PNNL-13889

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

Partial Re-vegetation of the Dust and Blowing-Sand Source Area

J. Becker
M. Sackschewsky

August 2001

Prepared for the U.S. Department of Energy under Contract DE-AC06-76RL01830

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RL01830

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information,
P.O. Box 62, Oak Ridge, TN 37831-0062;
ph: (865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161
ph: (800) 553-6847
fax: (703) 605-6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/ordering.htm

This document was printed on recycled paper.
(8/00)

PNNL-13889

Partial Re-vegetation of the Dust and Blowing-Sand Source Area

A proposal for use of a 175 K$ SEP fine

PREPARED FOR

U.S. Department of Energy Office of River Protection and

1 August, 2001

BY
J.M. BECKER AND M.R. SACKSCHEWSKY
PACIFIC NORTHWEST NATIONAL LABORATORY

SUMMARY AND RECOMMENDATION

We propose using the 175 K$ SEP money to stabilize approximately 300 - 340 acres located to the south-west of the 200West Expansion area fence. We propose a procedure that relies on drill seeding a mixture of perennial native grasses followed by truck application of a soil fixative such as Soil Master. This effort would compliment FDH/Duratek activities planned for inside the 200W fence lines. Assuming that both efforts are successful, the result would be between 2,000 and 2,500 meters of stabilized soil surface upwind of the primary receptors at MO-281 / 272-WA, which would result in a significant reduction in respirable dust at the receptor site.

BACKGROUND

Source Area

The entire source area for the blowing dust and sand has been estimated at approximately 5,000 acres, including the area inside the 200 West Expansion (Figure 1) (Becker and Sackschewsky 2001). This area begins just within the eastern border of the Arid Lands Ecology (ALE) Reserve and extends northward and eastward to the southwest portion of the 200 West Area.

However, we are considering only 4,000 of the 5,000 acres to be an important source of airborne dust and sand at the receptor location (Figure 1). This is based on the direction of the four wind events that were of sufficient strength (sustained [at least 1 hour] winds over 25 mph) to cause early work release (March 13 and 19, and April 1 and 30 of 2001) (Marquardt, personal communication May 15, 2001). These winds, as experienced at the receptor location (Figure1), originated from 210^0 to 330^0 (Marquardt, personal communication May 15, 2001). Consequently, the approximately 1,000 acres located directly south of the 200 West Area are considered to be a relatively unimportant source of blowing dust and sand.

Impossibility of Treating the Entire Source Area with the $175K SEP

The maximum amount of dust abatement possible could be achieved only by stabilizing and re-vegetating the entire source area (4,000 acres). It has been estimated that this would cost in excess of $1,000,000 (Becker and Sackschewsky 2001). Consequently, only a relatively small portion of this source area can be treated with the available $175,000.

