The Video Droplet Analyzer (VDA) developed by Southern Research Institute for mist eliminator performance testing was used to collect data on the size, quantity and distribution of droplets during operation with and without reheat.

The VDA consists of a probe-mounted video camera and a strobe illuminator. Droplet size and quantity for each range of droplet diameter are measured. Droplet data and gas velocity (independently determined) for each measurement point are then used to calculate the carryover rate.

The VDA was selected for carryover measurements at IGS because it permitted the collection of data inside the stack where it would not be influenced by atmospheric conditions. The initial baseline testing indicated the amount of fallout would increase 500 fold without reheat. Therefore, it was concluded a liquid collection system would be required to control fallout. A model study was performed to develop an effective liquid collection system with the goal being to reduce fallout of problematic droplets (over 100 micron diameter) during operation without reheat to the levels measured for the unmodified system while operating with reheat. Follow-up stack droplet testing would be used to evaluate the performance of the liquid collection system.

Stack droplet testing performed on the IGS Unit 1 a with liquid collector system has indicated satisfactory

Rainout from a Wet Stack Without Liquid Collectors

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performance of the liquid collection system. The amount of liquid fallout for droplets over 100 micron diameter were reduced 99.4% by the liquid system. The amount of liquid fallout for droplets over 100 micron diameter were reduced 99.4% by the liquid collection system during operation without reheat and is within 0.4 % of the original amount with the reheat system in service. These percentage reductions and the measured amount of liquid discharge in gpm are summarized in the table below. This is the only quantitative data currently available in the industry. The achievable effectiveness of the liquid collection system is site specific.

Measured Liquid Fallout

Volume of liquid fallout (Droplets > 100 micron diameter)

	Unit 1 Without Liquid Collectors		Unit 1 With Liquid CollectorsUnit 1
Load	With Reheat gpm	W/O Reheat gpm	W/O Reheat gpm
100%	0.0040	1.76	0.010
Capture	*99.8%*	*0.0% Base*	*99.4%*

Common Effect of Rainout Where Droplets Cover Staff Vehicles in a Plant Parking Lot

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