TRIP B-9

VISUAL POLLUTION OF THE PROPOSED NUCLEAR REACTOR SITE IN THE TOWN OF LLOYD, ULSTER COUNTY, NEW YORK

by,
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Introduction

The analysis of the environmental impact of a noxious facility implies the need for assessment of aesthetic and social impacts as well as the physical impact upon the land, air, water, and biota. Aesthetic impacts, such as upon the visible scene, have not been studied in detail for the environmental impact statement of the siting of a nuclear power plant at Lloyd, N.Y. although the U.S. Nuclear Regulatory Commission, Regulatory Guide 4.2, Revision 1 : Preparation of Environmental Reports for Nuclear Power Stations (January 1975) notes in Table 4 "Environmental Factors to be used in comparing alternative Plant Systems," that "People (aesthetics)" are to be considered where "The local landscape as viewed from adjacent residential areas and neighboring historical, scenic and recreational sites may be rendered aesthetically objectionable by the plant facility." (U.S.N.R.C, 1975, p. 42-62)

This lack of detailed concern is unfortunate: the changes due to the viewscape are obvious and of a degree of magnitude which demand their attention. Although the assessment of aesthetics is complex and fraught with problems of subjectivity, nevertheless transmission tower and power plant design and siting must be implemented in consonance with the overall human environment; indeed, Federal and State legal rulings reflect an increased awareness and justification for aesthetics as a form of environmental control.(Flad, 1974) Measurement of aesthetic impact of nuclear power plants is possible (Burnham, 1974). This paper and field trips will deal with some of the outstanding aesthetic concerns (cooling tower height and plume, transmission pylons and rights-of-way, and historic and cultural sites) with respect to varying viewsheds of the Lloyd site viewscape.

Aesthetics and Environmental Policy

The National Environmental Policy Act (NEPA) of 1969 mandated that all constructions using Federal funds for any part are required to file an assessment of the environmental impact of the facility. This policy has been followed by most State and some local governmental agencies. Such

projects as reservoirs, stream channelization, highways, mining buildings, dams and power plants are required to file an Environmental Impact Statement (EIS) according to section 102(c) of NEPA. Using such guidelines, a typical outline would include descriptions of the following: (i) present conditions, (ii) proposed action; (iii) probable impact; (iv) unavoidable adverse impacts; (v) alternatives; (vi) short term vs long term impacts; and (vii) irretrievable and irreversible impacts. Environment impacts are both physical and social, and may include qualitative as well as quantitative assessment. Guidelines from various agencies, environmental interest groups, and scientific or technical consultants have discussed aesthetic considerations with reference to social, physical, psychological and visual indicators.

Aesthetic impacts are those which change the cultural landscape in ways that are visible, experiential and psychologically meaningful. The cultural landscape and its component elements (skyscape, landscape, and townscape) are in constant change as a result of ongoing social process, so that the impact of any particular induced change is somewhat relative; neverthless, criteria which can create

an assessment of qualitative change are possible. (Flad, 1976)

Overall environmental categories which have been discussed as being subject to aesthetic or visual impact have included (i) scenic resources; (ii) urban design; (iii) noise; (iv) air quality; (v) water quality; (vi) fauna and flora; and (vii) land use. Social impacts, which may also be considered to relate to aesthetic interests, include: (i) cultural resources; (ii) historical resources; (iii) leisure and recreation resources; and (iv) health factors (psychological, physiological, safety, and hygenic). Examining a potential change through the construction of a proposed facility at a particular site according to such aesthetic and social concerns, then, would attempt to seriously evaluate specific criteria for each of these categories as well as some of the interactions between them. (Bagley, 1973) A recent handbook for writers and reviewers of EIS (Hopkins, 1973) suggests that general categories of the environment be assessed according to the following viewpoints: (i) land, includes geologic surface material, relief, and topography; (ii) air, includes odor, visual, and sounds ("noise is considered a physical/chemical" impact, whose elements consist of intensity, duration and frequency),(iii) water, includes

flow, clarity, the interface between land and water, and floating materials; (iv) biota, includes both wild and domestic animals and type and diversity of vegetation, (v) man-made objects, includes their presence, as structures, and their consonance with the environment; and (vi) composition, includes the composite effect, unique composition, and the resulting mood or atmosphere at the place or in the scene.

The assessment of aesthetic impact implies that criteria similar to that used in art criticism can be used in judging a landscape. Each landscape may be considered according to its expression of balance, form, shape, growth, space, light, color, texture, movement, tension, and expression. Elements of pattern (such as points, line, or area), have distinct reflections in a specific landscape; for example, edges create distinctions between locales, and give definition to places. Patterns, of course, can be too complex and therefore be viewed as chaotic; while some may be too simple and be seen as monotonous. Psychological assessment of design has shown that both order and diversity are important in the creation of a harmonious and appealing landscape.

The element of surprise is necessary in breaking up an otherwise routine pattern, but singular, emphatic points in the landscape may disrupt the overall quality of the scene. Hence, a 500 foot vertical cooling tower may visually intrude upon the other lines, curves and patterns of the composite whole, just as a series of electric power transmission line towers can disrupt an otherwise pastoral scene. The power line pylon or the cooling tower create too much contrast with the visible scene, and may also be interpreted as urban expansion into a rural landscape.