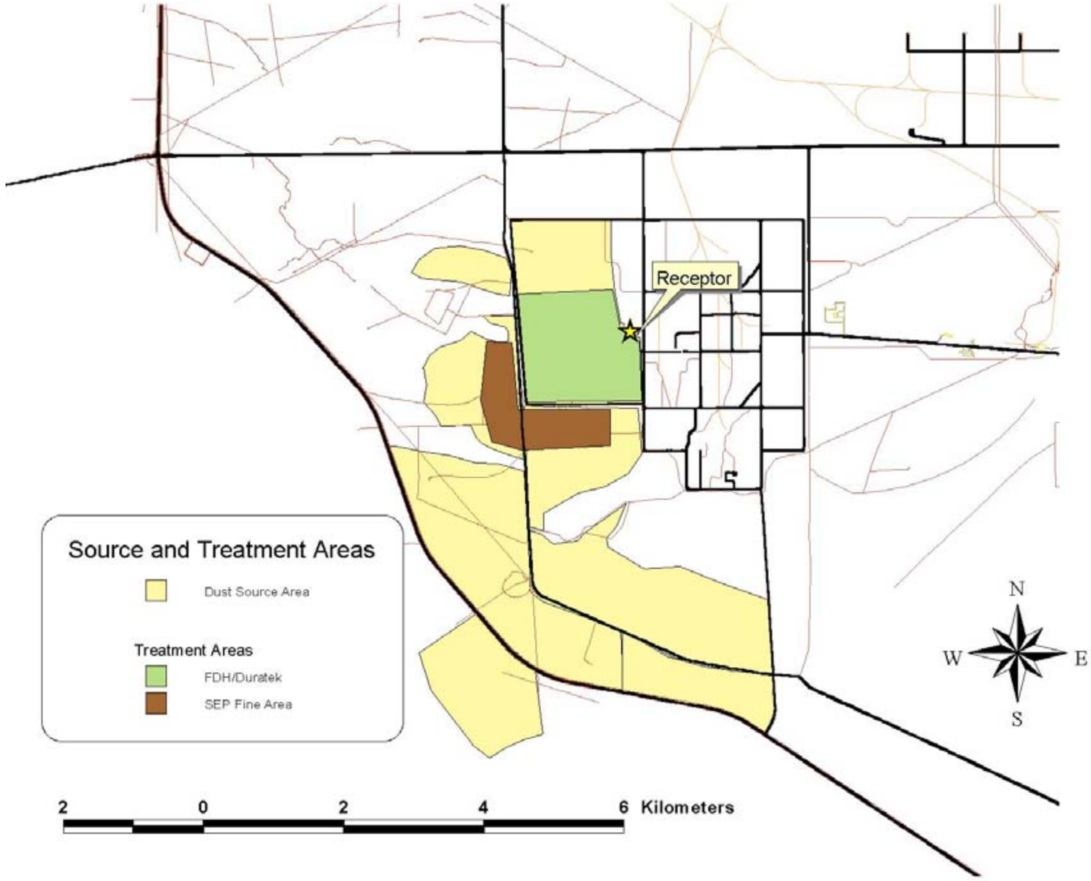

Figure 1. Source area (hand drawn via ocular reconnaissance from a vehicle) of blowing dust and sand, FDH/Duratek treatment area, and potential SEP fine treatment area.

PROPOSAL

Location of Recommended Treatment Area

Atmospheric Modeling

Partial reductions in airborne dust and blowing sand may be achieved by applying soil fixative and re-vegetating a portion of the source area. Reductions in dust concentrations were correlated by Dr. Van Ramsdell (PNNL atmospheric scientist) with the northwest and southwest portions of the source area as a function of distance upwind of the facilities (northwest portion extending 3,200 m [2 miles] upwind of the facilities and southwest portion extending 6,400 m [4 miles upwind of the facilities) (Becker and Sackschewsky 2001).

Reductions in respirable dust that could be obtained as a function of distance in the northwestly and southwesterly directions are depicted graphically in Becker and Sackschewsky (2001). For example, in the northwesterly direction, ~50% of respirable dust could be controlled via soil stabilization out to ~500 m upwind of the facilities. In the southwesterly direction, ~50% of respirable dust could be controlled via soil stabilization out to ~1,000 m upwind of the facilities. It was also estimated that the southwesterly portion of the source area likely contributes roughly 25% more airborne dust at the receptor location than the northwesterly portion.

It should be noted why soil stabilization near the facilities instead of at the furthest point upwind would be most effective. Dust generated from the source area located furthest upwind of the facilities has a greater opportunity to diffuse (resulting in reduced concentrations) more than dust generated closer to the facilities. Consequently, the preponderance of the dust experienced at the facilities comes from the eastern portion of the source area, i.e., proximal to the facilities.

Data from Prior CHG Early Releases

To date, at least 4 separate wind events have been of sufficient strength (sustained [at least 1 hour] winds over 25 mph) to cause early work release (March 13 and 19, and April 1 and 30 of 2001) (Marquardt, personal communication May 15, 2001). These winds, as experienced at the receptor location (Figure1), originated from approximately 210^0 to 330^0 (Marquardt, personal communication May 15, 2001). Consequently, the approximately 1,000 acres located directly south of the 200 West Area (not including the 200 West Expansion) are considered to be a relatively unimportant source of blowing dust and sand.

Targeted Treatment Area

The following are the 3 most important points to consider when selecting a treatment area. Winds that cause early work releases originate from the southwest and northwest. Twenty-five percent more blowing dust and sand experienced at the receptor location originates from the southwest direction than from the northwest. The parallel work that will be conducted by FDH and Duratek will occur in the southern portion of the 200 West Expansion, south and west of the receptor location.

