Calculation of Induced Current

Electric field strengths were provided by Bob Connors of NSTAR for lines 342 and 355 over two segments. Segment 1 was from Pilgrim Station to Jordan Road tap and segment 2 was from Jordan Road tap to the Snake Hill tap. The field strength was calculated at the place of lowest ground clearance. NSTAR used the ENVIRO program by EPRI to calculate field strength. These two lines share the towers over these two segments. Because the phasing arrangement changes at Jordan Road, the electric field strength is less from Jordan Road to Snake Hill. Only the segment from Pilgrim Station to Jordan Road was used for induced current analysis. For line 355, which goes on to Bridgeport, no data were available. The NSTAR printouts are attached.

The method employed to calculate induced current for electric field strength was based on the EPRI Transmission Line Reference Book, 2nd Edition. A multiplier was developed to convert the vertical component of the electric field to induced current. The multiplier was used on the average field strength over the length of a tractor-trailer truck parked perpendicular to the transmission lines at the point of lowest clearance. The spreadsheet used to perform the calculation is attached.

Calculations were performed by S.J. Connor, TtNUS, April 23, 2001.

Development an induced current multiplier for tractor-trailer trucks parked under transmission lines.
(References are to the EPRI Transmission Line Reference Book - 345 kV and Above; 2nd Edition)

Vehicle dimensions	(feet)	(meters)
length (A)	60	18.29
width (B)	8	2.44
height (H)	13.5	4.12

Induced Current Equation

Equation 8.8.3 I=jweES

where jw = 377

e = 8.85E-12

S is derived from Table 8.8.2

E is the vertical component of the average electric field strength in V/m

Calculation of S

S=AB(1+(1.4+5/(A/B)^.6)(.1(H/B)^.5+.78(H/B)+.07(H/B)^2+.01((H/B)/(A/B))^3))

S= 256.99

Since a trailer is about 4 feet off the ground and this value is one-half the width, it is possible to invoke the generalization on top of page 350 that S/AB is reduced by 10%. Therefore S is adjusted.

S(adj) = 231.2915

Multiplier

jweS = 7.72E-07 amps-meters/volt

= 7.72E-01 milliamps-meters/kilovolt

To be applied to average vertical field strength over the length of the tractor-trailer

Calculation of Induced Current for Pilgrim Lines 342, 355 between Jordan Road Tap and Pilgrim Station
(Reference FAX from Bob Connors of NSTAR to David Thrall, April 9, 2001)

ENVIRO results

	Lateral Distance (ft)	Vertical Electric Field (kV/m)
end effect	20	3.328
front	25	3.945
	30	4.666
	35	5.487
	40	6.38
	45	7.264
	50	7.979
midpoint	55	8.28
	60	7.935
	65	6.91
	70	5.515
	75	4.427
	80	4.386
back	85	5.16
end effect	90	5.862
end effect	95	6.004

The electric field strengths result from both lines 342 and 355, which share the same towers in the region of interest.

Average Electric Field - vertical component 5.8455

Induced Current = 4.51E+00 millamps