The landscape unit in its entirety, characterized by generalized impressions of a topographic and cultural region, and the setting of the particular proposed structure on its site, which gives details to the viewer, are seen by different observers from different physical positions, at varying distances and directions, under changing visual conditions. Taking into account different cultural values and social perspectives, some attempts have been made to assign relative weights onto various aesthetic criteria in a community assessment process. (Burnham, 1974). In judging viewscape quality, viewsheds were analyzed according to their "intactness", "vividness", and "unity". A viewscape is simply a

scene where elements may include both natural landscape features and man-made objects, while the viewshed also includes that which surrounds the area and is impacted by the facility's introduction. In the case of the Lloyd nuclear power plant site, both the magnitude of change and the cooling towers, are viewed as having a detrimental aesthetic impact upon the mid-Hudson valley region.

Cooling Tower Impact

The proposed nuclear power plant facility at Lloyd would have either two or four cooling towers, which will rise 137.3 meters (450 ft.) from a base a bit less than half that in diameter. Built on a site of deep muck soils and peat bogs, the tower would start at 320 feet and rise to 770 feet in altitude. Surrounding the general center of the site are hills and ridges over 600 feet; Illinois Mountain to the south is over 1000 feet at its crest, and Shaupeneake Mountain to the north is 850 feet. However, many breaks in these surrounding peaks, such as saddles and valleys, allow visible access toward the general site from the surrounding area. Especially important are the viewsheds from across the Hudson River on the east bank. Here, at places of special historical and cultural interest such as the Vanderbilt and Franklin Delano Roosevelt mansions in

Hyde Park, N.Y., the aesthetic impact will be notable. Sight line analysis (Burnham, 1974 pp73-79) for these viewsheds of the proposed site, along with population estimates of over a quarter of a million visiters annually to these historic homes plus the Poughkeepsie SMSA population of a quarter million, and the additional dimension of the social significance of the west bank view from these National Historic Landmarks, present an overwhelming case against the visible intrusion of such towers upon the viewscape.

Even more noticeable than the towers themselves will be the visible plume, or smoke, from the operation of the power plants. The planned towers are closed cycle evaporative natural draft cooling towers which will be used to dissipate heat from the electric generating units; each tower is expected to dissipate 8.12×10^9 Btu/hr of heat. Since the air is coming from an evaporative unit, it will also contain a lot of water vapor, thus producing a warm and moist plume visibly emenating from the stacks.

According to the Dames and Moore Cooling Tower Report;

> Due to the bouyancy of the plume, it will usually rise several hundred feet into the air in the immediate vicinity of the tower...
>
> Since an elevated flow of warm moist air is emitted from cooling towers, a visible plume up to a few hundred feet in length is normally observed in the immediate vicinity of the towers. A small percentage of the time, the plume will extend downwind of the towers for a distance of two or three miles. On very infrequent occasions, the plume will extend to distances over five miles downwind. (Dames & Moore, 1975,pp.2-3)

Data from the ASDA/ERDA meteorological station on site, as described in this report, suggest that visible plume lengths of less than four miles in length will be seen 96.3% of the time, particularly in the SSW sector, while visible plumes greater than 20,000 feet (4 miles) would exist only 3.7% of the time; plumes in the winter months are to extend beyond 20,000 feet 9.5% of the time. Such percentages obscure four interesting facts: (1) plumes will exist at some length and duration for 365 days of the year; (2) plumes of a length greater then 4 miles will exist on at least 13½ days of the year, most of which will be during the winter; (3) winter plumes can be expected to produce the greatest hazards as a result of increased ground fogging or icing, especially since the Hudson Valley

is an area of high relative humidity (Dames & Moore, 1975 p.47; Konigsburg, 1976, p.32) Calculations by Egemeier (n.d.) project perhaps two days of plumes reaching as far as 16 miles. Since the height of the ASDA/ERDA meteorological tower is only 90 meters, local wind conditions may be obscuring the general westerlies that will tend to bring this high and long plume down over the heavily populated Poughkeepsie urban area, where it will be both a more visible aesthetic insult as well as a potential hazard to air and surface transportation.

To put it another way, using their own data as well as data from other existing power plants (Appendix D), it can be noted that plumes will exist every day, although at different lengths and for varying duration, and be an omnipresent observable change in the Mid-Hudson skyscape.

Transmission Tower Impact

The transmission of electrical energy from the site of the electric utility production plant to the substations for eventual dissemination to the private and public users has had an enormous impact upon the visual landscape of North America. Federal and State regulations now require the utility company to site their rights-of-way so as to do minimal damage to the visual environment (Howlett & Elmiger, 1969), and to encourage the more ecological use of the rights of way. (Goodland, 1973) B-9-21

Nevertheless, there remains great damage that increased mileage of higher voltage lines (345kv and 765kv) will do irreparable harm to the biota, including man (Young, 1973), while the extension of 345 kv, 500 kv, and 765 kv lines begins to dominate the skyline. According to the most recent reports of the NYS Power Pool, the Mid-Hudson Valley is projected to become an area of increasing density of such lines. The Pleasant Valley substation is particularly noted as a growing node in the electricity transmission network.

Transmission lines carrying electricity from the Lloyd nuclear power plants would create aesthetic impacts upon three areas: (1) the rural area immediately surrounding the site of power generation; (2) the Hudson River as they cross from the west bank to the east bank; and (3) the Valkill historical site of Hyde Park.

In the immediate vicinity of the Lloyd power plants, the towers and lines which carry the electricity would create a very strong visual imprint upon the rural region. Not only is this an obvious visual contrast of texture, pattern, and balance; but, also the imprint of the "meaning"of the power line as a linkeage to urbanization (Gussow and Lowenthal, 1973)

The aerial crossing of the Hudson River strikes severely at the importance of the River as a "place"in the history of artistic expression throughout the eighteenth, nineteenth, and twentieth centuries. How, one might well ask, would Thomas Cole have painted such a scene? Just as the river begins to become a clear, less polluted, and more important amenity, it would be subject to another aesthetic insult. As the right-of-way stretches from the east bank to the Pleasant Valley substation it will be in view of the famous "cottage" owned by Eleanor Roosevelt. At this time a citizens committee has been formed to purchase and preserve Valkill as an integral part of the Roosevelt Hisorical Site.