Considering these 3 factors, the area we propose for treatment, that will likely provide the greatest benefit in terms of reducing respirable dust and blowing sand, is a band located adjacent to the western and southern sides of the 200 West Expansion (Figure 1). The size of this band, i.e., the number of acres that can be treated, was determined by the treatment costs on a per acre basis (see below) and the total amount of funds available.

Soil Stabilization and Re-vegetation Treatments, Costs, and Benefits

Timing of Grass Seeding, Seed Mixture, and Seeding Rate

Seeding grasses (and application of a soil fixative [see below]) may well provide long-term stabilization of the treatment area. However, establishment of grasses is not advisable until fall 2001. Grasses seeded during summer could imbibe sufficient water from summer rainstorms to initiate germination. Once germinated, seedlings would not survive due to lack of water during summer. Consequently, establishment of grasses should begin just after the onset of fall rains and cooler temperatures, e.g., late October.

We recommend seeding only native species, and Hanford-derived species if possible, in the treatment area. One possible seed mixture, for which seeding costs have been evaluated (Wildlands, Inc.), is presented in Table 1. The source of the seed that would be used to plant the treatment area is a grower in Eltopia, WA. The grower has indicated that demand for seed for fall plantings, particularly by the U.S. Bureau of Land Management, is expected to still be high (as a result of last year's fires and in anticipation of another potentially severe fire season this year) and that orders are normally placed in the spring. Consequently, availability of seed may be short lived. Therefore, an order should be placed as soon as possible, in order to secure the quantity of seed that would be needed for this project.

Table 1. Possible seed mixture for the proposed treatment area.

Common Name	**Latin Name**	**Pounds of Pure Live Seed[a]/Acre**
Indian rice grass	*Oryzopsis hymenoides*	2.0
Needle-and-thread grass	*Stipa comata*	0.5
Sand dropseed	*Sporobolus cryptandrus*	1.0
Sandberg's bluegrass	*Poa sandbergii*	2.0
Sherman big blue grass	*Poa secunda*	4.0
Total[b]		9.5

[a] Pure live seed consists of viable seed and excludes noxious weeds, impurities, etc. The number of pounds required varies by species depending on the size of individual seeds, i.e., species with smaller seeds require fewer pounds per acre to achieve the same coverage.
[b] According to Wildlands, Inc., who obtained this information from the seed producer (located in Eltopia, WA), the normal seeding rate for these species (on a site such as the project area) is ~6 lbs/acre. This rate was increased 50% to account for harsh environmental conditions and thus help ensure success of the planting.

Fertilization of Grass Seed

Several U.S. Bureau of Land Management (BLM) districts in northern Nevada and southern Utah have had native seed (used for fire restoration) treated with a fertilizer spray formulated (3-8-3 [N, P, K]) to promote seedling establishment and growth. The fertilizer spray, originally used to treat dry land grains, was developed by Soil Spray Aid, Inc., of Moses Lake, Washington. Soil Spray Aid, Inc. also deploys application of this fertilizer spray to large quantities of seed. The fertilizer spray does not form a coat but is absorbed by the seed and contains no hazardous materials. Soil Spray Aid, Inc. can either treat seed at the location of the seed supplier, or treat the seed after its arrival on the Hanford Site. Seed can be treated for **$0.20/lb**. The BLM (Winnemucca, Nevada district) has qualitatively reported major improvements in the basal area (number of stems, important for soil stabilization) of Sherman big blue grass in the first growing season after application of this fertilizer.

Seeding

Grasses would be seeded using a tractor and a range drill. A range drill is preferred over broadcast seeding. Drilling seed maximizes seed-to-soil contact, facilitating germination and establishment. Broadcasting leaves seed on the soil surface where it can more readily be blown away and/or devoured by birds, and thus generally requires a higher seeding rate to achieve a similar level of grass establishment as drill seeding. Seeding of the treatment area would cost, including seed, about **$107.43/acre**. This cost is somewhat higher that provided in Becker and Sackschewsky (2001) (~$97.43/acre) for treating the entire source area due to less economy of scale.

Application of Soil Fixative

Stabilization of the soil surface of the treatment area would require application of a soil fixative. This would also serve to hold drilled seed in place until germination and establishment. Soil fixative can be applied immediately following seeding by a truck with large balloon tires (fat-tired floaters). A fat-tired floater would minimally disturb the seeded area, i.e., not substantially alter the depth at which seeds have been drilled (important for germination and establishment). Without soil fixative, it is possible that drilled seed could be carried away by wind or be covered by blowing sand. These phenomena likely contributed to the very limited success of FDH's grass seeding campaign of fall 2000. Applying a soil fixative would minimize this problem, while not hindering germination and establishment. Polyacrylimide soil fixatives have been shown to be neither beneficial nor detrimental to the growth of seeded grasses (Al-Rowaily and West 1992).