Conclusion

A concern for the aesthetic impact of a nuclear power generating facility is not a secondary matter. Not only is it mandated by the Nuclear Power Regulatory Commission in pursuance of the goals of NEPA, but it is an appropriate measure of the goals and purpose of the electric utility or state agency which originates the proposal for a site and employs a consulting firm to do the EIS. Some concern was shown for the biotic impact upon the John Burroughs Sanctuary (National Audubon Society, 1974), but its aesthetic impact on this historic site and on the historic sites along the Hudson River (Roosevelt, Vanderbilt and Ogden

Mills Estates) was less apparent. The accompanying road log to the field trip details some of the viewsheds and aesthetic amenities of the Lloyd site and its impacted Mid-Hudson region.

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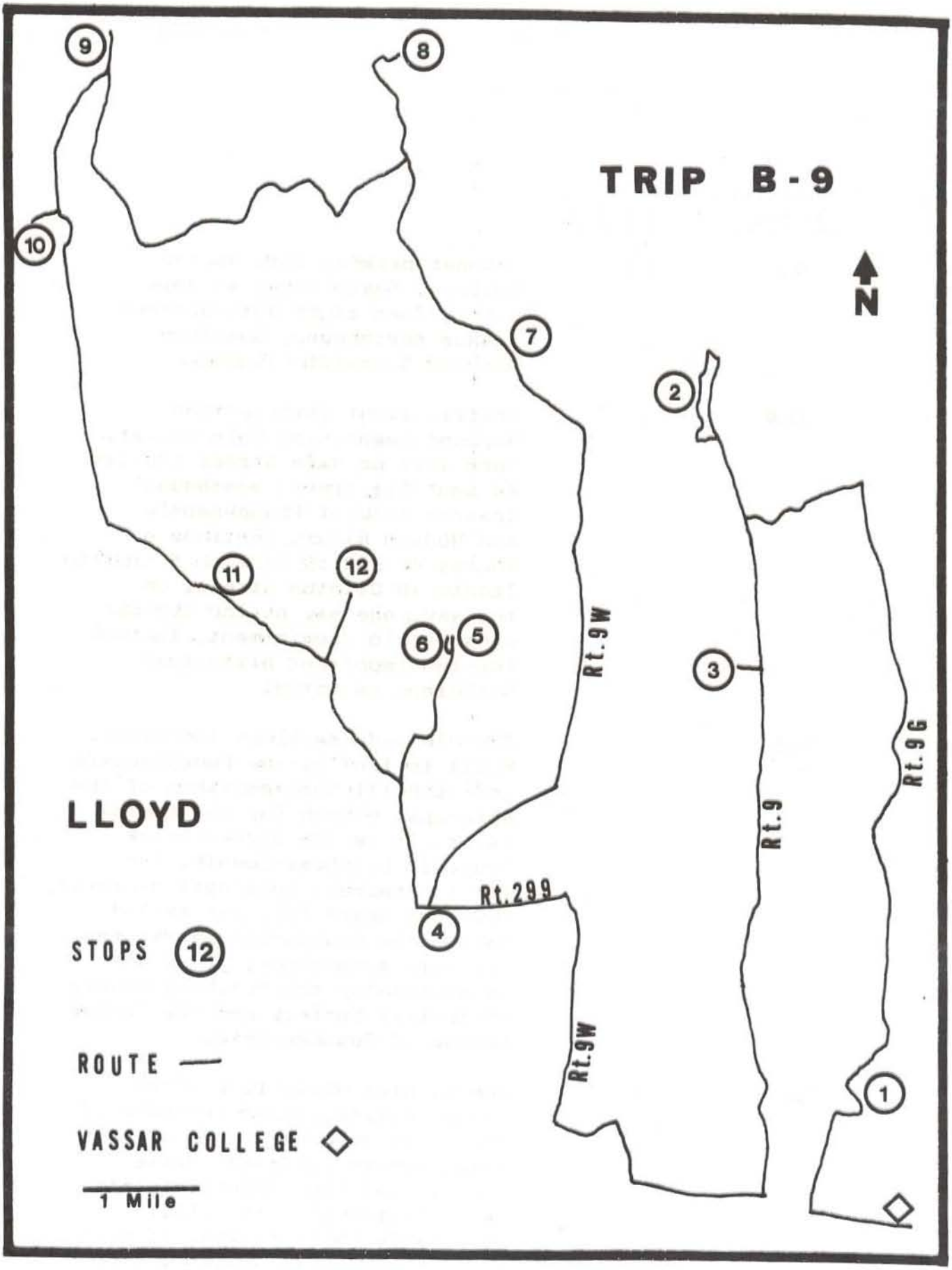
TRIP B-9
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TRIP B-9

ROAD LOG
(First Leg)

Cumulative Miles	Miles from last point	
0.0	0.0	Skinner parking lot, Vassar College. Board buses at this point. Turn right onto Raymond Avenue northbound. Continue through 5 traffic lights.
0.9	0.9	Traffic light intersection Raymond Avenue and Main Street. Turn left on Main Street (Routes 44 and 55); travel westbound towards city of Poughkeepsie and Hudson River. Continue on Routes 44 and 55 through 5 traffic lights to Clinton Street. On the way, one may notice typical urban strip development, including two important historical buildings as noted.
1.5	0.6	The Glebe House is on the right. Built in 1767 by the Poughkeepsie and Fishkill congregations of the Episcopal church for their minister, it is the oldest brick house in Dutchess County. The first permanent Episcopal minister, Reverand Beardsley, was exiled during the Revolutionary War for his Tory sympathies. It is now maintained by the Dutchess County Historical Society and the Junior League of Poughkeepsie.
1.8	0.3	The Clinton House is a State historic site, named in honor of the first governor, who made his headquarters in Poughkeepsie when it was the temporary state capital from 1777 to 1783. Originally built c.1765, it was rebuilt and enlarged in 1783 by

Cumulative Miles	Miles from last point	
		Udny Hay, purchasing agent for the state, with assistance from artisans from the Continental Army sent by General Washington.
1.9	0.1	The West Indian grocery on the right is an urban landscape indicator of ethnic change in the Poughkeepsie Central Business District.
2.0	0.1	Traffic light, intersection of Main Street and Clinton Street. Turn right on Clinton. Keep straight on Clinton (bear towards left fork). Continue north on Clinton Street through two traffic lights.
2.7	0.7	Turn right into College Hill Park. Go up hill to park.
2.9	0.2	In College Hill Park, keep to right fork.
3.0	0.1	Keep to left fork. Views west and south excellent.
3.3	0.3	Top of College Hill Park.
		STOP 1
		The largest park in the city of Poughkeepsie, College Hill Park is located on the highest point in the city (375 feet). Excellent views south and southwest of Poughkeepsie and its environs, as well as the bridge and the Hudson River; farther south the Fishkill or Breakneck Ridge can be seen. West and northwest lie the Catskills; the Lloyd power plant site lies among the hills to the northwest. The park is named for a school which existed at this site in the mid-nineteenth

Cumulative Miles	Miles from last point	
		century. After the school and subsequent plans to use the buildings had failed, William W. Smith, of Smith Brothers cough drops in Poughkeepsie, donated the land to the city in 1892. The Greek Doric designed stone solarium on the crest of the hill was built in 1935-6.
3.5	0.2	Keeping to left around the hill, take right fork and begin to descend the hill.
3.6	0.1	Open reservoir on left. This open area affords the best view northwest across the Hudson River towards the Lloyd site. The open reservoir was formerly the main water supply of the city. Continue down the hill.
3.9	0.3	Exit onto North Clinton Street. Turn right, northbound.
4.0	0.1	Traffic light at intersection of Clinton Street and Parker Avenue (Route 9 G). Turn right onto 9 G.
5.1	1.1	Violet Avenue school on left. Continue north on Route 9 G (Violet Avenue).
5.8	0.7	Entering Town of Hyde Park.
7.6	1.8	Michael's Restaurant on right. This building was used as the tea room for Val-Kill Industries, established in 1927 by Mrs. Eleanor Roosevelt. Eleanor Roosevelt's cottage (Val-Kill) still exists one quarter of a mile east of this point (on a dirt road 150 feet north of the intersection of Route 9 G and Creek Road). At the cottage Mrs. Roosevelt organized a cottage crafts industry which attempted

Cumulative Miles	Miles from last point	
		to reintroduce the crafts of furniture making, pewter smithing and hand-weaving as a local economy. The cottage is presently under consideration for inclusion in the Federal Register as a National Historic Landmark.
		If a power plant is built at Lloyd, the electricity will be shipped by high tension transmission lines along a powerline corridor that traverses this property; the lines and pylons will dominate the Val-Kill skyscape.
8.7	1.1	Homestead Market on the right. This property until recently was the last remaining dairy farm in the Poughkeepsie-Hyde Park urban area.
9.5	0.8	William Stoutenburgh House, on left. One of the only two remaining early Dutch stone houses, built probably in 1750 by William, son of Jacobus Stoutenburgh, the first settler of Hyde Park. It was fired upon by British ships in October 1777. Otto Berge, who was foremost maker of antique reproduction furniture at Mrs. Roosevelt's Val-Kill furniture shop, lived in this house for over forty years until 1975.
9.6	0.1	Traffic light at corner of Route 9G and the East Park-Hyde Park Road. Turn left travel westbound towards Hyde Park. Road follows Fallkill for part of way.
10.9	1.3	Traffic light at intersection of Hyde Park Road and Route 9 in center of Hyde Park village. Turn right on 9 going north.
11.1	0.2	Turn left into Vanderbilt National Historic Site.
11.7	0.6	Parking lot, Vanderbilt Estate.

Cumulative Miles	Miles from last point	
		STOP 2
		The Vanderbilt Estate was built by the grandson (Frederick) of Cornelius (Commodore) Vanderbilt in 1895. The building is a classic by the architectural firm of McKim, Mead & White.
		A short walk from the parking lot to the mansion and surrounding lawns. From the edge of the bluff a magnificent view west across the Hudson River.
		Viewing southwest, one can have a clear sight-line towards the Lloyd site, exactly 3 miles away. All four stacks will be visible.
12.0	0.3	On the exit road, a view west and northwest of the Catskills.
12.1	0.1	Exit onto Route 9. Turn right, southbound. Directly across the exit are the former estate horse-barns, now the Hyde Park Playhouse, famous for summer theater.
12.9	0.8	Traffic light in village center. Continue south on Route 9.
13.6	0.7	Bergh-Stoutenburgh House on left. The second of the two remaining stone houses in Hyde Park, built before the Revolutionary War. Its gambrol roof is unusual. Now recycled and occupied by the Green Frog dress shop.
13.9	0.3	On the left (next to Gasland gas station) is a cleared lot...all that remains of the third of the previously three existing pre-Revolutionary