A local supplier of this service (Wildlands Inc., Richland, WA) has estimated that Soil Master (an acrylic polymer) could be applied by truck (fat-tired floater) at **~$410/acre**. This cost is somewhat higher that provided in Becker and Sackschewsky (2001) (~$313/acre) for treating the entire source area due to less economy of scale. Although, Soil Master could be applied via fixed-wing aircraft or helicopter, these methods would be cost prohibitive (Becker and Sackschewsky 2001). Wildlands Inc. will guarantee effectiveness of the soil fixative for up to 6 months following application. Wildlands Inc. has also verbally agreed to re-apply Soil Master, at no additional charge, to any areas that destabilize during this time.

Crimped Straw as a Substitute for Soil Fixative

A less desirable substitute for soil fixative is crimped straw. Straw would need to be applied at a rate of 1 to 2 tons/acre. Straw costs ~$200/ton. Thus, crimping straw over the treatment area following seeding would cost approximately $500.00/acre (straw plus spreading and crimping). This per-acre cost is greater than that of a soil fixative (see above) and crimped straw is very likely to be less effective than soil fixative. It should be noted that FDH's grass seeding campaign in the 200 West Expansion in fall 2000 utilized crimped straw and that this campaign had very limited success. We believe this was likely largely due to due to removal of seed by high winds. We believe soil fixative would have been a much more effective measure for holding drilled seed in place than crimped straw, and thus recommend the same for seeding the treatment area under discussion.

Total Costs and Corresponding Size of the Treatment Area and Potential Benefits

Total costs for the soil fixative and its application, and grass seed and drilling, would be **~$517.43/acre**. At this per-acre price, ~**340 acres** (Figure 1) could be treated. This would entail drilling of ~3,230 lbs of seed. If this quantity of seed was fertilized, the cost of fertilization would be ~**$646**.

This 340-acre band (Figure 1), in combination with the area within the 200 West Expansion to be treated by FDH and Duratek, would provide soil stabilization out to from 2,000 m to 2,500 from the affected facilities in the west-southwesterly direction. If both treatments were 100% effective, they could reduce respirable dust originating out of the west-southwest from 60% to 70% (Becker and Sackschewsky 2001).

Current Parallel Efforts

Fluor Daniel Hanford (FDH) (Ray Johnson) and Duratek (Richard Roos) currently plan to seed with grasses and plant with sagebrush (*Artemisia tridentata*) 500-600 acres in the southern portion of the 200 West Expansion Area (Figure 1). Their plan (loosely defined at this point) calls for broadcast spreading grass seed early this summer in a water/soil-fixative emulsion. It is foreseen that the soil sealant (yet undecided as to what brand of soil fixative will ultimately be used) will stabilize soils in the area and hold the seed in place until germination. If the grass seed has not imbibed too much water during application and does not do so during subsequent summer rainstorms, it will remain dormant until fall rains begin (approximately late October), at which time germination will occur.

In August, prior to grass seed germination, their plan calls for planting sagebrush tubelings in islands across the 500-600 acres. Sagebrush planting will done so as to minimally disturb the soil surface, and be timed so as to occur prior to grass seed germination, in order not to disturb grasses in the process of becoming established. However, during sagebrush planting the integrity of the superficial crust created by the soil fixative will be partially compromised. It is hoped that this will not hinder success of the grass-seeding program by leaving seed exposed to high winds, causing its burial or removal prior to germination and rooting.

References

Becker, J.M and M.R. Sackschewsky. 2001. Addendum to 200 West Area Dust Mitigation Strategies: Treatment of the Dust Source Area. May 14. Letter Report to CHG.

Al-Rowaily, S. L. and N. E. West. 1992. Effects of Polyacrylimide on Establishment and Growth of Crested Wheatgrass Seedlings and Sagebrush Tubelings. Symposium on Ecology, Management, and Restoration of Intermountain Annual Rangelands, Boise, Idaho, May 18-22. Pages 275-280.