Cumulative Miles	Miles from last point	
		stone houses.
14.5	0.6	Entrance to Franklin D. Roosevelt National Historic Site.
14.8	0.3	Parking lot for F.D.R. home and museum.
		STOP 3
		The birthplace of the 32nd President of the United States, and home for himself and family. The 94 acre site contains a museum and library as well as the graves of both Franklin and Eleanor Roosevelt. Originally built c. 1826, the wings were added in 1915 by F.D.R.
		The view from this home of 3.1 miles of the Lloyd site is only slightly obscured by a range of hills in the Lloyd region. Stacks numbered 3 and 4 of the proposed Lloyd site plan would definitely be seen in any case.
		Buses return to Route 9 exit.
15.1	0.3	**Right turn to Route 9, southbound.**
15.6	0.5	Barkers shopping center on right. After intensive discussion, stone walls were preserved.
16.9	1.3	Culinary Institute of America on right. Formerly St. Andrew's Novitiate, a Jesuit seminary since 1903. American Trappist Monk Fr. Thomas Merton, author of The Seven Storey Mountain and numerous poems and essays, is buried here. Purchased by the C.I.A. in 1970 as a college for fine chefs.

Cumulative Miles	Miles from last point	
18.0	1.1	Hudson Valley Psychiatric Hospital on the left.
18.6	0.6	Marist College on the right.
18.7	0.1	Keep right on Route 9 by-pass.
19.9	1.2	Turn left onto ramp for bridge to follow Routes 44 and 55 westbound across Hudson River. RESET ODOMETERS for Second Leg of Trip B-9.

TRIP B-9

ROAD LOG
(Second Leg)

Cumulative Miles	Miles from last point	
0.0	0.0	RESET ODOMETERS. The Second Leg of the trip starts at the East side of the Mid-Hudson Bridge (City of Poughkeepsie) at the entranceof Route 9 By-Pass to the Bridge. Cross the Bridge, view northward along Hudson River. Road (routes 44&55) climbs steeply through ridge on west bank. Passes by toll booths to Route 9-W.
		The curved road cut just west of the bridge reveals a section inter-bedded shales and graywackes mapped as Austin Glen formation on the 1970 N.Y. State geologic map and by Dames and Moore, 1975. On the west (left) side of the cut several faults are visible. Note that an individual bed may vary in thick-ness even over short distance. We will see a lot of out-crops that are frustratingly similar to this one.
		Good marker beds are non-existent and what poor markers there are are useful only in very small areas. Fossils are rare and usually non-diagnostic. Thus geologic mapping in the Lloyd area is a slow and arduous task. All the rocks in the Lloyd area are Ordovician in age.
1.9	1.9	After crossing bridge, turn right, proceed North on Route 9-W (and routes 44 & 55). Remain on 9-W.

Cumulative Miles	Miles from last point	
3.4	1.5	Turn left onto Route 299. Follow signs towards New York Thruway.
4.6	1.2	Riverside Road on right. Stop alongside Route 299 just before reaching Riverside Road.

STOP 4

This outcrop consists mainly of steeply dipping graywackes. On the 1970 N.Y. State Geologic map this is mapped as Quassaic although this sequence differs from the map's description of the Quassaic. Dames and Moore map this outcrop as Schenectady Formation, just south of here, along strike, they map the same rocks as Quassaic Sandstone. These rocks may be Quassaic or may overlie the Quassaic.

This outcrop is a section of the east limb of an assymetric syncline with its east limb overturned. On the east end of the outcrop the rocks dip east steeply and are overturned. On the west end of the outcrop the rocks dip steeply west and are right-side-up. The fold axis is just west of here, perhaps along the Black Creek (i.e. near the bridge).

If we were to travel to the west we would not see a repeat of the strata exposed here, but would see mostly shale. Thus it is assumed that a fault is buried beneath the fill along Black Creek. The fault could be a thrust dipping east that formed contemporaneously with the folding or it could be a steeply dipping normal fault dipping east as shown by Dames and Moore, 1975. Minor faults in this outcrop might suggest this.

Cumulative Miles	Miles from last point	
		I prefer the former interpretation and Dames and Moore prefer the latter. As the fault is buried neither answer can be proven at this time.
4.8	0.2	Continue west on Route 299 to Chodikee Lake Road (at sign to Highland Training School, follow road to school). Note shales on right side of road, gently dipping towards east, also outcrops on left in pasture of east dipping shales.
5.4	0.6	Hawleys Corners Road and revolutionary age cemetary on left. Proceed straight on Chodikee Lake Road.
5.9	0.5	Right turn. Follow signs to Highland Training School.
6.0	0.1	Cross Black Creek. Note waterfall on right. Outcrops of gently eastward dipping shales with interbedded graywacke.
6.8	0.8	On grounds on Highland Training School. Take right fork.
7.2	0.4	Park in Highland Training School parking lot. Walk to various outcrops in area. Poisonous snakes are found in this area. Use appropriate caution.

STOP 5

We will stop on the east shore of Chodikee Lake and hike to the east across the west limb of a syncline to the axis of syncline. Stop 4 was on the east limb of this same fold.

To the west of where we will park the busses is Chodikee Lake. Based on outcrop along the south shore of the lake (near the waterfall for example)

Cumulative Miles	Miles from last point	
		it appears that the bedrock under the lakes is mainly shale with some interbedded graywacke. The low ridge just west of the lake is mainly massive graywacke. The ridge is bounded on the east by a shear zone that follows a swampy valley.
		As we walk east you will note that the exposed bedrock is mostly graywacke. Shales are found in some of the valleys beneath the soil. The axis of the syncline is just west of a cliff formed by graywackes of the east limb of the fold. If we were to continue to the mountain summit we would climb valley and ridge topography with very little shale. Thus the shales beneath Chodikee Lake do not seem to repeat on the east limb. This again suggests that the fold is faulted. The extreme assymmetry of the fold and the general pattern of thrusting from the east suggest that the fault would be a reverse fault.
		The rocks that crop out at the axis of the fold at this point are the youngest rocks of the Lloyd site. Their exact age is not certain as diagnostic fossils have not been found in this area. I have found fossils in float and am hopeful that I will find some in place.
7.6	0.4	Return to bus for short loop from parking lot to Administration Building on shores of Chodikee Lake.
		STOP 6
		View stop across lake towards site of nuclear power plants and cooling towers, less than one mile NW of east shore of Chodikee Lake. Notice meteorological tower directly west (at southern end

Cumulative Miles	Miles from last point	
		of site). The tower is 90 meters tall; thus the cooling towers will be almost two times as tall, as well as much more massive. Return along Chodikee Lake Road to Route 299.
8.7	1.1	Immediately past waterfall (on left) take a left turn at intersection; continue towards Route 299.
9.7	1.0	Turn left onto Route 299.
10.0	0.3	Just after crossing the bridge over Black Creek, turn left onto Riverside Road.
10.4	0.4	As examples of the agricultural land use that may be affected by land pressures due to growth, or to climatological change; note the vineyards and orchards to right side of road.
10.7	0.7	Outcrop on left. Outcrop shows slightly metamorphosed slatey shales and siltstones, with foliation steeper than the eastward dip. Continue on Riverside Road.
11.2	0.5	Stop sign. Turn left onto North Road (Old Route 9-W north). This runs parallel to new Route 9-W north.
11.6	0.4	Agricultural land use typical of region; note new plantings of apple orchard on left.
11.8	0.2	Examples of architectural individualism; note house with sculptured gargoyles on left, and building with used car parts sign on the right side of Route 9-W.
12.5	0.7	Stop sign, Turn left onto Route 9-W northbound. Outcrop on immediate left at stop sign is another good example of shales.

Cumulative Miles	Miles from last point	Description
12.7	0.2	Town of Esopus sign on right side of highway. Two nuclear plants are projected to be sited on the town line between Esopus and Lloyd, less than two miles directly west. Such exact siting is to spread the economic impact over two towns.
13.0	0.3	Mother Cabrini Retreat House on right. Many former Hudson River estates have been converted to monestaries, seminaries, or retreat housed by various churches and orders, such as the Holy Cross, Christian Brothers, and Marist Brothers. Excellent views of the Hudson River valley looking eastward from these properties.
14.3	1.3	After crossing a railroad bridge, enter the village of West Park and immediately turn left onto Floyd Ackert Road. (Although marked on the right side, it is unmarked on the left. Turn left just before the Post Office.)
15.1	0.8	Outcrop on right. Extremely steeply dipping. Excellent example of an overturn, note ripple marks overturned.
15.5	0.4	At driveway (entrance) to Cabin of John Burroughs, noted Catskill naturalist and author of many books on natural history in the 19th Century, stop for short walk to lunch stop area.
		STOP 7
		LUNCH STOP - Bus will stop briefly to offload passengers for a short walk alongside outcrops alongside road and will meet us a Gordon Preserve Park (along Black Creek

Cumulative Miles	Miles from last point	Description
		in the Gordon Memorial Woods). Watch it -- Poison Ivy is abundant in this area.
		The buses will stop near the crest of the ridge where the bedrock is clearly overturned. We will walk down the road to the Black Creek where several ledges in the stream dip south. Just west of the stream bedrock dips east. The Black Creek is following the axis of the syncline along this reach. We are on the axis of the syncline at a point stratigraphically much lower than at the Highland Training School, Stop 5. This is one of the most accessible places to view the syncline. Even so, we cannot trace beds from one side of the fold to the other because of a fault.
		Southeast of here on the road that parallels the creek is Villa Valley. At Villa Valley another fault is exposed in outcrop. It dips east at a slight angle to bedding and is apparently a thrust. It strikes north and crosses Floyd Ackert Road about half a mile east of here.
		Lunch can be eaten along the banks of Black Creek or the dammed up swimming pool on the creek. Tour participants are encouraged to seek additional evidence from neighboring outcrops, or commune with nature in the manner of John Burroughs.
		Reboard buses and continue on Floyd Ackert Road.
16.2	0.7	VanderWater Road on left; continue straight on Floyd Ackert Road.

Cumulative Miles	Miles from last point	Description
16.8	0.6	Stop sign at Swarte Kill Road. Keep straight on Floyd Ackert Road.
17.5	0.7	Stop sign at Old Post Road. Floyd Ackert Road ends here. Turn left onto Old Post Road.
17.7	0.2	Keep straight onto Popletown Road. (Old Post Road continues after a 90 degree turn left.) Popletown Road becomes a gravel road as it steeply climbs 350 feet to the peak of Shaupeneak Mountain. Note very gentle dips on outcrops.
18.7	1.0	Keep right, up fork to Radio Tower.
18.9	0.2	Summit of Shaupeneak Mountain.

STOP 8

From the clearing afforded by the Western Union communications tower facilities, note the view South and Southwest of the Lloyd nuclear site. The nuclear plants and cooling towers will be approximately four miles directly south from this peak, in the center of the presently relatively unspoiled and aesthetically pleasing view.

There is an OUTHOUSE available at this stop.

A short walk to various outcrops on peak; especially noteworthy are the red cherts. Return to bus for trip back down mountain to Old Post Road.

This stop is at the northern end of the syncline we saw at Black Creek and the Highland Training School. We are several thousand feet stratigraphically lower than we were at the training school.

Cumulative Miles	Miles from last point	Description
		The stratigraphically lower part of the fold is far more gently folded and is not overturned. Several north striking shear zones cut the structure and at least one can be seen in outcrop along the cliff to the east.
		Just north of a former community antenna system rocks crop out that fit the description of Quassaic Quartzite as given on the Geologic Map of New York, 1970. They are overlain by thousands of feet of rocks that do not fit the description. The description from the 1970 N.Y. State Geologic Map key is as follows: "Quassaic Quartzite - thick bedded red and green quartzites and greenish-gray sandstones, conglomerates with pebbles of red and black chert, shale and limestone."
		Dames&Moore in their 1975 report have changed the description of Quassaic. Their map key states: "Quassaic Sandstone: Grey to brown calcareous protoquartzite and subgraywacke with occasional conglomeratic zones of limestone, chert and shale pebbles."
		The point of this trip is not to pick bones over stratigraphic nomenclature, but to get a general idea of the environmental geology of the Lloyd Site. The proposed nuclear power plant complex represents the first time there has been significant economic reason to work on the geology of this region.
19.1	0.2	Road from communications tower feeds in - to Popletown Road. Keep left, continue down the mountain on Popletown Road.

Cumulative Miles	Miles from last point	Description
20.0	0.9	Stop sign. Turn right onto Old Post Road. Note historic one room school house building on right which has been recycled into a home.
20.9	0.9	Loughran Lane on left; keep right on Old Post Road.
23.1	2.2	Dashville Road on left. Keep right on Old Post Road.
24.9	1.8	Route 213 enters on left, continue north on route 213.
25.4	0.5	Sturgeon Pool of the Wallkill River.

STOP 9

Sturgeon Pool is part of a hydroelectric installation of Central Hudson Gas and Electric Corporation.

Dames & Moore 1975 have mapped the northern half of the pool as Snake Hill Formation. The eastern shore of the pool is massive graywacke and the hill on the west is largely shale. Thus on the 1970 N.Y. State Geologic Map the eastern shore is mapped as Austin Glen and the west as Normanskill (Snake Hill).

As an example of the visual imprint of electric power transmission lines and pylons in the skyscape, note the 345kv lines across the lake at the spillway. Lines which carry greater loads (765kv) require higher pylons and are therefore even more apparent in the landscape and skyscape. Return south along Route 213.

Cumulative Miles	Miles from last point	Description
25.8	0.4	Old Post Road enters on left. Keep right and continue straight ahead on Main Street (Route 213).
26.0	0.2	The village of Rifton.
26.3	0.3	Outcrops on left of shales with interbedded thin graywackies.
26.6	0.3	1876 stone Church on right.
27.2	0.6	As we drive south along Sturgeon Pool, you will note thic graywacke beds interbedded with shale. Dames & Moore show a thrust fault relationship between the graywackes and shales.
27.3	0.1	Dashville Road on left. Keep right on 213.
27.5	0.2	Central Hudson Gas and Electric Corporation electric power substation on right. Pull into parking lot.
		STOP 10
		Offload from busses in the C-H parking lot and walk down Route 213 on left side of road. WATCH FOR TRAFFIC. A small fold is in evidence, as well as interesting facies changes of graywacky and shale. Note as you walk along to road cut that at least one 2 ft. thick massive graywacke bed develops shale interbeds to the west. Generally, there is a facies changes in the Lloyd area with graywackes on the east and shales to the west.
		We will walk up the bank and through the woods to get to a unique outcrop. There is no trail so watch your step.

Cumulative Miles	Miles from last point	Description

This outcrop is described by Dames and Moore in the 1975 report on page 31 as follows:

"4.1 Dashville Thrust"

Perhaps the most spectacular and (from a classical viewpoint) unexpected structure in the region is the Dashville thrust. This feature is exposed along Rt. 213 between Rt. 32 and Rifton, and is best preserved in the hillside below the Woodcrest School. There, upward form road level, occur (1) moderately folded Snake Hill sandy shale, (2) 20 ft. of thrusted slices of schenectady Formation and Quassaic sandstone,(3) three feet of tectonically mixed Snake Hill and Quassaic and, (4) about 200 ft. of Snake Hill Formation. The investigators feel that (1) the amount of evident thrusting (2) the observed intermixing of Quassaic and Schenectady, (3) the thinness of the characteristically thick Quassic-Schenectady section, and (4) the overlying zone of mixed Quassic.

Snake Hill all argue for a tectonic sliver of Quassaic and Schenectady caught in a major thrust of Snake Hill over Snake Hill."

The names used by Dames and Moore refer to lithology as follows (abstracted from their map key):

Schenectady formation: thinly bedded subgraywacke interbedded with siltstone and silt-shale.

Quassaic sandstone: Protoquartzite and subgraywacke with occasional conglomerate zones.

Snake Hill Formation: Silt and clay shales interbedded with thinly bedded siltstone.

Cumulative Miles	Miles from last point	Description
		Look at the outcrop and come to your own conclusions. Is what you see due to thrusting or some other cause?
		Continue to "Perrines Bridge", an old covered bridge across the Wallkill circa 1844 (Ulster County Historical Site). Buses will pickup at pulloff across from covered bridge.
28.0	0.5	Return north along Route 213 to Dashville Road.
28.7	0.7	Turn right onto Dashville Road. Immediately turn right onto Cow Hough Road.
28.9	0.2	Dubois Lane on left. Keep straight on Cow Hough Road.
29.5	0.6	Turn left onto Van Nostrand Road. (Cow Hough Road ends at this intersection and becomes North Ohioville Road straight ahead.)
30.2	0.7	Stop sign at Plutarch Road in the hamlet of Plutarch. Continue straight ahead (east) on Van Nostrand Road.
30.8	0.6	South Eltings Corners Road on left. Continue straight ahead on Van Nostrand Road.
		STOP 11
		Events similar to earthquakes have been reported by several homeowners in this area. The reports are only from those who live along a line parallel with the base of the ridge just east of the road intersection.
		The reports seem to be aligned along a N-S linear feature that shows up on landsat photography. The linear also shows up on topographic maps and on the ground as

Cumulative Miles	Miles from last point	Description
		a series of aligned valleys. This linear is one of the more noticeable of several subtle N-S linears that cross the site. This linear is apparently at least 8 miles long.
		Where one of the linears crosses Shawpeneak Summit sheared graywackes crop out on the southeast side of a valley that marks the linear. Dames and Moore drill hole 2 is 500 ft. east of the linear. The hole was drilled to 249 ft. and several broken zones were reported. It seems most reasonable to conclude that his linear is a fault.
		People who live along this alignment have reported events that may be earthquakes. The linear passes through one of the proposed nuclear power plants. A summary of the reported events are listed in the appendix.
30.9	0.1	North Eltings Corners Road on right. Continue straight ahead. (Van Nostrand Road becomes Hawleys Corners Road at this junction. Continue straight ahead east on Hawleys Corners Road.)
32.0	1.1	Turn left onto Martin Road.
32.1	0.1	Just after turning onto Martin Road (north) will be seen the ASDA (ERDA) Meteorological Station on the right. Climatological data is gathered at ground level and from the 90 meter tower noticeable from the road.
32.4	0.3	Truck farms on right.

Cumulative Miles	Miles From last point	Description
		STOP 12
		Situated on the deep rich muck soils, Sorbello's greenhouses and onion farms are located in the very heart of the proposed nuclear site at Lloyd. The land use plan proposes the first two plants and cooling towers to be located just to the north in the same swampy soils. View south and notice the height of the ASDA-ERDA meteorological tower (90 meters) and recall that the cooling towers planned for this site are almost two times as tall and massive enough at their bases to essentially fill the valley east-west. Return back along Martin Road.
32.8	0.4	Turn left (more or less straight ahead) onto Hawleys Corners Road.
34.1	1.3	Turn right onto Chodikee Lake Road. (Cemetary on left at corner)
34.7	0.6	Turn left onto Route 299. Return to Route 9-W southbound, Routes 44 and 55 eastbound, across the Mid-Hudson Bridge to Poughkeepsie and Vassar College.

APPENDIX

Possible Earthquakes at or Near the Lloyd Site

Date	Time	Description	Reported By	Location of Observation
1950's	1950 and 1952	House shakes few seconds (house now owned by Metro's)	Dorothy Yess and Emma Grand	1.1 mile WSW of meteorological tower
1975		Several events reported but dates and times unknown	Rosemary Esposito Irene Metro	1 mile WNW 1.1 mile WSW
1-11-75	8:00 a.m.±15'	House vibrated and thumping-grinding noise from beneath driveway. Not like sonic boom or blasting	Rosemary Esposito	1 mile WNW of meteorological tower
2-20-76	7:15 a.m.±2'	Thumping and grinding noise like boulders colliding. Lasted six seconds. Floor vibrated; dog went berserk.	Frederick and Rosemary Esposito	1 mile WNW of meteorological tower
		Con Ed stations ... recorded a small emergent event coming from the north at 7:16 a.m.	Mary M. Golisano (Lamont-Doherty Geological Observatory)	Indian Point. 37 miles south of meteorological tower
3-16-76	11:09 p.m.±3'	2-3 seconds of loud noise like a blast; little rattling	Irene Metro	1.1 mile WSW of meteorological tower
4-7-76	6:20 a.m.±2'	Thumping and grinding noise, lasted a few seconds	Rosemary Esposito	1 mile WNW of meteorological tower

Date	Time	Description	Reported By	Location of Observation
4-13-76	2:30-3:30 p.m.	Noise heard while outside.	Elaine Dillahunt	1.2 miles WSW of meteorological tower
5-13-76	10:45 p.m.±2'	Rocks sliding and rubbing	Frederick Esposito	1 mile WNW of meteorological tower
6-16-76	5:00 p.m.±2'	Loud thump first, sound of rocks falling and rolling	Rosemary Esposito	1 mile WNW of meteorological tower
6-22-76	2:45 p.m.±2'	Loud thump first, sound of rocks falling and rolling	Rosemary Esposito	1 mile WNW of meteorological tower
7-5-76	11:10 a.m.±2'	A lot of vibration	Rosemary Esposito	1 mile WNW of meteorological tower
7-25-76	7:40 p.m.±15'	Vibration in ground (in concrete patio)	Thomas Spinard Betty Spinard Frederick Esposito Rosemary Esposito	1 mile W of meteorological tower
8-2-76	12:30 a.m.±15'	House vibrated, medicine chest doors rattled	Fred Vincent Esposito	1 mile WNW of meteorological tower
8-10-76	2:07 a.m.±3'	Awakened by loud noise sounds like a heavy tram crossing a joint in the tracks. Bed vibrated strongly for 3 seconds.	Frederick Esposito Rosemary Esposito	1 mile WNW of meteorological tower